Anatomy

● Sheet ○ Slide

number	2
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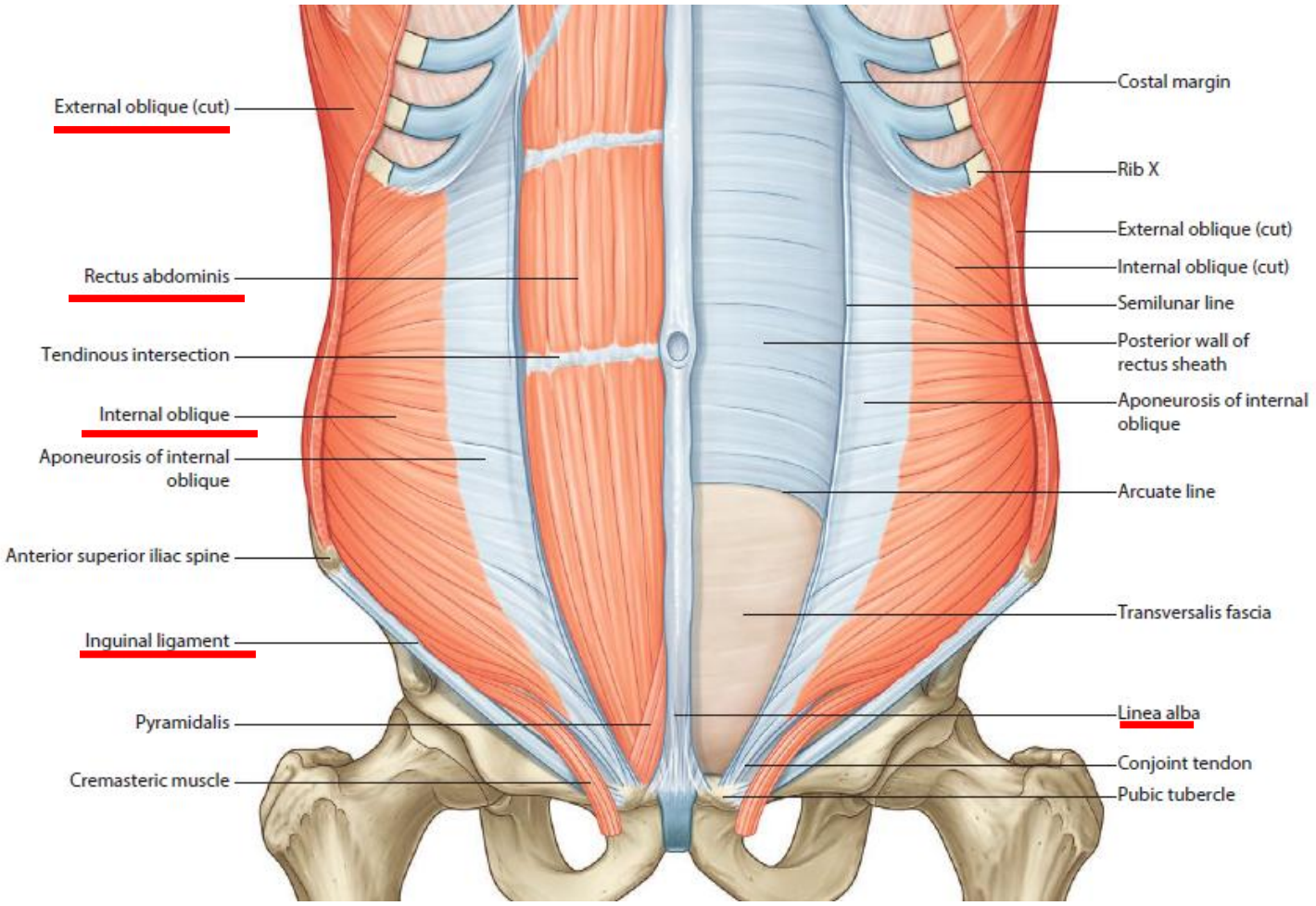


External oblique fibers run downwards, foreword and medially.

Its lower part becomes aponeurosis, which is distinct from the fleshy part of the muscle.

Origin: **OUTER** surface of the Lower 8 ribs.

Internal oblique fibers run upward, forward and medially.

Transversus abdominis fibers run horizontally.

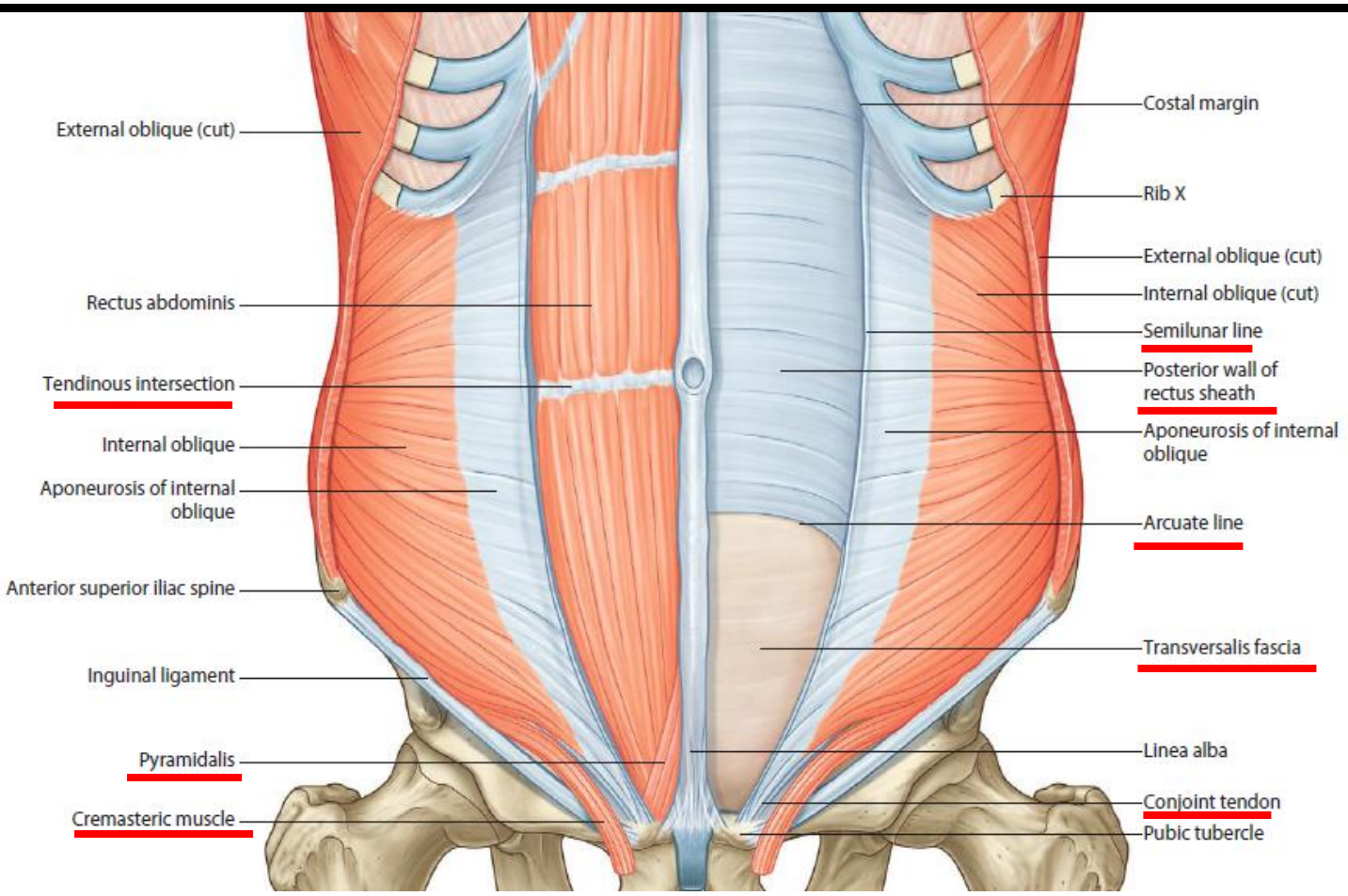
Origin: **INNER** surface of the Lower 6 ribs

All abdominal muscles insert in the **linea alba.**

Nerve fibers from intercostal nerve run between transversus abdominis and Internal oblique then they enter the rectus abdominis from lateral to medial.

Linea alba extends from **Xiphoid process** of sternum to **pubic symphysis.**

Inguinal ligament is a tough folding of aponeurosis of **EXTERNAL** oblique upon itself and extends from the anterior superior iliac spine to pubic tubercle .



The lateral margin of the rectus sheath is linea semilunaris.

If we cut the **rectus sheath,** we find inside it the **rectus abdominis** and **pyramidalis** –which may be absent- and **Tendinous intersections.**

So, the contents of the rectus sheath are:

Rectus abdominis, pyramidalis, inter costal nerve, Inferior epigastric artery and vein, superior epigastric artery and vein.

Below the **Arcuate line** (which is in the posterior wall of rectus sheath), we can find a layer called **transversalis facia**.

Rectus sheath walls formed by anterior abdominal muscles aponeurosis:

Above the costal margin **(xiphoid process region)-** anterior wall # aponeurosis of the external oblique. - posterior wall # thoracic wall that is, the fifth, sixth, and seventh costal cartilages and the intercostal spaces.

Between the costal margin **and** ***the level of the anterior superior iliac spine (above and below the umbilicus)*** - The aponeurosis of the internal oblique splits to enclose the rectus muscle.
- The external oblique aponeurosis is directed in front of the muscle.

- The transversus aponeurosis is directed behind the muscle.

***Between the level of the anterior superior iliac spine and the pubis*-- the anterior wall**: The aponeurosis of all three muscles form. **The posterior wall** is absent, and the rectus muscle lies in contact with the fascia transversalis.

Notice the lacunar ligament and the pectineal ligament on the pubic bone. The pectineal ligament is attached to the bone, is medial, and goes to the femoral triangle.

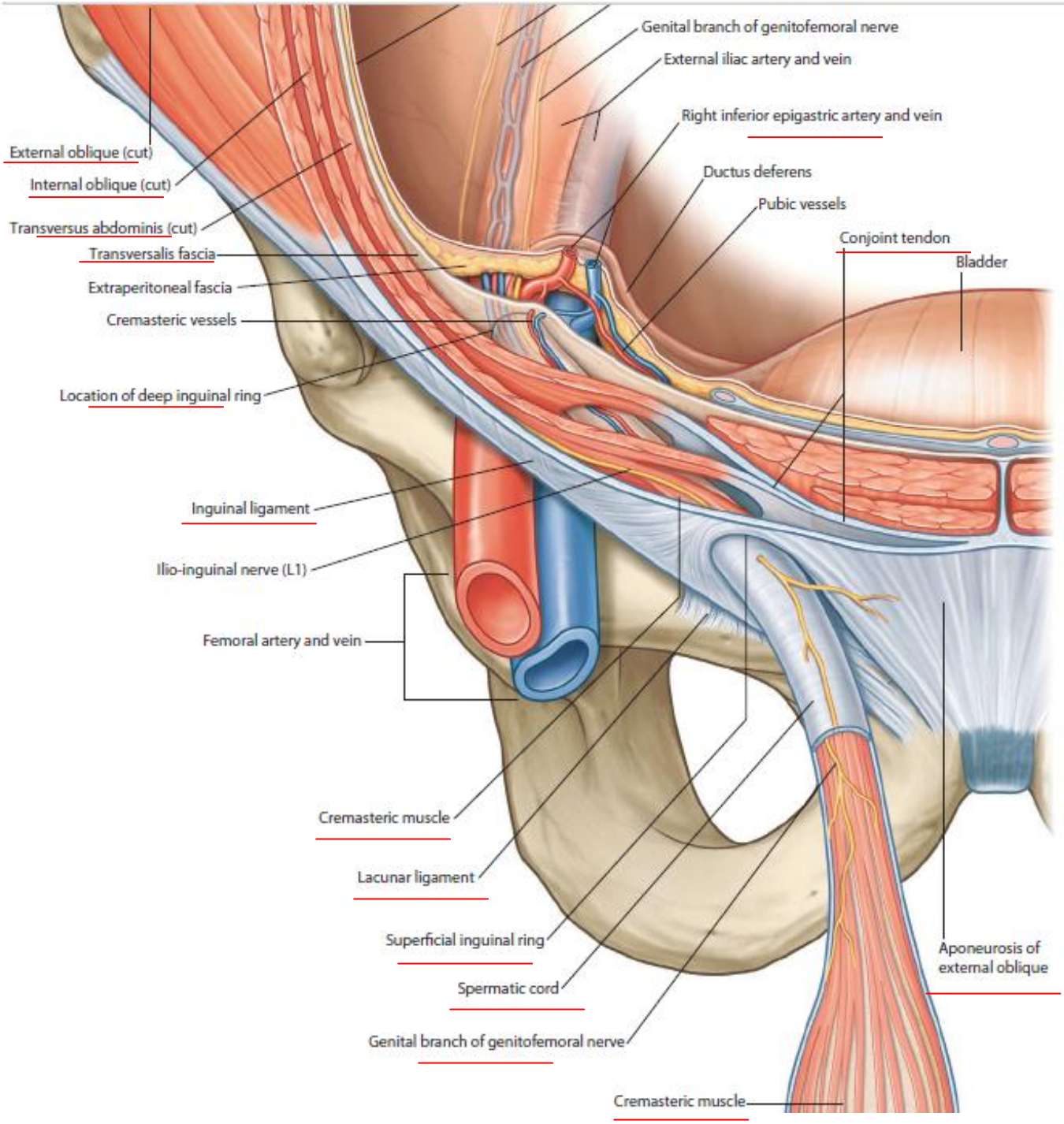
External oblique, internal oblique and transversus abdominis are innervated by the 6 lower thoracic nerves and the first lumbar nerve (iliohypogastric and ilioinguinal).

Notice the anastomosis of the inferior and the superior epigastric arteries in the anterior abdominal wall.

Notice that the arcuate line lies at the anterior superior iliac spine level.

Important Questions in the exam

- *What are the anterior wall of rectus sheath made from???*
- *What are the contents of the recuts sheath?*


Genital branch of genitofemoral nerve
External iliac artery and vein
Right inferior epigastric artery and vein
External oblique (cut)
Internal oblique (cut)
Transversus abdominis (cut)
Transversalis fascia
Extraperitoneal fascia
Cremasteric vessels
Location of deep inguinal ring
Ductus deferens
Pubic vessels
Conjoint tendon
Bladder
Inguinal ligament
Ilio-inguinal nerve (L1)
Femoral artery and vein
Cremasteric muscle
Lacunar ligament
Superficial inguinal ring
Spermatic cord
Genital branch of genitofemoral nerve
Aponeurosis of external oblique
Cremasteric muscle

Inguinal ring

A defect in the external oblique aponeurosis makes up the superficial inguinal ring, through which passes the spermatic cord. The ring has medial and lateral cruses.

Boundaries of inguinal canal:

This canal is 4 cm long. The deep ring opens to the abdomen.

- **Anterior wall: Aponeurosis of the external oblique, and by the internal oblique muscle laterally. Internal oblique supports the deep ring.**
- **Posterior wall: Transversalis fascia and conjoint tendon (which is formed by the internal oblique and transversus abdominis aponeurosis; important to take stitches)**
- **Roof: Internal oblique and transversus abdominis.**
- **Floor: Inguinal ligament and thickened medially by the lacunar ligament.**
- **Inferior: Inguinal ligament.**

Ilioinguinal nerve is piercing the posterior wall of inguinal canal, and it doesn't go through the deep ring.

Surface anatomy:

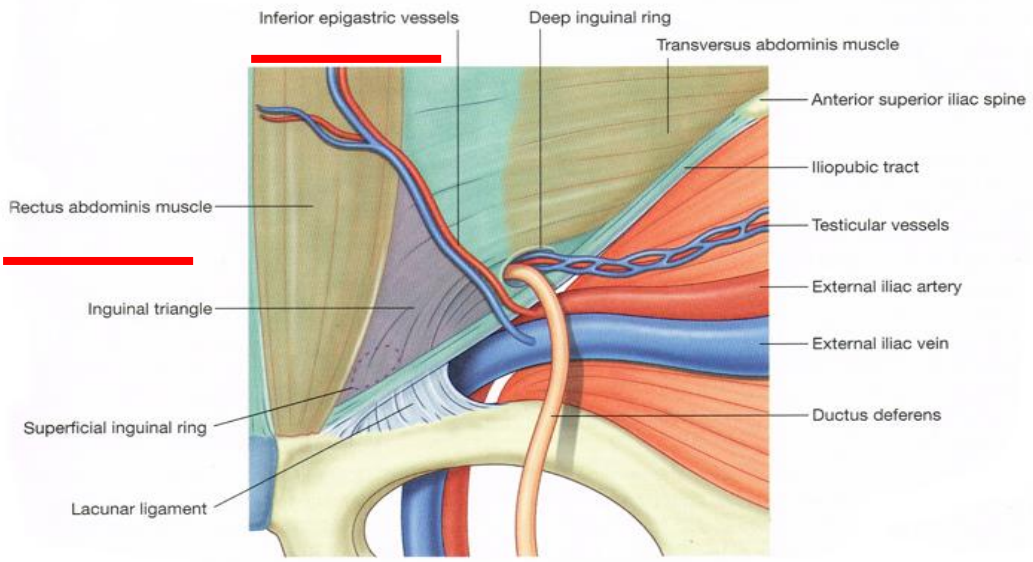
- **The canal is above the inguinal ligament. The deep ring opens to the abdomen. The canal continues from the deep ring to the superficial ring.**
  The superficial ring is medial to the femoral artery and vein and the femoral nerve.

Contents of inguinal canal:

In males, it consists of the **spermatic cord**: the spermatic cord goes through the deep inguinal ring, and through the inguinal canal (4 cm above the inguinal ligament). It emerges from the superficial ring, and enters the scrotum to the testes.

In females: it consists of the **round ligament** (to labia majora). The round ligament is small, and the inguinal canal is strongly blocked by fibrous tissue, so the indirect inguinal hernia is rare in females.

For both sexes: **genital branch of the genitofemoral nerve**. The **ilioinguinal nerve** pierces the posterior wall of the canal to become one



of the contents (not through the deep ring as the rest of the contents).

These nerves are sensory to the genitalia and the surrounding structures. Ilioinguinal nerve innervates the skin of he scrotum.

Boundaries of the Inguinal Triangle:

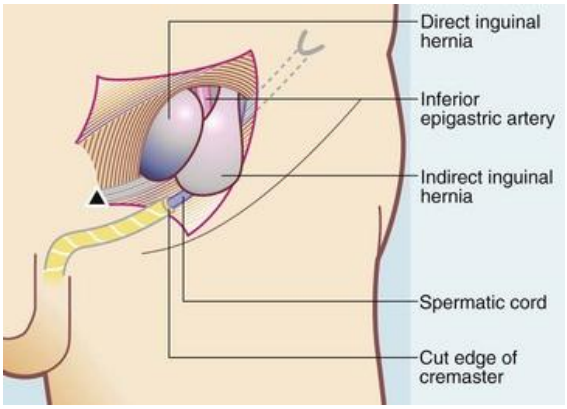
- Lateral: **Inferior epigastric vein**
- Medial: **Edge of rectus abdominis**
- Base: **Inguinal ligament**

Spermatic Cord has Three Fascia:

1) **External spermatic fascia** (from aponeurosis of external oblique) – as a continuation of the superficial ring.
2) **Fascia of cremasteric muscle** (from internal oblique muscle)
3) **Internal spermatic fascia** (from transversalis fascia) – from the deep ring.

What Is an Inguinal Hernia?

An inguinal hernia occurs in the groin area when fatty or intestinal tissues push through the inguinal canal. If you have a hernia in this passage, it results in a protruding bulge that may be painful during movement.



Two types of Inguinal Hernias:

1) Direct inguinal hernia
2) Indirect inguinal hernia

	Direct	**Indirect**
Location	Inguinal triangle, medial to inferior epigastric vessels	Deep inguinal ring to the scrotum, lateral to inferior epigastric vessels
Bulge direction	Forward	Forward and medial
Reduction	Backward	Upward and lateral
Cause	Weakness in the abdominal muscles especially with aging	Congenital (see below)
	Bilateral (on both side because the weakness is on both sides	Bilateral (in congenital hernia) unilateral (in adult)
Deep ring test	Hernia appears	Hernia doesn't appear
Superficial inguinal ring test	Feel impulse against the side of the examining finger	Feel an impulse against the tip of the examining finger

Both herniae are peritoneal sacs that contain part of the great omentum or the small intestine (jejunum or ileum).

The direct hernia is usually bilateral. The congenital indirect hernia, if in infants, is also usually bilateral.

How to differentiate between direct and indirect hernia?

There are two tests:

1) **Superficial test**: When the hernia is indirect, we ask the patient to reduce the bulge into the abdomen until it reaches the superficial ring, your finger should be upward and lateral. After that, the pulsation of the epigastric artery can be felt at the tip of your finger. If the pulsation felt at the lateral side of finger, that means it's a direct hernia.
2) **Deep ring test**: Ask the patient to reduce the bulge, put your finger in the deep ring to close it, then ask the patient to cough. If it was indirect hernia, the bulge will not appear, but if it was direct hernia, the bulge will appear.

Best one who can reduce the hernia (bulge) is the **patient himself.

We can also differentiate between these two herniae by their location of the inferior epigastric artery. Also remember that the inguinal herniae are superior and medial to the pubic tubercle; whereas, the femoral hernia is lateral and inferior.

Descent of testes and the indirect hernia:

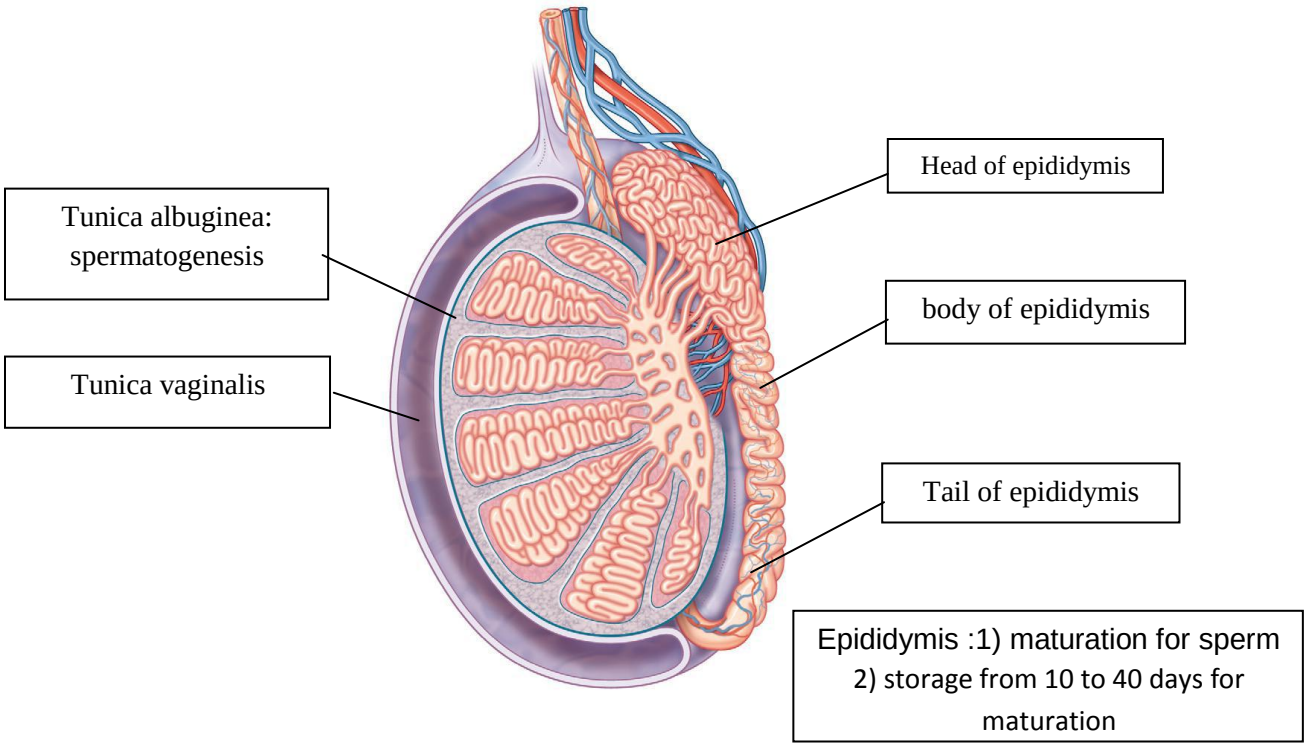
Testes develops at the level of L1 in the posterior abdominal wall in the embryo, and before the 8th month of pregnancy, the testes descend through the inguinal canal by the guidance of the **gubernaculum** (part of the peritoneum). At the 9th month of pregnancy (at birth), the testes should have reached the scrotum. If not, an operation must take place as soon as possible.

After the testes reach the scrotum, the **proccessus vaginalis** obliterate, and it becomes fibrous tissue. Also the deep ring is plugged by fibrous tissue.

Congenital indirect hernia is caused by failure of embryonic closure of the **processus vaginalis**. While the baby is crying we can see the bulge of the hernia. This may also result with herniation later in life, when having chronic coughing or constipation (a rise in the intra-abdominal pressure).

Inguinal hernia is more common in males in comparison to females (in whom the inguinal hernia happens **above and medial** to the pubic tubercle).

BUT keep in mind that the femoral hernia is common in females (below the inguinal ligament and lateral to the pubic tubercle).



In **males,** there is spermatogenesis **every day,** hundred millions.
In females, there is **only one** mature ovum every month produced from one side, BUT only one sperm can fertilize the mature ovum.

Vas deferens is a cord like structure from the tail of epididymis to behind the urinary bladder until it reaches seminal vesicles –which allows maturation and nutrition (by fructose) for sperm-.

Content of spermatic cord:

3 arteries, 3 nerves, 3 other things

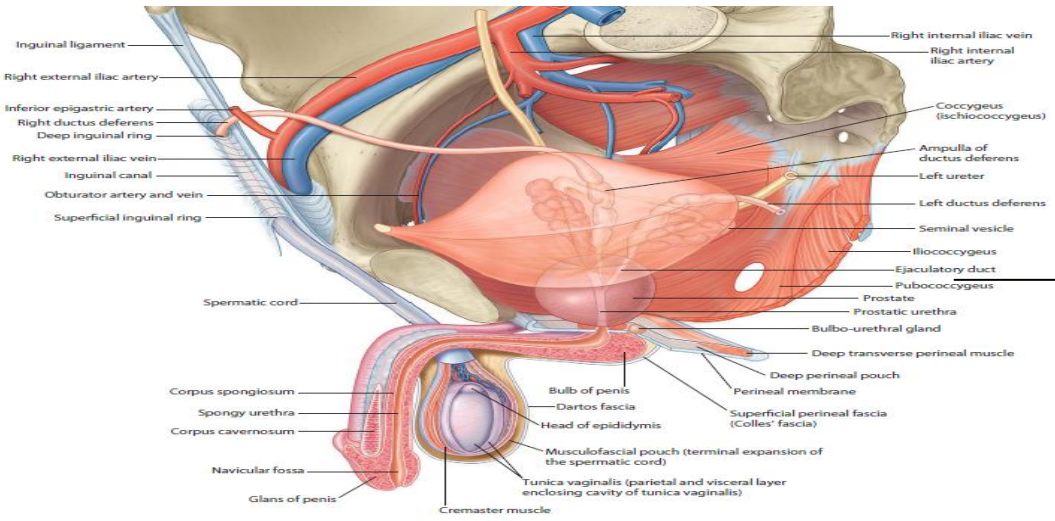
- **3** arteries: testicular, deferential, cremasteric
- **3** nerves: genital branch of the genitofemoral, cremasteric nerve, sympathetic nerve fibers
- **3** other things: vas deferens (45 cm), pampiniform plexus of veins, lymphatic vessels

The **testicular artery** is a branch of the abdominal aorta at the level of **L1** that supplies blood to the testis. It is a paired artery, with one for each of the testes.

Artery to vas (ductus deferens) **deferential** or (vesiculodeferential **artery**) is a branch of the **Superior vesicle artery**, which in turn arises from the **internal iliac artery.**

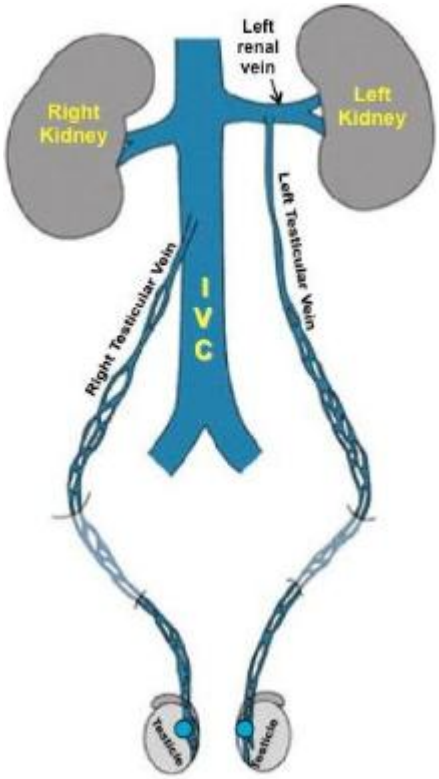
There are sympathetic and parasympathetic innervation, genital branch of genitofemoral nerve which supplies the cremasteric muscle, and when you make itching to the upper medial of the thigh, contraction happen and the scrotum ascends upward to the abdomen (reflex)→ Very common in winter in order to preserve the temperature of scrotum.
On the other hand, in summer, the scrotum relaxes and descends downward.

The lymph of **testes and epididymis** drains to the abdomen - **paraaortic lymph node**- while the **scrotum** drains to **superficial inguinal lymph node**. You have to be familiar with this in order to know: if we find an inflammation in the scrotum, the superficial inguinal lymph node



Ejaculatory duct, left and right , opens in prostatic urethra

will swallow, while if it was found in testes the para aortic lymph node will enlarge.



Left pampiniform plexus of veins drains in the inguinal canal, in the deep ring; it becomes the left testicular vein which drains in the **left renal vein** (perpendicular)

Right pampiniform plexus of veins drains in the inguinal canal. In the deep ring, it becomes right testicular vein which **ends in the inferior vena cava** (oblique)

Persons who stand for a long time like police men, may suffer from **varicocele** in which the veins become dilated, tortuous and congested with blood which raise the temperature in the testes and kill the sperm.

Common in the left side because the vein is perpendicular (while in the right side, vein is oblique) and the testes are lower than the right side.
Lymphatic drainage:

- Scrotum: to the superior inguinal lymph node
- Epididymis and testes: para-aortic lymph node in the abdomen. Any enlargement in these lymph nodes means that there is an inflammation or cancer in the area that drains in the node.

It is important to memorize the content of spermatic cord which is covered by fascia and has artery, vein, nerve and lymphatic vessels

****This sheet is complementary to the lecture, so the doctor said that you should read about epididymis, scrotum , testes and vas
****Please refer to slide after you finish this sheet because the doctor didn't mention all of information in the lab ☺

THE END

" لا تشرق الروح الا من دجى المٍ , هل تزهر الارض الا ان بكى المطر ؟!! "