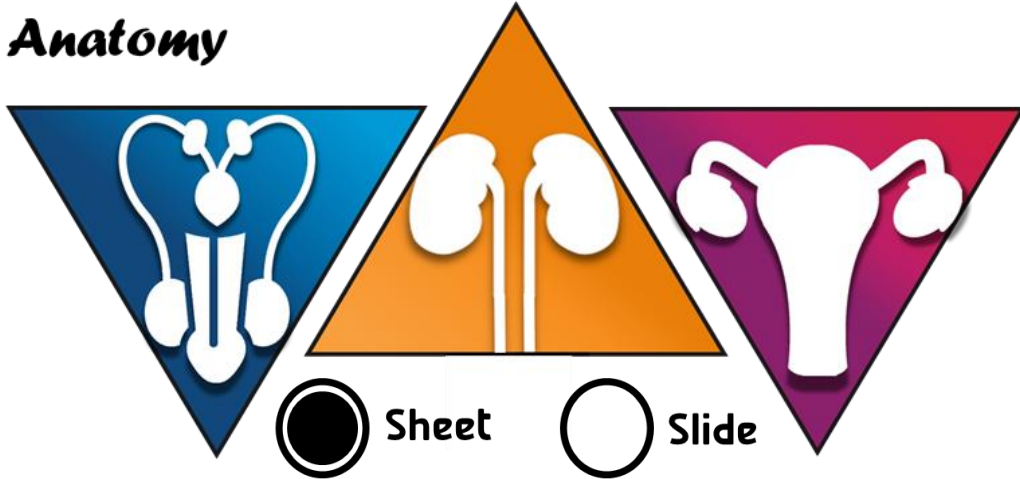




Urogenital system

Anatomy



Number:

-6

Done by:

أحمد رواجبة-

Corrected by:

محمود الحربي-

Doctor:

أحمد السالمان-

The Male Reproductive System

❖ The male genital system structures are divided into:

Internal structures: 1- Prostate

2-Seminal vesicles

3-Ejaculatory ducts

4-Vas deferens (or Ductus deferens)

External structures: 1-penis

2- the scrotum (which contains the

testis, epididymis and the spermatic cord)

-The glands found in the male genital system are: one prostate, a pair of bulbo-urethral glands, and a pair of seminal vesicles.

❖ Embryological development of the testes:

The testes develop on the posterior abdominal wall. Then they descend before birth through the inguinal canal into the scrotum.

During this journey, they carry their supportive structures (blood vessels, nerves, and lymphatics) and obtain their covering (tunica vaginalis) from the peritoneum. That is why the testes are supplied from the abdomen not the pelvis. This also explains why the reproductive tract, in males, turns from the perineum up to the abdomen then descend to the pelvis and return to the perineum. ?????

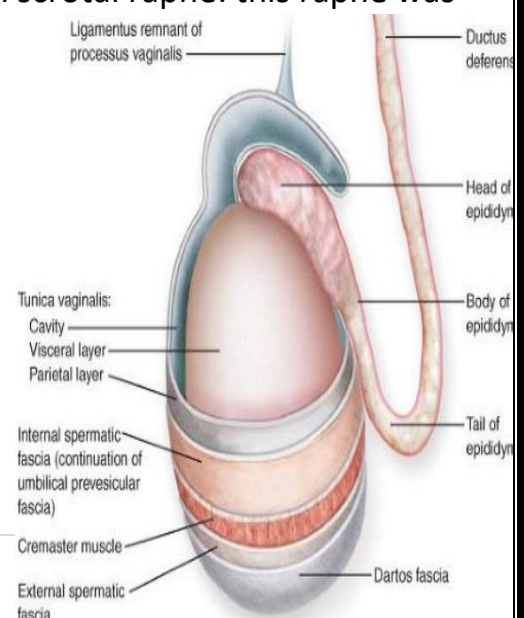
❖ Scrotum

-The scrotum is a pouch of skin outside the body.

-It contains: **1-Testis.** **2-epididymis:** the structure the transports sperm from the testis into the vas deferens. **3-The spermatic cord:** a bundle of ten structures that ascend from the testis and go to the abdomen.

-The scrotum has a line in the middle called the median scrotal raphe: this raphe was formed from the fusion of 2 folds in the embryo

Layers of the scrotum: Layers of the scrotum correspond to the layers of the anterior abdominal wall, and some of them are continuous with those of the abdomen. This correspondence is shown in the table below.



Layers of the anterior abdominal wall	Layers of the scrotum
Skin	Skin
Superficial fascia Superficial fatty layer Deep membranous layer (Scarpa's fascia)	Superficial fascia Replaced by Dartos muscle Deep membranous layer (Fascia of Colles)
External oblique muscle	External spermatic fascia
Internal oblique muscle	Cremasteric muscle and fascia
Transversus abdominis	<i>No corresponding layer</i>
Transversus fascia	Internal spermatic fascia
Extraperitoneal tissue	Loose connective tissue
Peritoneum	Tunica vaginalis around the testis

The superficial fascia of the anterior abdominal wall is composed of two layers: a **superficial fatty layer** (Camper's fascia) and a **deep membranous layer** (Scarpa's fascia). In the scrotum the superficial fatty layer is replaced by smooth muscular layer (Dartos fascia or Dartos muscle) and the deep one is called Colles' fascia.

*Be aware that there is no deep fascia in the abdomen

-Muscles of the scrotum:

1-Dartos muscle: This muscle is found in the wall of the scrotum and it replaces the superficial fatty layer that comes from the abdomen. It is a smooth muscle supplied by sympathetic fibers reaching from the genital branch of the genitofemoral nerve. Its function is 'thermoregulation'. In cold weather, it contracts and elevates the testis to come closer to the body. In hot weather, it relaxes so the testis become far from the body.

2- Cremasteric muscle: This muscle is found in the wall of the scrotum and it is an extension from the internal oblique muscle. It is a striated muscle supplied by the genital branch of the genitofemoral nerve. Its function is 'thermoregulation'. In cold weather, it contracts and elevates the testis to come closer to the body. In hot weather, it relaxes so the testis become far from the body.

*Be aware that both muscles are supplied by the genital branch of the genitofemoral nerve, but the Dartos is supplied by sympathetic fibers and the Cremasteric is supplied by somatic fibers.

-Cremasteric reflex: This reflex is elicited by lightly stroking or poking the superior and medial (inner) part of the thigh. The normal response is an immediate contraction of the Cremasteric muscle that pulls up the testis ipsilaterally (this reflex is usually

tested in infants). The afferent (sensory) limb of the reflex: ilioinguinal nerve. The efferent (motor) limb of the reflex: genital branch of genitofemoral nerve.

-Blood supply of the scrotum

Three main arteries supply the scrotum:

- 1- **Cremasteric artery**: it is a branch of the inferior epigastric artery. the IEG artery arises from the external iliac artery and ascends medially to the deep inguinal ring (the artery that is clinically important to differentiate the direct from the indirect hernia)
- 2- **Superficial external pudendal** and **deep external pudendal**: they are branches of the femoral artery.
- 3- **Scrotal branches** of the **internal pudendal**: it is the terminal branch of the anterior trunk of the internal iliac artery. As a rule, the internal pudendal provides blood supply to every part in the perineum.

So, the external iliac contributes by 3 arteries (IEG, SEP, DEP) and the internal iliac by one artery, the internal pudendal (scrotal branches).

-Innervation of the scrotum:

- 1- **Anterior one third** is supplied by: the **Ilioinguinal** nerve and **genital** branch of **genitofemoral** nerve.
- 2- **Posterior two thirds** are supplied by: 1-the **posterior scrotal** nerve branches off from the perineal nerve, a branch of the pudendal nerve 2- **The posterior cutaneous nerve of the thigh.**

-Lymphatic drainage of the scrotum: to the **superficial inguinal** lymph nodes.

❖ Testis

It has 2 poles (the upper and lower), 2 borders (anterior and posterior), and 2 surfaces (medial and lateral).

-Covering of the testis, three layers:

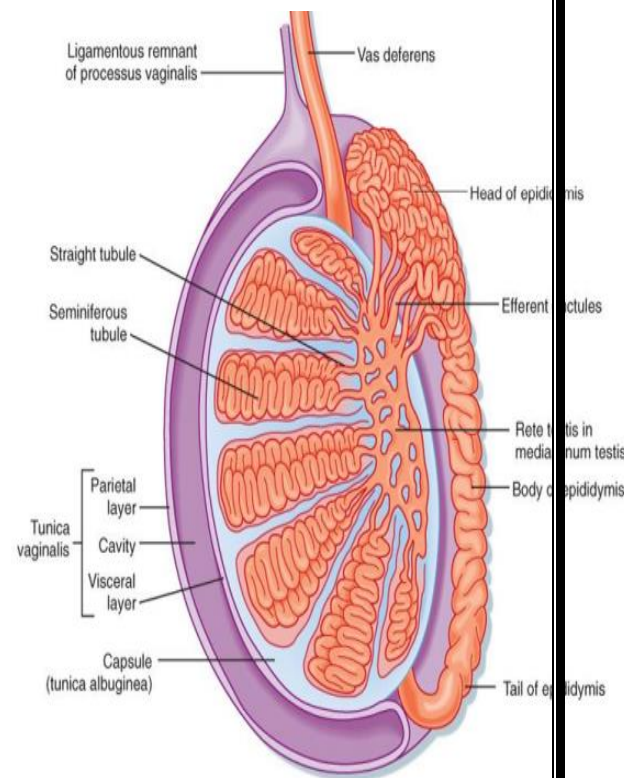
- 1- **Tunica vasculosa**: It is the most inner layer. It is formed of vascularized connective tissue and extends between the lobules of the testis. This layer gives the blood supply to the testis.

2- **Tunica albuginea:** It is the middle layer. It is the tough white fibrous layer which covers the testis all around.

3- **Tunica vaginalis:** It is the outermost layer. It is the lower part of the **processus vaginalis** of the peritoneum. It is invaginated by the testis from behind, so it covers the whole testis except the posterior aspect. It has parietal and visceral layers with a cavity in between. The remaining part of the processus vaginalis, which extends from the peritoneum to the tunica vaginalis, is usually obliterated. If it is not closed, the connection between the peritoneum and the tunica vaginalis could lead to diseases like **congenital hernia** or **hydrocele**.

-Sinus of epididymis: that part of the cavity of tunica vaginalis which extends between lateral side of testis and the epididymis

-The composition of the testis: the thickened postero-superior part of the tunica albuginea (**mediastinum testis**) sends septa to divide the testis into lobules. Each lobule consists of highly coiled **seminiferous tubules** (produce spermatozoa) and **interstitial cells of Leydig** in between the tubules (produce testosterone) (extra: *ferous* is a suffix to describe things that produce specified material; for example, the seminiferous tubules produce semen and the uriniferous tubules produce urine). At their end, they become the **straight tubules**. The straight tubules come together and anastomose to form the **rete testis** in the mediastinum testis. From upper part of the rete testis, **efferent ductules** which emerge from the upper pole of the testis to form head of epididymis.



The **scrotal septum** divides the scrotum into two compartments; right and left.

❖ **The epididymis**

-It is the highly coiled comma shaped tube which is attached to the postero-lateral aspect of the testis.

-It provides an environment for storage and maturation of sperms. It has one contractile muscular layer and cilia inside on the epithelium to push the sperms slowly.

-The epididymis continues as the vas deferens.

Length: In the comma shaped coiled form it is about 1.5 inches long. When it is uncoiled, it measures about 6 meters in length.

It has 3 parts:

- 1- **Head:** forms a cap at upper pole of the testis, to which is connected by efferent ductules. These ductules form head of the epididymis
- 2- **Body:** is the intermediate part and is made up of the single coiled tube
- 3- **Tail:** is the lower end of the tube and it continues as vas deferens which ascends medial to the epididymis.

-Arterial blood supply of the testis and epididymis: They are supplied by **testicular** artery, a branch of the abdominal aorta at the lower border of **L2 vertebra**.

It descends on the posterior abdominal wall to reach the deep inguinal ring where it runs in the spermatic cord in the inguinal canal. It supplies epididymis and enters the testis

It anastomoses with cremastic artery and artery of the vas

-Venous drainage: Venous blood from testis and epididymis drain into the pampiniform plexus. It surrounds and accompanies the testicular artery in the spermatic cord up to the superficial inguinal ring. In the inguinal canal, it gives rise to a **single testicular vein**. The **right** vein ends in the **inferior vena cava** and the **left** one ends in **left renal vein**.

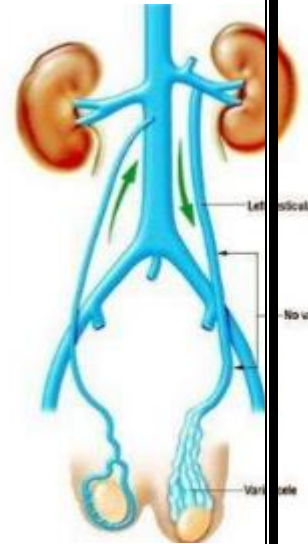
Clinical note: Varicocele

-A varicocele is a condition in which the veins of the pampiniform plexus are elongated and dilated.

-It is a common disorder in adolescents and young adults. The most important **complication** of it is infertility. The patient will come to the clinic complaining of

infertility or pain in the scrotum . It is more common occurring on the **left side** because:

- 1- The right testicular vein joins the low-pressure inferior vena cava (the angle between them is an acute angle), while the left vein joins the left renal vein, in which the venous pressure is higher (the angle between them is a right angle (90°)).
- 2- The Left side is drained by the left renal vein which receives the left suprarenal vein. The suprarenal vein contains adrenaline and noradrenaline which cause vasoconstriction.
- 3- the left renal vein may be compressed between aorta and superior mesenteric artery.
- 4- Left testicular vein may be compressed by heavy stool-filled left colon.
- 5- The left testis is lower than right one with elongated left testicular vein.



-Innervation of the testis: THIS PART EVERY STUDENT READ THE ARTICLE (I DIDN'T REVIEW IT _

The testes are embryologically derived from the same level as the kidneys. Therefore, they share a common level of autonomic innervation, which is 90% sympathetic originating from the T10-L1 segments, and the rest parasympathetic originating from the S2–4 segments. Three groups of autonomic nerves travel with the gonadal vessels and vas deferens to the epididymis and testis:

- 1- **Superior spermatic nerves**, composed of fibers from the **renal** and **intermesenteric plexuses** follow the testicular artery to the testis. This association between the intestinal (intermesenteric) and testicular nerves may explain the “kick in the stomach” feeling accompanying testicular injury.
- 2- **Middle spermatic nerves** arise from the **superior hypogastric plexus**, pass to the mid-ureter and travel alongside the vas deferens to the internal ring, where they join the spermatic cord. The ureteral proximity may explain pain radiation to the scrotum of an obstructing ureteral stone.
- 3- **Inferior spermatic nerves** originate from the pelvic plexus (**inferior hypogastric plexus**), and join the middle spermatic nerves at the prostate-vesical junction. Some afferent and efferent fibers decussate to the contralateral pelvic plexus, which may explain how lesions in one testis affect the function of the other testis

-Lymphatic drainage: to the **lateral aortic** lymph nodes.

-Thermoregulation of the testis: The process of spermatogenesis needs a temperature 2-3°C below the body temperature. This is achieved through the following 3 mechanisms:

1. **Cutaneous mechanism:** The scrotal skin is very vascular and rich in sweat glands. Fat is absent in its subcutaneous tissue, all aid heat loss.
2. **Muscular mechanism:** Includes 2 muscles, dartos and cremastic. In cold, cremastic muscle elevates the testis near the body, so preventing heat loss. In warm weather, the opposite effects are obtained.(extra: contraction of dartos, in response to decrease in temperature, reduces the surface area and the blood supply to the skin; thus, minimizing heat loss.)
3. **Vascular mechanism:** The pampiniform plexus aids heat loss by radiation, so it helps in maintaining low temperature around the testis.

❖ **The spermatic cord**

It is a group of structures which meet at deep inguinal ring and traverse the inguinal canal down to posterior border of the testis through the superficial inguinal ring.

Constituents of the spermatic cord:

1. **Testicular Artery or the gonadal artery** (from aorta)
2. **Cremastic Artery** (from inferior epigastric artery)
3. **Artery of the vas** (from the inferior vesical artery)
4. **Vas deferens**
5. **Pampiniform venous plexus**
6. **Vestige of processus vaginalis.** The vestige is formed as a result of the obliteration of the processus vaginalis (to cut the connection with the peritoneum)
7. **Genital branch of genitofemoral Nerve.**
8. **Sympathetic plexus** around the testicular artery and artery of the vas
9. Lymphatics of testis and epididymis ascending to lateral aortic lymph nodes.

Clinical notes:

1-Torsion of the Testis:

Torsion of the testis is a rotation of the testis around the spermatic cord. It is often associated with an excessively large tunica vaginalis. The problem with the rotation is that the testicular artery is also rotated around itself causing ischemia, and in severe cases it may proceed to gangrene. The patient complains from severe pain. It is an emergency case because the testicular artery may be occluded, followed by necrosis of the testis.

2-Hydrocele: It is an accumulation of fluid within the tunica vaginalis between the parietal and visceral layers. It can occur if the processus vaginalis does not close after the descent of the testes

3- Haematocele: It is an accumulation of blood within the tunica vaginalis between the parietal and visceral layers.

* shining a light through the scrotum distinguishes the hydrocele from Haematocele; clear transillumination indicates hydrocele and opaque transillumination indicates haematocele.

❖ *Ductus Deferens (Vas Deferens)*

-It is thick walled muscular tube. It springs from the lower end of the epididymis and ends behind the base of the bladder, by joining the duct of the seminal vesicle to form the ejaculatory duct; its length is about 45 cm.

-Function: transmits the spermatozoa from the **epididymis** to the **ejaculatory duct**, which in turn opens in the **prostatic urethra**.

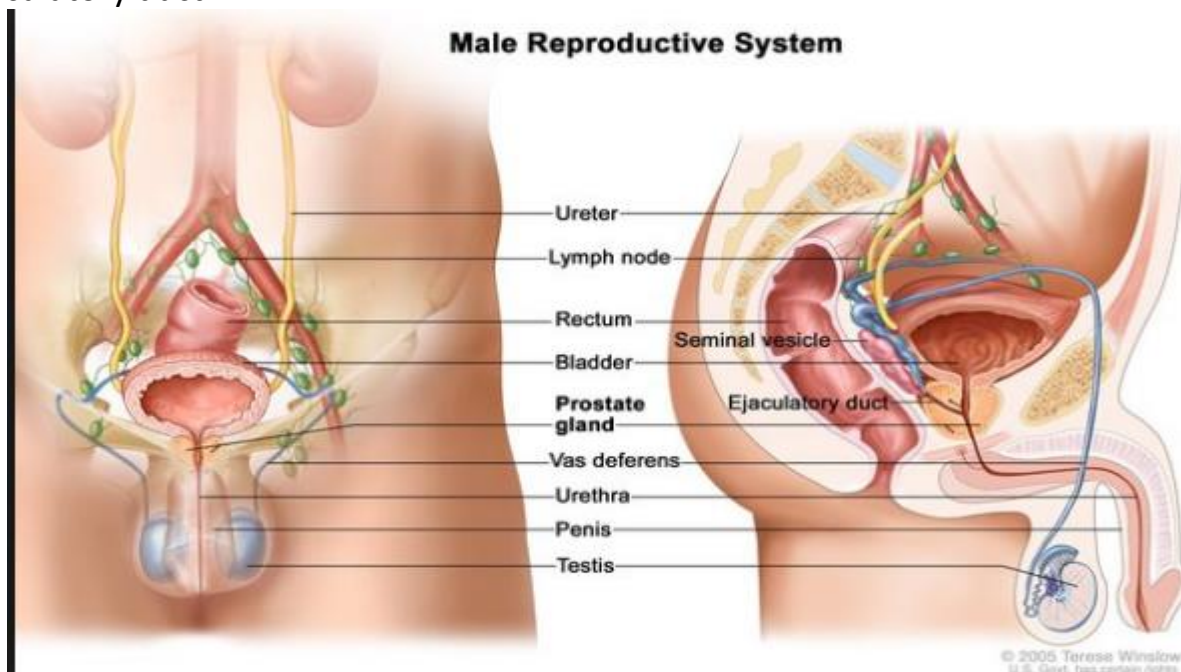
-Course and Relations of the Vas: Its distal part lies in the scrotum and inguinal canal, its proximal part runs in the pelvis:

A. Course of its distal part in the scrotum and inguinal canal: From the tail of the epididymis, it ascends along the posterior aspect of the testis (as the epididymis is posterior to the testes), medial to the epididymis. Then, it ascends in the spermatic cord to traverse the inguinal canal. After the inguinal canal, it will pass through the deep inguinal ring to go medially in the pelvis. To go medially, it will have to cross a lot of structures. It leaves the cord and curves around the lateral side of the **inferior epigastric artery** to enter the pelvis.

B. Course of its proximal part (in the pelvis) : The vas descends posteriorly external to the peritoneum, crossing these structures in the lateral wall of the pelvis after it curves around the inferior epigastric artery :-

External iliac vessels, obturator nerve and obturator vessels and the obliterated umbilical artery (medial umbilical ligament) (in that order).

Then, it turns medially and crosses the **ureter**(in females, the uterine artery crosses the ureter) near the superolateral angle of the base of the bladder . Behind the bladder base, it runs superior to, then medial to the seminal vesicle and expands to form **ampulla of the vas**, then it narrows to join the duct of the seminal vesicle to form the ejaculatory duct .



-So the relations are: curves around the inferior epigastric artery → crosses over the external iliac artery → crosses over the obturator nerves and vessels → crosses over the medial umbilical ligament → it turns medially and crosses the ureter

-Blood supply of Vas deferens:

Artery of the vas arises from the **inferior vesical artery**. It runs in the spermatic cord and anastomoses with the testicular artery.

-Venous drainage of vas deferens: vein of vas joins the **vesical venous plexus**.

-Innervation of the vas deferens: are derived from prostatic nerve plexus which comes from the **inferior hypogastric plexus**. Fibers are mainly sympathetic for the process of ejaculation.

Applied Anatomy: bilateral vasectomy is a common operation for male sterilization.

❖ **Seminal Vesicles**

It is a sacculated tube, about 5 cm long.

Site and relations: it lies behind base of the bladder and has the following relations:

- 1- **Anteriorly:** Base of the **bladder**.
- 2- **Posteriorly:** the **Rectum** and the **rectovesical** pouch.
- 3- **Superiorly:** Its upper end is covered by peritoneum of the rectovesical pouch and related to the vas deferens.
- 4- **Medially :** **ampulla of the vas** deferens
- 5- **Inferiorly,** it narrows into a small duct which joins the vas to form **ejaculatory duct**.

-Blood supply: from **inferior vesical** and **middle rectal** arteries.

-Venous drainage: to **vesical venous plexus**.

-Innervation: from the prostatic nerve plexus which comes from the **inferior hypogastric plexus**. Fibers are mainly sympathetic.

-Functions: the seminal vesicle produces an alkaline secretion rich in fructose and mucus. The secretion is added to the spermatozoa in ejaculation.

Applied Anatomy:

- 1- When the seminal vesicles are enlarged, they could be felt on rectal examination.
- 2- Abscess in the seminal vesicle may rupture into the peritoneal cavity. They are usually drained by the rectum because it less dangerous than draining it from anywhere else.

