Anatomy

Faculty of Medicine - JU2017

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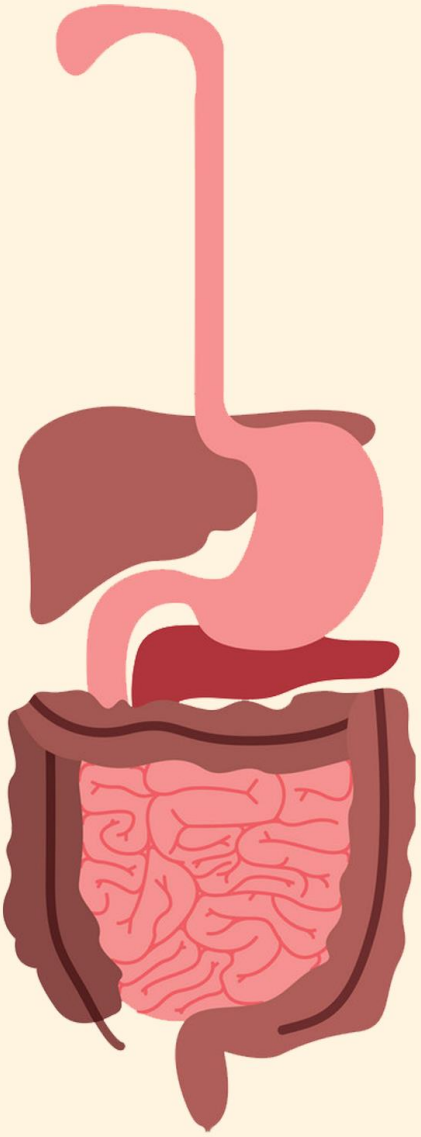


2nd system - GI

Inguinal Hernia

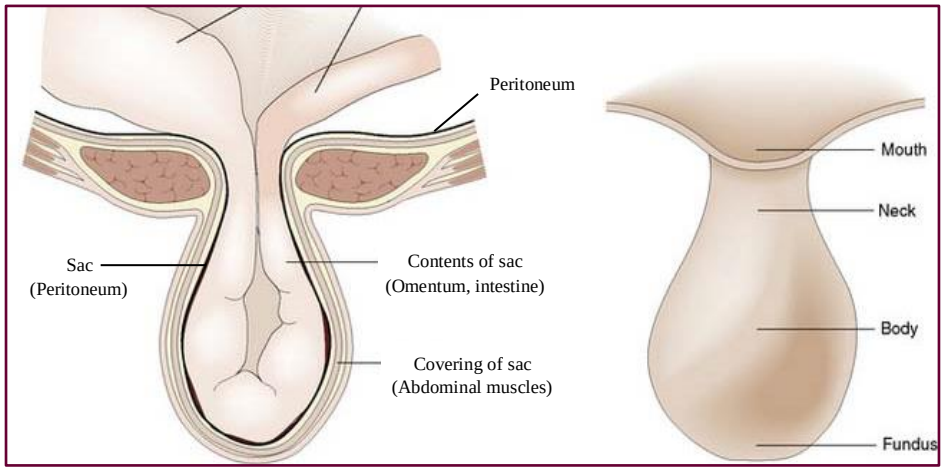
- An abdominal hernia is the protrusion of part of the abdominal content **beyond** the normal confines of the abdominal wall through weak points in the abdominal wall. This happens due to a **combination of**:
  1- **Weakness**
  2- **Strain;** increase in intra-abdominal pressure.

- Weakness can be in the:
  1- **Anterior abdominal wall muscles**; they become weak in elderlies.
  2- **Deep inguinal ring** in the transversalis fascia; considered a weak point because the spermatic cord passes through it.
  3- **Umbilicus**.

- The strain may result due to:
  1- **Chronic constipation** in elderlies.
  2- **Chronic coughing** in smokers.

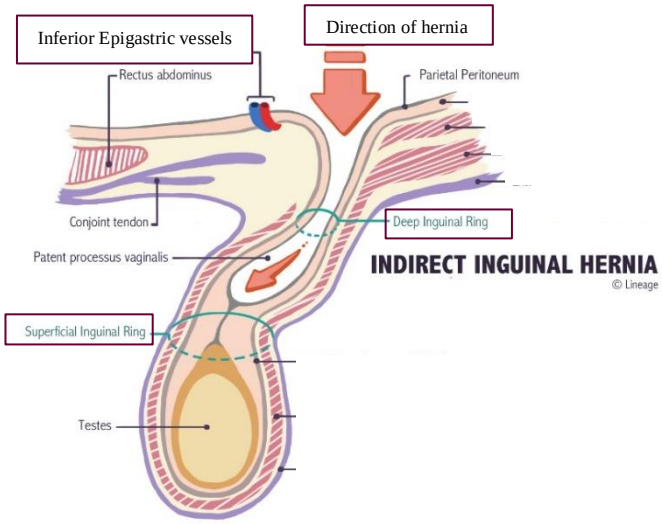
  ➔ **Increasing** the abdominal pressure with **strain** results in the opening of **weak points** allowing hernia to occur. **Small intestine** loops herniate most often, but also portions of **great omentum** may also protrude.

- A hernia consists of 3 parts:
  1- **The sac**; a pouch (diverticulum) of the **peritoneum**. It has a **neck** situated at the defect, **fundus,** and a **body**.
  2- **Covering of the sac**; derived from the layers of the **anterior abdominal** wall muscles.
  3- **Contents of the sac**; portions of either **omentum** or **small intestine**.

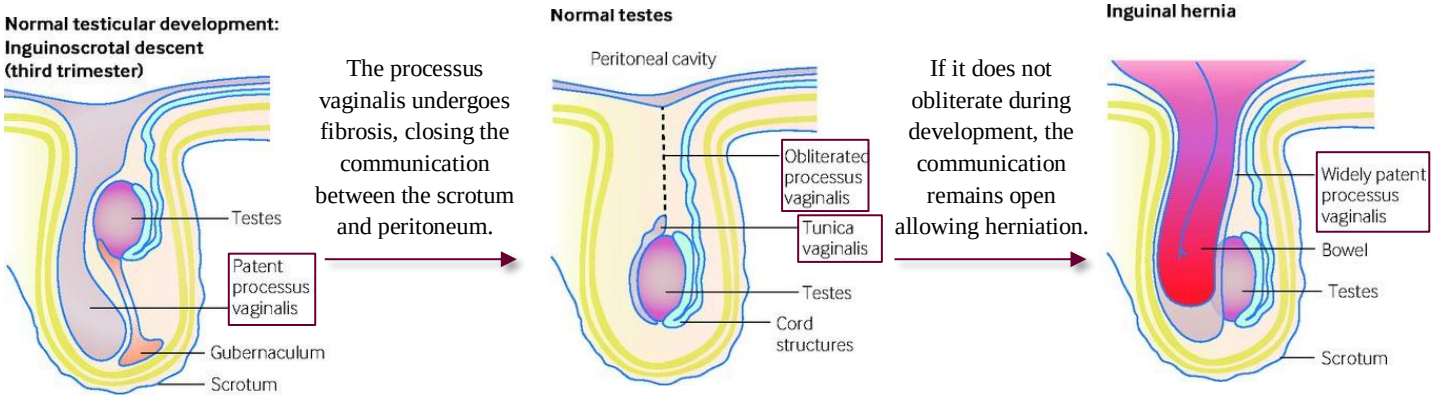


- There are many types of hernias, such as inguinal hernia, umbilical hernia, incisional hernia, etc. The inguinal hernia is the **commonest** and it can be either **indirect** or **direct**.

1- Indirect (most common)



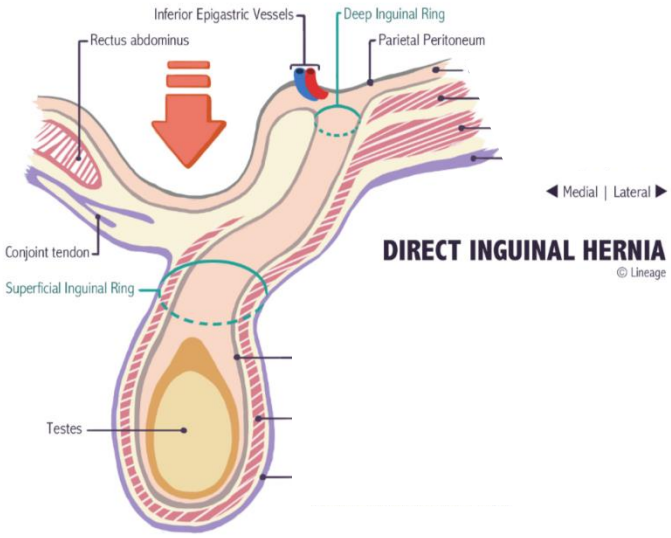
- **Route:** In **males**, it follows the course of the **spermatic cord**, entering the **inguinal canal** through the **deep inguinal ring**, **lateral** to the **inferior epigastric vessels** extending through the inguinal canal as far as the **superficial inguinal ring** or even the **scrotum**; the longer it persists the farther it goes. While in **females**, it extends through the superficial inguinal ring reaching the **labia majora**.
- The hernia descends **downwards, forward and medially**. To reduce it (push it back to the abdomen), a pressure is applied **upwards, backward and laterally**.
- It is mainly due to **congenital** defects where the **processus vaginalis persists**.
- **Explanation:** During the development of the embryo, the testes descend into the scrotum carrying along with it a **double layered peritoneal sac** called '**Processus Vaginalis**'. Later on, the **proximal** portion of the processus vaginalis **obliterates** undergoing fibrosis while the **distal** portion persists as '**Tunica Vaginalis**'.
- If the processus vaginalis did **not** undergo **obliteration** it remains in open communication between the **peritoneum** cavity and the **scrotum**, allowing herniation through it, with the **neck** of the hernia positioned at the **deep inguinal ring** *(recall the route).*



- If the indirect hernia is due to a **congenital origin** *(defect in the processus vaginalis),* it happens **bilaterally**, i.e. on both sides of the lower abdomen.
  If it's **acquired**, it happens **unilaterally** with it being more common on the **right** side; because the right testis descends **later** than the left testis.
- The indirect hernia is more common in **young males** than in females (20:1).

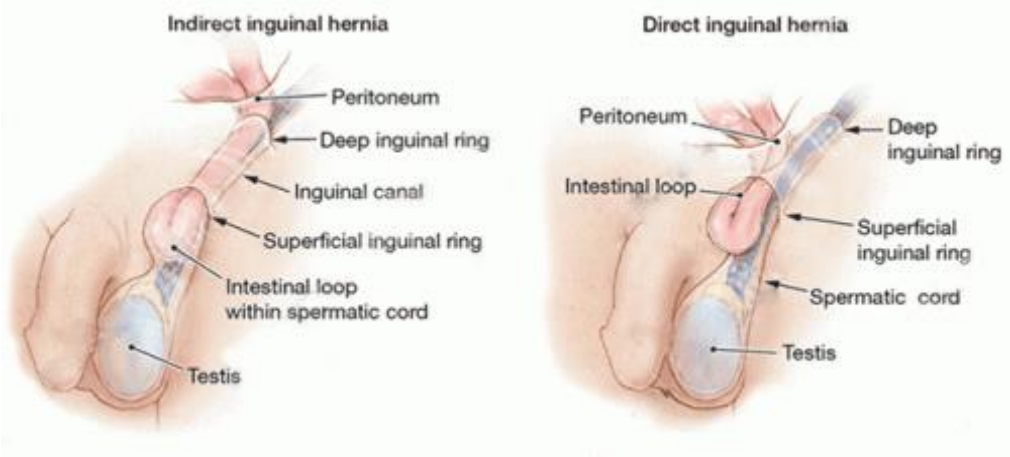
2- Direct

- It composes about **15%** of all inguinal hernias.
- It is common in **old** men due to the **weakness** of the abdominal muscles and **chronic constipation**, rarely showing in females.



- **Course**: The hernial sac bulges forward only directly into the **inguinal triangle**, **posterior** to the **inguinal canal floor** and **medial** to the **inferior epigastric vessels**. It is directly **behind** the **superficial inguinal ring**.
- The neck is **wide**, and it occurs **bilaterally**. Sac is formed by **peritoneum** and **transversalis fascia**.
- The direct hernia occurs in the **inguinal triangle** and it's **not** related to the inguinal canal, thus **never** reaching the scrotum. The **indirect** hernia follows the path of the spermatic cord through the **inguinal canal** and it's **not** related to the **inguinal triangle**.

Notice the routes



- **Tests for Hernia:**

A- Superficial inguinal test: Depends on the **pulsation** of the **inferior epigastric**. Reduce the hernia through the superficial inguinal ring by placing the index on it moving backward.

If the hernia is direct → Inferior epigastric vessels pulsation will be felt on the **side** of the index.

If the hernia is indirect → Inferior epigastric vessels pulsation will be felt on the **tip** of the index.

B- **Deep inguinal test**: This test is more accurate than the first one. Reduce the hernia by thumb, then hold it in position over the deep ring closing it. The patient is asked to stand up and cough.

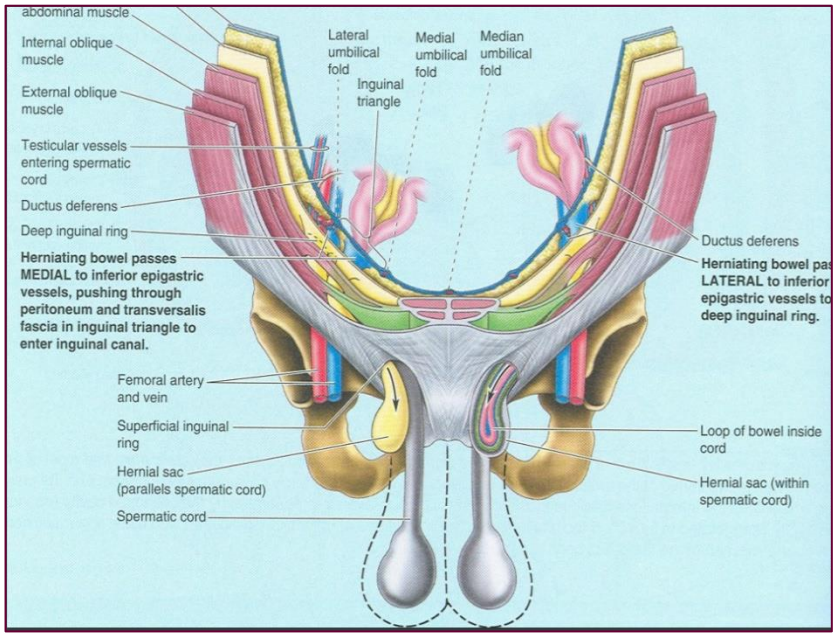
If the hernia is indirect → Hernia will **not** appear (bulge).

If the hernia is direct → Hernia will **appear** since the inguinal triangle is **open**.

- **Treatment:**

The treatment for both hernias is surgical. The hernia is **reduced** to the abdomen and then **stitches** are applied to strengthen the **weak area** *(especially behind the conjoint tendon)* from which the hernia had bulged.

Direct Inguinal Hernia



Indirect Inguinal Hernia

Memorize this table since it's important to differentiate between types of inguinal hernias.

	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

Scrotum

- It is an **outpouching** of the lower part of the anterior abdominal wall **outside** the body to keep the testis **cooler** (2-3^{o} lower than the body) for **sperm production**.
- Originally, it is a **single** pouch, but then a **septum** appears forming **two** pouches, each containing a **testis**, **epididymis** and the **lower end** of the spermatic cord. A ridge in the midline indicates the line of fusion of the 2 lateral labioscrotal swellings.
- Layers of the wall of the scrotum from external to internal:

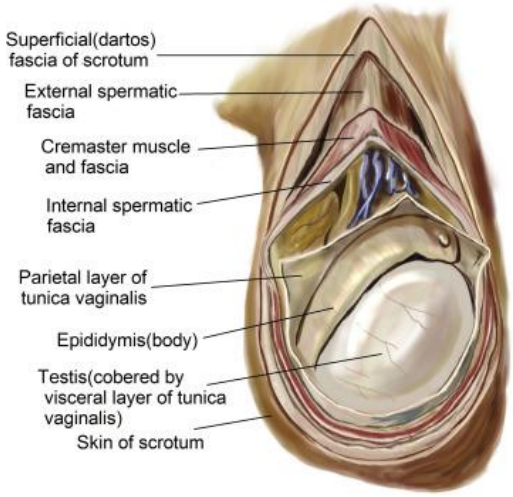
  1- **Skin**, which is **thin**, **pigmented** and **wrinkled**. Pigmented due to the presence of **melanocytes**.

  2- **Superficial fascia** which is continuous with the fatty (Camper's) and membranous layer (Scarpa's fascia) of the anterior abdominal wall. It has 2 layers:

  a- Dartos muscle: Fat extending to the scrotum is replaced by this **smooth muscle**, which is responsible for the **wrinkling** of the scrotum's skin innervated by **sympathetic** fibers.

  b- Colle's fascia: Membranous layer.

  ➔ Both layers contribute to the median partition (ridge) that crosses the scrotum separating the testes from each other.



  3- **Spermatic fascia**; layers of the **spermatic cord** derived from the muscles of the anterior abdominal wall:

  a- External spermatic fascia: Derived from the **external** oblique aponeurosis and attached to the margins of the **superficial** inguinal ring.

  b- Cremasteric muscle and fascia: Derived from the **internal** oblique muscle inside of the inguinal canal.

  c- Internal Spermatic fascia: Derived from the fascia **transversalis** and attached to the margins of the **deep** inguinal ring.

  d- Tunica Vaginalis originally from the distal part of Processus vaginalis.

- Tunica Vaginalis covers the anterior, medial and lateral surfaces of each testis, i.e. all sides **except posteriorly**. It gives 2 layers, **parietal** (connective tissue) and **visceral**, both surrounding the **testes** and **epididymis**.

  Between these 2 layers is a **potential space** where **fluid** may **accumulate** causing a type of swelling named '**Hydrocele**' treated by aspiration.

In summary, the layers of the scrotum are:

Skin → Superficial fascia (Dartos and Colle's) → External spermatic fascia → Cremasteric muscle and fascia → Internal spermatic fascia → Parietal layer of tunica vaginalis → Visceral layer of tunica vaginalis → Testis

External spermatic fascia

Cremaster muscle

Internal spermatic fascia

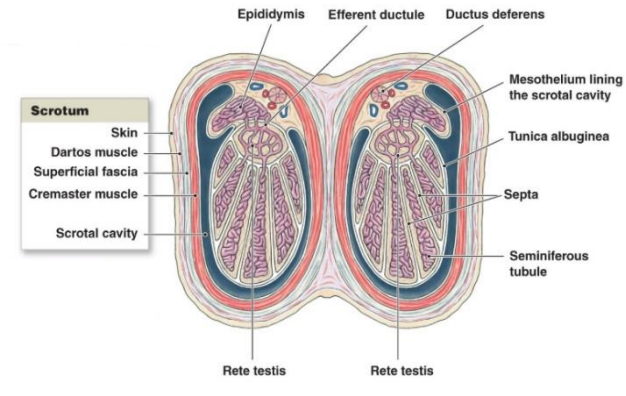
Parietal layer of the tunica vaginalis testis

Visceral layer of the tunica vaginalis testis

Note: *When forming **aspiration** for the scrotum in case of **Hydrocele**, the needle will pass through **all layers of the scrotum** except the **visceral layer** of the **tunica vaginalis**. Since the fluid is accumulating between the parietal and visceral layers of tunica vaginalis.*

Testes

- Testes are **firm**, **mobile** organs tilted **forward** within the **scrotum,** separated by a **septum** *(Dartos muscle and Colle's fascia).*
- **Left** testis usually lies at a **lower level** than the **right** testis.
- The testes are surrounded by a **tough fibrous** capsule named as '**Tunica Albuginea**'.
  - ➔ It sends a series of **fibrous septa** dividing the interior of the testis into **lobules.**
  - ➔ In each **lobule**, there are 1-3 coiled **seminiferous** tubules.
  - ➔ Tubules open into a network of channels called the **rete testis.**
  - ➔ Small **efferent ductules** connect the rete testis to the upper end of the epididymis (head).

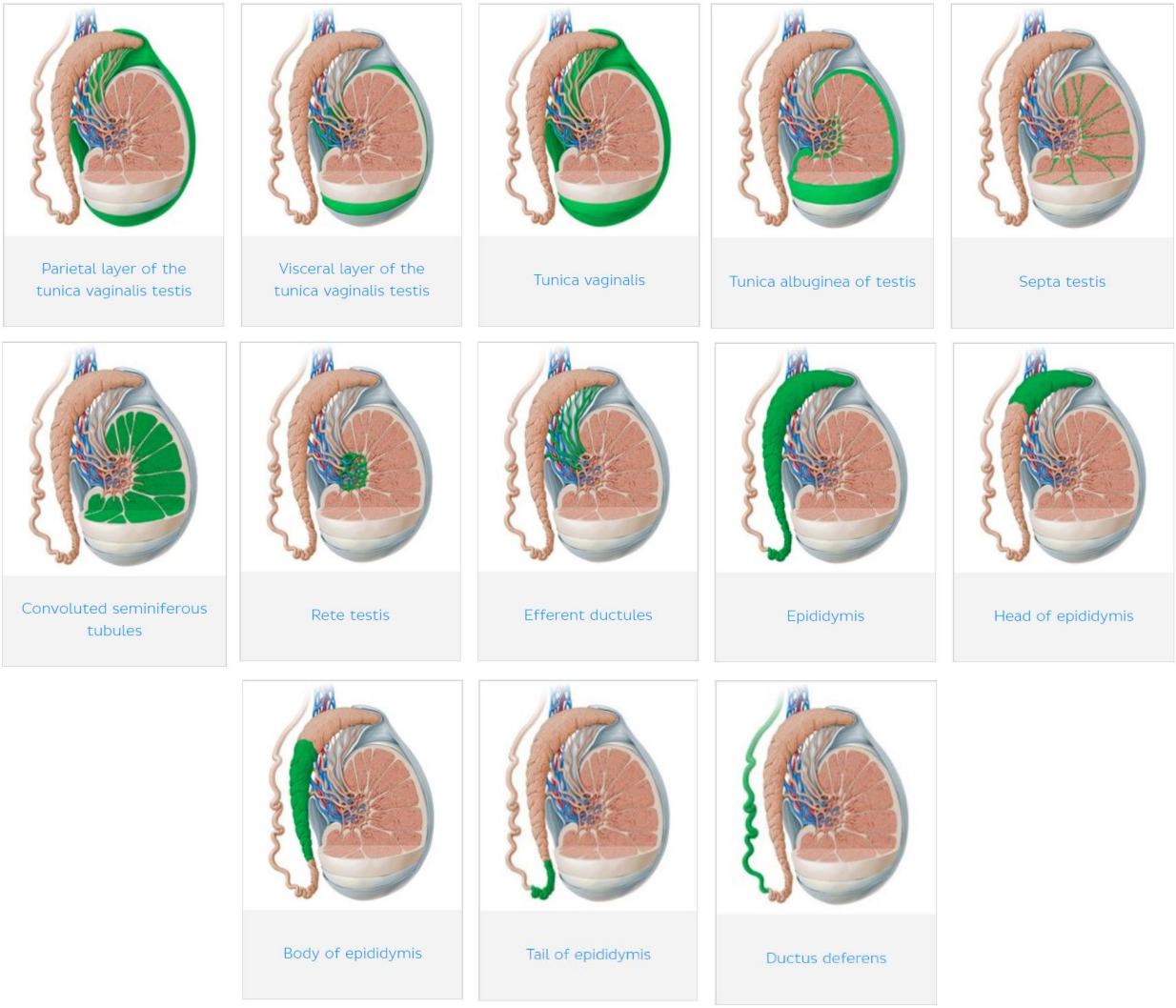


In summary, in testes:

Tunica Albuginea → Fibrous septa forming lobules → Each lobule has 1-3 seminiferous tubules → Open into rete testis → Efferent ductules → Head of epididymis.

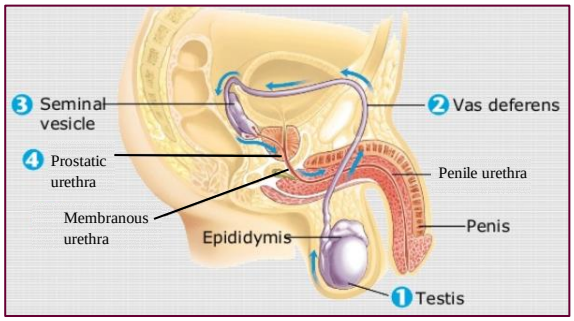
- Structures inside the testes:
  1- **Seminiferous tubules**: Thin, highly coiled structures where **sperm production** occurs.
  2- **Interstitial cells**: Major source of **androgens** located between seminiferous tubules.
  3- **Epididymis**: Site of sperm **maturation** (10-14 days), it runs along back of testis. It has a head, body, and tail where vas deferens begins.
  4- **Vas deferens**: Sperm carrying tube 45cm in length. It begins at the testis *(tail of epididymis)* and ends at the urethra *(seminal vesicle).* It travels through the spermatic cord.

Follow the pictures from left to right, to understand each structure separately.



- **Pathway of sperm:**
  1- Seminiferous tubules **produce spermatozoa** and are collected in the **rete testis**. From there, spermatozoa reach the **head** of the epididymis via **efferent ductules** where sperm **maturation** takes place.
  2- Sperm is **transported** to the **vas deferens**, which starts from the **tail** of epididymis and ends in the **seminal vesicle**, located posterior to the urinary bladder *(one on each side).*

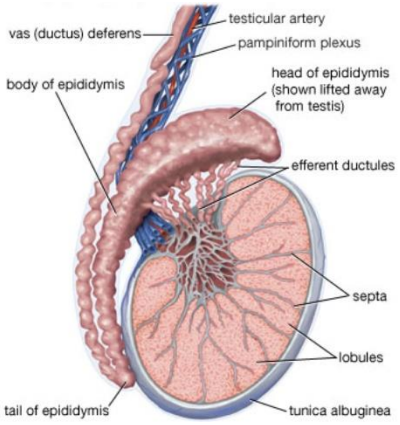
3- From the seminal vesicles, **ejaculatory ducts emerge** *(one on each side).* Each duct ends in a **prostatic urethra** where **semen** then travels through the membranous urethra, penile urethra, and then leaves the body.



- **Blood supply of testes:**

1- Abdominal aorta at the level of L2 gives rise to the **left and right Testicular arteries**. Each goes through the inguinal ring into the spermatic cord to the testes and epididymis.

2- **Pampiniform plexus** reduced to a single vein, **testicular vein**, at the deep ring level. It ascends through the inguinal canal, then the **right** testicular vein drains into **IVC** while the **left** testicular vein drains into the **left** renal vein.



> ***Note:*** *The drainage of the **left testicular** vein into the **left-renal vein** causes the vein to be **more perpendicular** having a **higher pressure** than in the right side.*

- **Lymphatic drainage:**

1- **For Testes:** Drainage follows **testicular arteries** and ends in the lymph nodes on the sides of the aorta at level L1 (**Lumber / para-aortic nodes**).

2- **For Scrotum**: Lymph drains into the **inguinal lymph nodes in the femoral triangle**.

> ***Note:*** *If a tumor occurs in the **testes** the enlargement is seen in the **para-aortic** lymph nodes, but if the tumor was in the **skin** of the **scrotum** then the enlargement is seen in the **superficial inguinal lymph nodes** in the femoral triangle.*

- **Nerve supply:**

1- **To Testes**: Sympathetic fibers run with the testicular artery from renal or aortic **sympathetic plexuses**. These fibers are also **afferent sensory** nerves through the sympathetic fibers.

2- **To Scrotum**: By the same sympathetic fibers to testes. In addition to the **ilioinguinal** nerve (L1) and the **genital branch** of the genitofemoral nerve which supplies the **cremasteric muscle**.

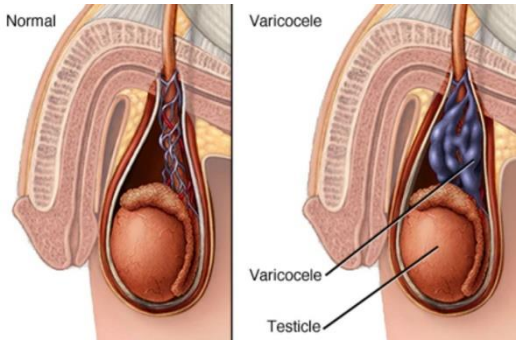
> ***Note 1:*** *The **cremasteric muscle** moves the testes **upwards** in adaptation to **cold** weather and it **relaxes** in adaptation to **hot** weather. This is important in **regulating** the temperature of scrotum to suit the production of sperm.*

Note 2: *The **cremasteric reflex** is a reflex found in human males that is elicited when the inner, upper medial part of the thigh is stroked. Stroking of the skin causes stimulation of the **genital branch** of the genitofemoral nerve causing the cremaster muscle to **contract** and pull **up** the testicle toward the inguinal canal upward.*

Clinical Notes

Abnormalities in the testis and scrotum:

1- Varicoceles



The veins of the **pampiniform plexus** become elongated, dilated and tortuous. The **left** side is affected **more** than the right side, because of **higher venous pressure** on the left side. It **increases** the temperature of the scrotum (+3°) affecting the production of sperm causing **infertility**. It is more common in young & adults.

The treatment is surgical in which most of the veins are cut and ligated keeping one or two veins to allow venous drainage **lowering** the temperature.

2- Vasectomy

It is the process of **ligating** the **vas deferens** tubes on both sides to cause **infertility**.

3- Hydrocele

It is the accumulation of fluid within the tunica vaginalis of the testis, i.e. between the 2 layers; parietal and visceral. Causes can be inflammatory or idiopathic.

Hydrocele pressurizes the testis requiring tapping (aspiration) as mentioned before.

4- Processus Vaginalis

Recall how the **upper part** is **obliterated** just before birth while the **lower** part **persists** as **Tunica vaginalis**.

If it persisted with no obliteration → Indirect bilateral inguinal hernia.

If it gets narrowed → Congenital hydrocele.

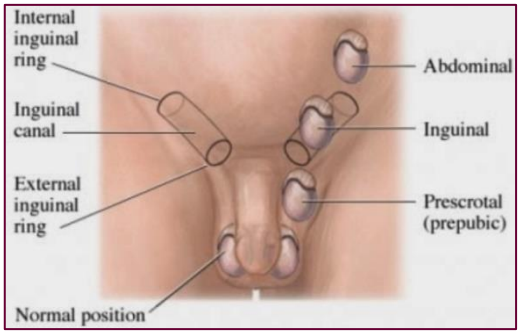
If both, lower and upper parts, are obliterated keeping the middle part open→ Encysted hydrocele.

Congenital Hydrocele Encysted Hydrocele

Congenital abnormalities of the testes:

1- Cryptorchidism

Incomplete descent of the testis although traveling down the **normal pathway**, it may be found in the abdominal cavity, inguinal canal, superficial inguinal ring or at the upper part of the scrotum.



2- Maldescent

Testes travel down an **abnormal pathway**, it may be found in the superficial fascia, the root of the penis, perineum or in the thigh.

It is **more difficult** than Cryptorchidism requiring an immediate operation. If the testis remains in an abnormal position beyond 6 years, this will impair the production of testosterone.

Good Luck ♥