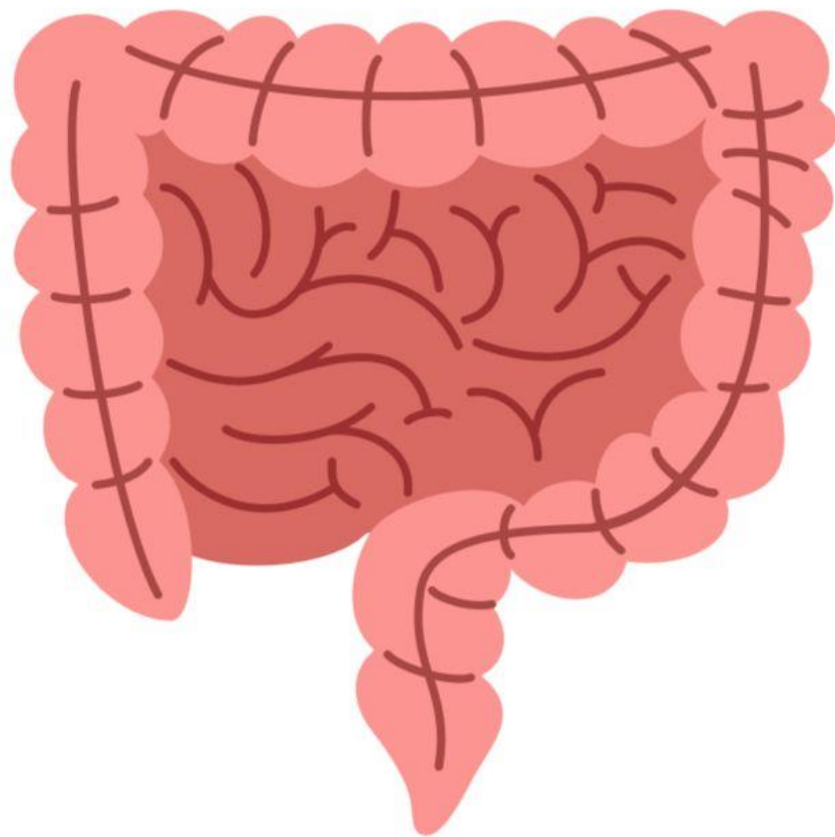


GIS



Sheet no. 5

Anatomy



Done by: Doctor 018
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Hello miserable med students, this is the fifth sheet of anatomy, hope you enjoy while reading it. 😞

This sheet is a continuation of the last sheet (obviously).

I will put extra pictures for more clarification in this link, please bother yourself and check it:

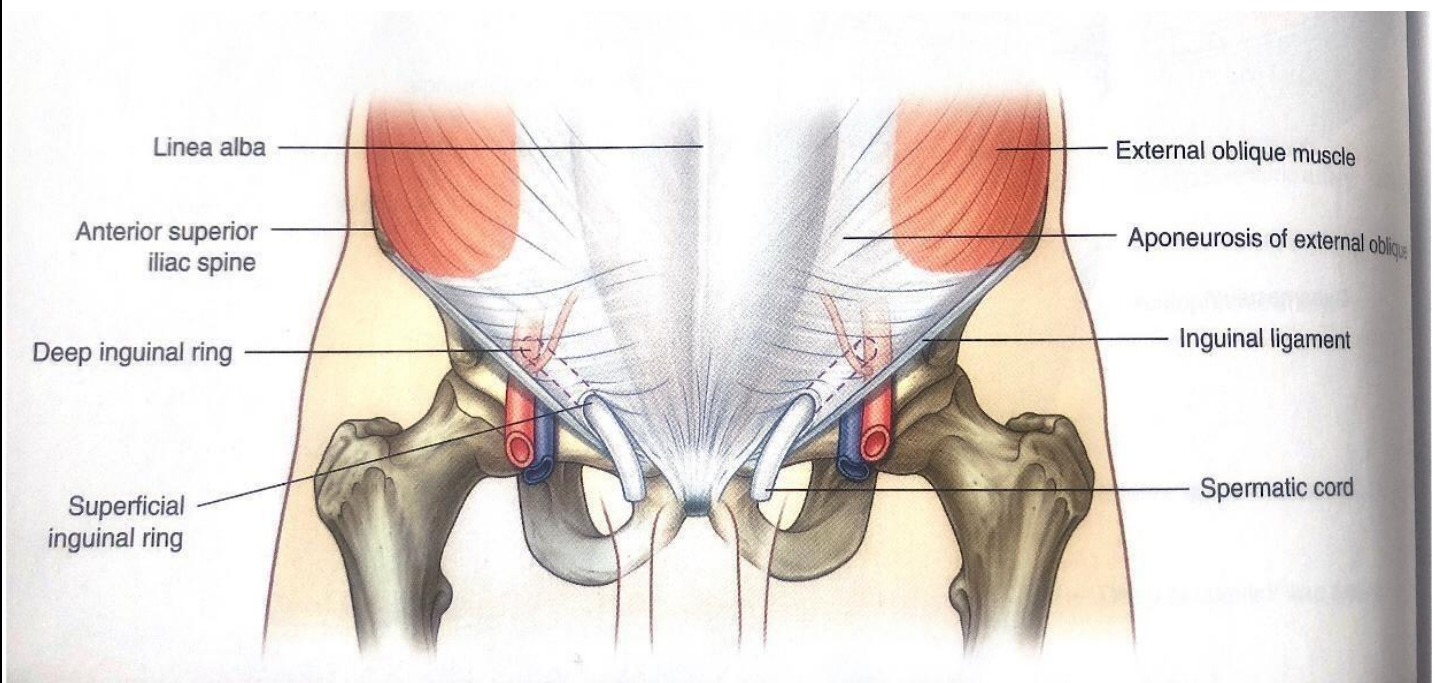
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1. Inguinal Canal :

It is an oblique passage through the lower part of the anterior abdominal wall, which is present in both sexes. In males, it allows structures to pass from the testis to the abdomen and vice versa (mainly the **spermatic cord**). In females, it permits the passage of the **round ligament of the uterus**, from the uterus, to the labium magus. It transmits ilioinguinal nerve in both sexes and genital branch of the genitofemoral nerve.

This canal is about **1 ½ inches (4cm) long in the adults**. It extends from the deep inguinal ring downward and medially to the superficial inguinal ring, parallel to and immediately above the inguinal ligament in the iliac fossa.

In the newborn child, the deep ring lies almost directly posterior to the superficial ring above each other.



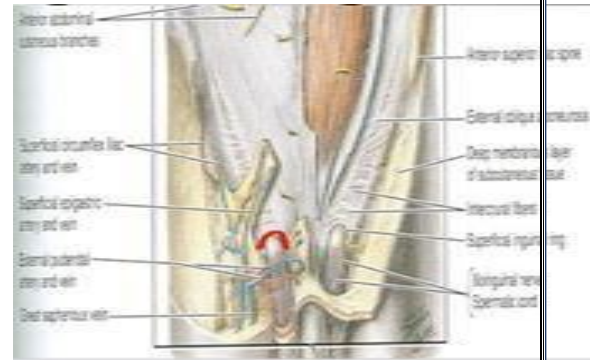
Deep Inguinal Ring is an oval opening in the **fascia transversalis**. It lies about ½ inch (1.3cm) above the inguinal ligament, midway between the anterosuperior iliac spine and the symphysis pubis. Margins of the ring give attachment to the internal spermatic fascia covering the spermatic cord, which means it's formed by the transversalis fascia.

The deep inguinal ring can be detected by sensing the pulse of the femoral artery then moving vertically to it.

Superficial Inguinal Ring Triangular in shape. It's considered a defect in the aponeurosis of the **external oblique muscle** which lies immediately above and medial to the pubic tubercle. Its margins (sometimes called crura)(Med. & Lat. crus)create an apex/arch above the spermatic cord & giving attachment to the **external spermatic fascia**.

Note: The **external spermatic fascia** is formed by the **aponeurosis of the external oblique muscle**.

Anterior Wall of Inguinal Canal is formed from the external oblique muscle, along its entire length. It is reinforced in its lateral third in front of the deep inguinal ring 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*. This means that the deep inguinal ring provides support & protection for it and its content (vas deferens + arteries, veins, nerves + 3 spermatic fascia).



***MORE EXPLANATION ;** The strongest part in the anterior wall offers support to the weakest part of the posterior wall, which is located exactly behind it (the deep inguinal ring); **Remember:** the deep inguinal ring is an opening in fascia transversalis which forms the posterior wall.

In the embryo, the ovaries/testis are formed in the posterior abdominal wall at the level of L1 lumbar vertebrae, during the 8th month of embryonic development. The gubernaculum + processus vaginalis guide & pull the testis/ovaries, allowing them to enter to the inguinal canal and continuing their tract. Remember that the testis pass until they reach the scrotum, thus they must be seen in a newborn. While the destination of the ovaries would be through the iliac fossa. The spermatic cord-formed during the descending of the testis-starts from the deep ring and extends in the canal behind the urinary bladder, leaving through the superficial ring, then extends to the scrotum, while the vas deferens - it's a muscular tube that carries the sperms from epididymis to ejaculatory duct-starts at epididymis then ascends up inside the spermatic cord to continue its journey in the pelvic cavity. So the deep inguinal ring is super important for the passage of these structures as we said before. Although the gubernaculum & processus vaginalis have a critical function they will undergo obliteration & fibrosis to close the deep ring tightly, preserving the passing structures fixed in place. A defect in the closure of the deep ring would allow parts of the small intestines/the greater omentum to enter the deep ring & canal causing a **congenital indirect inguinal hernia**.

Posterior Wall of Inguinal Canal It is formed, along its entire length, by the **fascia transversalis**. It is reinforced in its medial third by the conjoint tendon, which is the common tendon of insertion of internal oblique and transversus. The conjoint tendon is attached to the pubic crest and pectineal line. We track the conjoint tendon's borders to define the posterior wall. This wall is strongest where it lies opposite the weakest part of the anterior wall, the superficial inguinal ring.

Inferior Wall of Inguinal Canal = floor 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 formed by the arching lowest fibers of the internal oblique and transversus abdominis muscles.

Please be alert that we have 2 nerves passing through the canal:

Genital branch of the genitofemoral nerve: it enters the deep ring, passes through the canal, & leaves the superficial ring to supply the cremaster muscle inside the scrotum. It has a sensory role since it has a cremasteric effect.

Ilioinguinal nerve: it enters the canal through the posterior wall (**doesn't** pass through the deep ring), leaving the canal from the superficial ring to take sensation from the scrotum.

8-Ilioinguinal (Hwsselbach's) Triangle :

It is a region of the anterior abdominal wall above the inguinal ligament; formed by three borders:

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

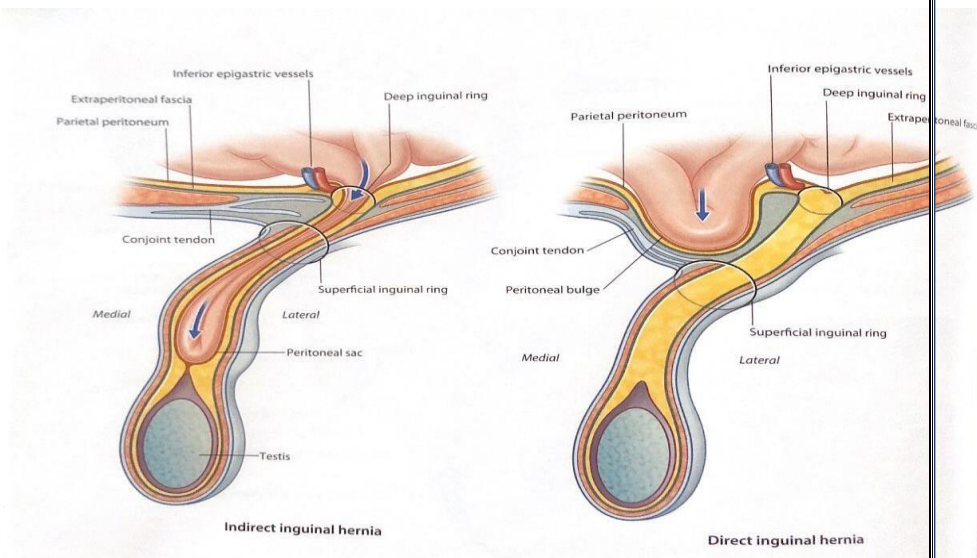
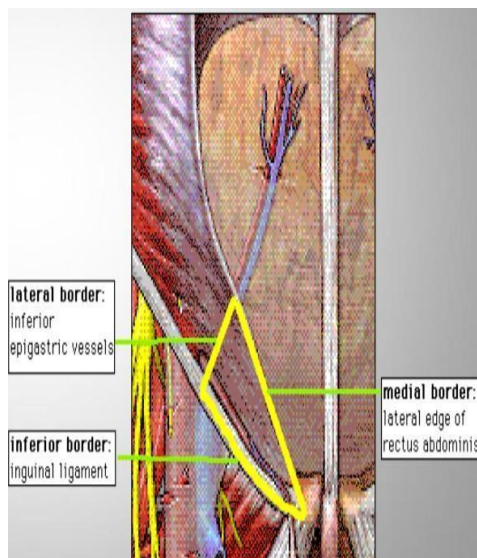
This triangle is considered a weak point, causing an old age patient with weakened abdominal muscles, chronic cough, chronic constipation, smoker or performs any other behavior that increases the abdominal pressure on that triangle, to suffer from **direct hernia**.

Direct hernia is a medical case in which the increased abdominal pressure would cause the small intestines to push the wall creating a swelling bulge in the ilioinguinal area.

So Remember ;

Indirect Inguinal Hernia → **Inguinal Canal**

Direct Inguinal Hernia → **Inguinal Triangle**



SPERMATIC CORD

Before we start; some terminology to remember :

- **Testis:** the male reproductive gland, its functions are to produce both sperm and androgens, primarily testosterone.
- **Epididymis:** a tube that connects a testicle to a vas deferens, it's responsible for maturation of the sperms
- **Vas deferens:** is a tiny muscular tube that carries sperm from the epididymis to the ejaculatory duct.
- **Scrotum:** a thin external sac of skin that is divided into two compartments; each compartment contains one of the two testes.
- **Prostate:** is a gland located between the bladder and the penis, it is just in front of the rectum. It secretes fluid that nourishes and protects sperm.
- **Seminal vesicles:** vesicular glands, are located within the pelvis. They secrete fluid that partly composes the semen.
- **Ejaculatory duct :** is formed by the union of the vas deferens with the duct of the seminal vesicle, pass through the prostate, and open into the urethra at the seminal colliculus.

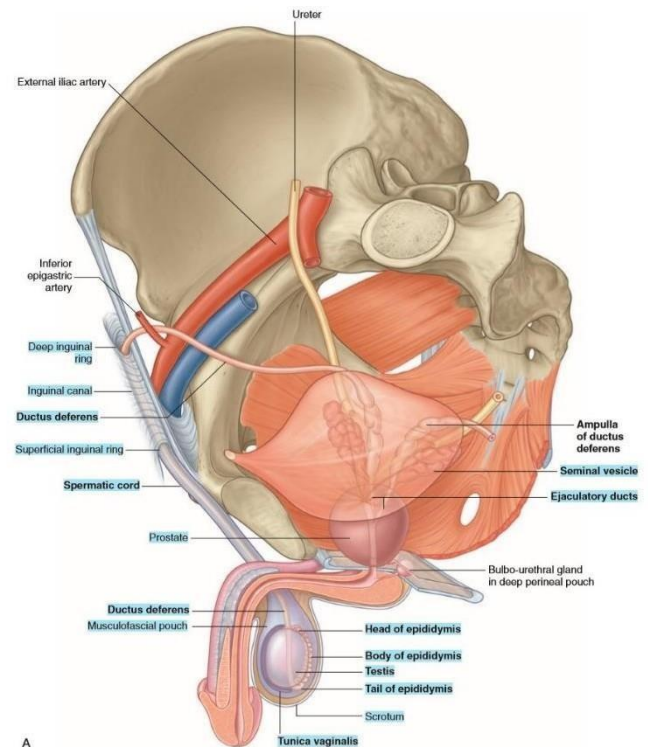


Fig. 5.47 Reproductive system in men. A. Overview.

Now let's go back to Spermatic cord:

- ❓ It is found in males only
- ❓ It is a collection of structures that pass through the inguinal canal **to** and **from** the testis

To: Certain arteries and motor nerves go to the testes through spermatic cord

From: Vas deferens emerges from tail of epididymis and moves away from the testis through spermatic cord (More details about vas deferens later on)

❓ It is covered with three concentric layers of fascia derived from the layers of anterior abdominal wall:

1) External Spermatic fascia: derived from the external oblique aponeurosis and attached to the margins of the superficial inguinal ring.

2) Cremasteric Fascia: derived from the internal oblique muscle inside the inguinal canal.

3) Internal Spermatic Fascia: derived from the fascia transversalis and attached to the margins of deep inguinal ring.

❓ It begins at the deep inguinal ring lateral to the inferior epigastric artery and ends at the testis.

Spermatic Cord has structures run with it; can be remembered using **ANO x 3**:

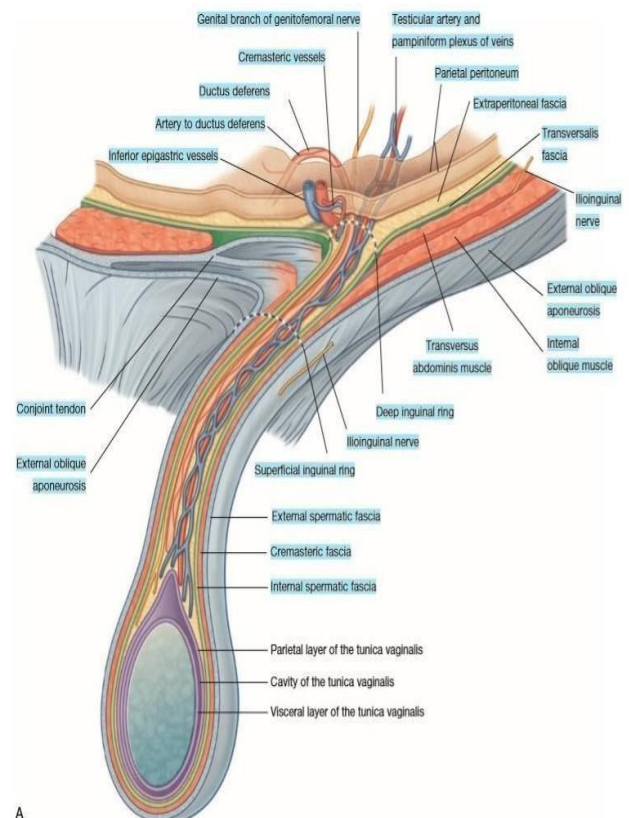
1) Arteries: testicular artery, cremasteric artery, artery of vas deferens.

2) Nerves: ilioinguinal, genital branch of genitofemoral, autonomic nerve fibers.

3) Others: vas deferens, pampiniform plexus of veins, testicular lymphatics.

1. VAS DEFERENS

- It is a cord like structure, 45cm long. It starts from the tail of epididymis & ends in the prostatic urethra, surrounded by artery, vein & lymphatics.
- Can be palpated between finger and thumb in the upper part of the scrotum.
- It is a thick walled muscular duct that transports spermatozoa-mature ones- from the epididymis to the seminal vesicles. Seminal vesicles give nutrition to the sperms then contracts to send them away through right and left ejaculatory ducts until they reach prostatic urethra. After that they pass through membranous urethra, penile urethra (penis), and finally outside the body.



2. TESTICULAR ARTERY

(Right and left); branches of abdominal aorta at L2. It descends on the posterior of the anterior abdominal wall (through deep ring) and goes through inguinal canal to supply the epididymis and testes.

3. TESTICULAR VEIN

The pampiniform plexus; a net or spider web around the testes, continues through the inguinal canal (it becomes the singular testicular vein at the level of deep ring). The right testicular vein goes to inferior vena cava (obliquely), and the left one goes straight up (perpendicular) and ends in the left renal vein.

- **Remember:** Varices are engorged, dilated, and tortuous veins.
- Because the left testis is lower, its vein goes straight upward, and has a higher pressure, which can cause varices on the left side
- Varicocele of the testis leads to infertility because they increase temperature of the testis. Sperm production occurs at 2-3 degrees below body temperature, that's why testes are located in the scrotum outside the body. Removal of varicocele returns the testis to their optimum temperature and the patient is fertile again.

4. AUTONOMIC NERVES

Are mainly sympathetic fibers that go with the testicular artery. They contain both vasomotor nerves as well as afferent sensory nerve from the testes. So, if a patient has orchitis (inflammation of the testis), the severe pain sensation is carried through these sympathetic fibers.

5. THE GENITAL BRANCH OF GENITOFEMORAL NERVE

It is a branch of L1 and L2, and it supplies the cremasteric muscle (the cremasteric muscle pulls the testes upwards towards the body in cold weather to maintain the temperature needed for sperm production). Itching of the upper medial side of the thighs leads to contraction of the cremasteric muscle, which is called cremasteric reflex, HOW? This reflex happens from the stimulation of femoral branch of the genitofemoral nerve then it goes to the spinal cord and returns in the genital branch leading to contraction of the cremasteric muscle.

6. THE TESTICULAR LYMPHATICS

Drain the testis and epididymis and goes through the inguinal canal to pour into the para-aortic lymph nodes at level of L1. While the lymphatic drainage of the scrotum (skin) goes to the inguinal lymph nodes in the femoral triangle.

7. PROCESSUS VAGINALIS

Part of peritoneum that takes the testes from the abdomen down to the scrotum. Testes and ovaries originally develop in the posterior abdominal wall at the level of L1. In the 8th month of pregnancy, processus vaginalis along with the gubernaculum, pull testes downwards to the deep ring → inguinal canal → superficial ring → Scrotum. Ovaries are pulled downwards in the same way until they reach iliac fossa.

***NOTE:** If the testes were not in place after birth, a surgical intervention has to be done.

When the testes are finally in the scrotum, processus vaginalis undergoes obliteration and fibrosis, **sealing** the deep inguinal ring completely. A defect in this process will lead to congenital indirect inguinal hernia.

→ Coverings of the testis:

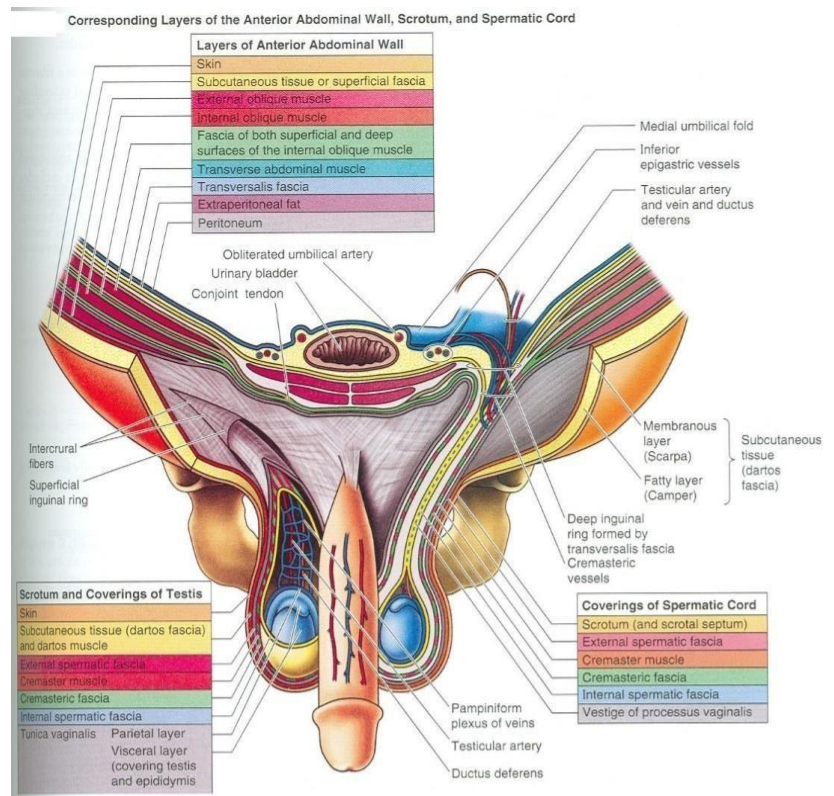
1) Skin

2) **Fatty layer:** Dartos fascia and Dartos muscle which are derived from Camper's fascia. Dartos muscle is responsible for wrinkling of the skin of scrotum

3) **Membranous layer:** Colle's fascia which is derived from Scarpa's fascia

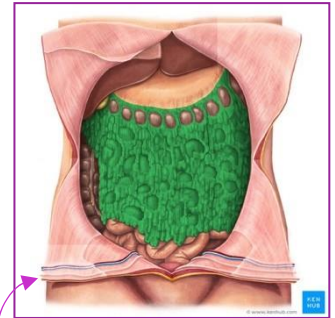
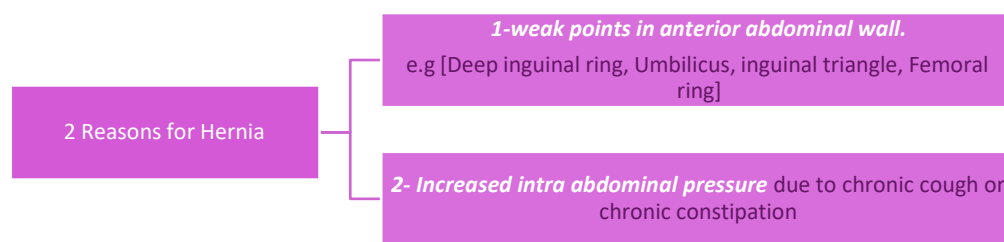
4) **External spermatic fascia, cremasteric fascia, internal spermatic fascia**

5) **Tunica Vaginalis** (Remnants of processus vaginalis after it gets obliterated in the deep ring. It consists of two layers, parietal and visceral.



Hernia:

A hernia is protrusion of part of peritoneum and abdominal viscera beyond the normal confines of the abdominal wall.



Hernia consists of 3 parts:

- **The Sac:** Pouch [Diverticulum] of peritoneum.
- **Contents of the Sac:** Small intestine or greater omentum (a fold of visceral peritoneum that hangs down from stomach).
- **Covering of the Sac:** Derived from layers of anterior abdominal wall which the hernial sac passes.

Indirect Inguinal Hernia:

The most common form of Hernia, it is of congenital origin (and can be acquired), also it's more common at right side than left side? Because of delayed descent of the right testicle. The Hernia moves through deep inguinal ring **lateral to inferior epigastric vessels** -> Inguinal canal -> may stay along inguinal canal or extend as far as superficial inguinal ring.

Causes:

- A) Fail in the obliteration of Processus Vaginalis -> **Congenital Indirect inguinal hernia, and it's usually bilateral.**
- B) Increased intrabdominal pressure like in chronic smokers -> chronic cough -> Deep inguinal Ring opens because peritoneum and abdominal viscera put pressure on it -> when small intestine pass through this opening -> Hernia, this hernia will continue to grow if untreated. Also, chronic constipation raises the intrabdominal pressure.
- C) In females it's very rare to happen, but if it did then the sac will move through deep inguinal ring -> inguinal canal -> Labia majora.

The hernia of this type either: → Moves at sides of spermatic cord.
→ Or enters between structures (contents) of spermatic cord.

If surgery done to treat hernia that's inside the spermatic cord cautions must be taken because *Vas deferens* is there and any cut will lead to infertility.

Some people do this in purpose for male sterilization or permanent contraception in process called Vasectomy in which *Vas deferens* is cut and tied to prevent sperms transportation to urethra.

Relations: Indirect Hernia passes laterally to **inferior epigastric artery**.

* Since Indirect Inguinal Hernia descends downward/forward/Medially, then we can push it back (reduction) upward/backward/laterally

Direct inguinal hernia:

Happens in Inguinal Triangle, it reaches the level of Superficial Inguinal Ring without passing through Deep Inguinal Ring.

Direction: Forward only, so retraction is backward.

Common scenario:

Old male patient (rare in women) -> his abdominal muscles are weak due to old age -> he also has chronic constipation -> Increased intrabdominal pressure -> Hernia.

Relations: Posterior to Inguinal Canal, and Medial to inferior epigastric artery.

Note:

Neck of Direct hernia is wider than neck of Indirect form? Because the neck of indirect hernia is at level of Deep ring, which is narrow. While the neck of direct hernia is at inguinal triangle which is wide area.

