



GENITOURINARY SYSTEM

SUBJECT : Anatomy

LEC NO. : 2

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وَقُلْ رَبِّ زِدْنِي عِلْمًا



GUS..

Lecture (2)

Anatomy & Histology of Ureter, Urinary bladder & Urethra

Dr. Amany Allam

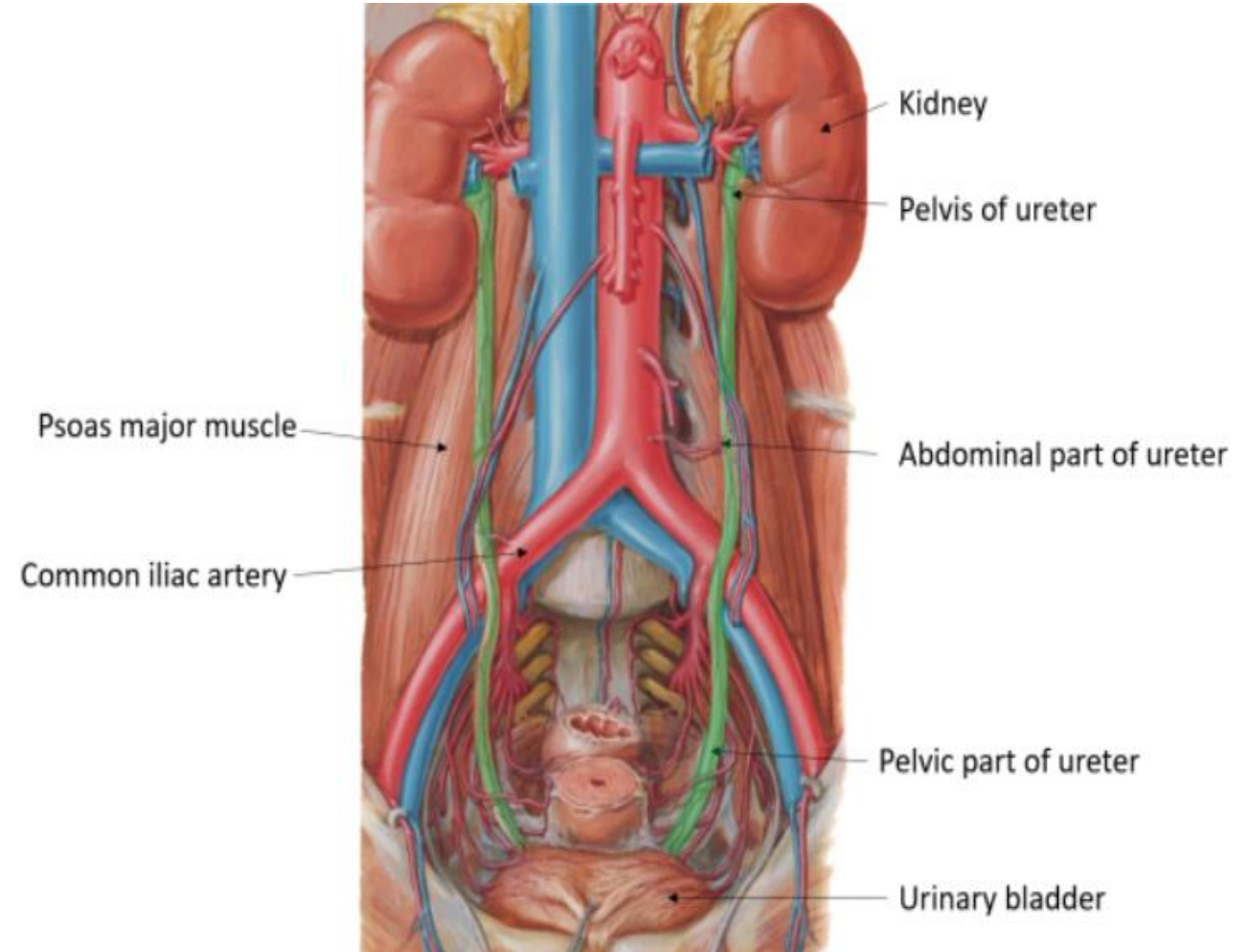
Assistant professor of Anatomy & Embryology

ILOs

- 1. Understand the extension, relations, blood & nerve supply, and lymphatic drainage of ureters.**
- 2. Outline the three constrictions of the ureters.**
- 3. Describe the shape, location, surfaces, relations, blood & nerve supply, and lymphatic drainage of urinary bladder.**
- 4. Understand the Intraperitoneal and extraperitoneal rupture of urinary bladder.**
- 5. Describe the gross anatomy of male and female urethra.**
- 6. Describe the histology of the ureter, urinary bladder and urethra**

✿ Because kidney is an abdominal part and urinary bladder is a pelvic part, ureter will have 2 parts according to its relations abdominal and pelvic (continuous with each other) **Ureter**

- The two ureters are retroperitoneal muscular tubes that extend from the kidneys to the urinary bladder.
- It is about 25 cm (10 inches) long.
- Its upper part lies in the abdomen (**Abdominal part**).
- Its lower part lies in the lesser pelvis (**Pelvic part**).




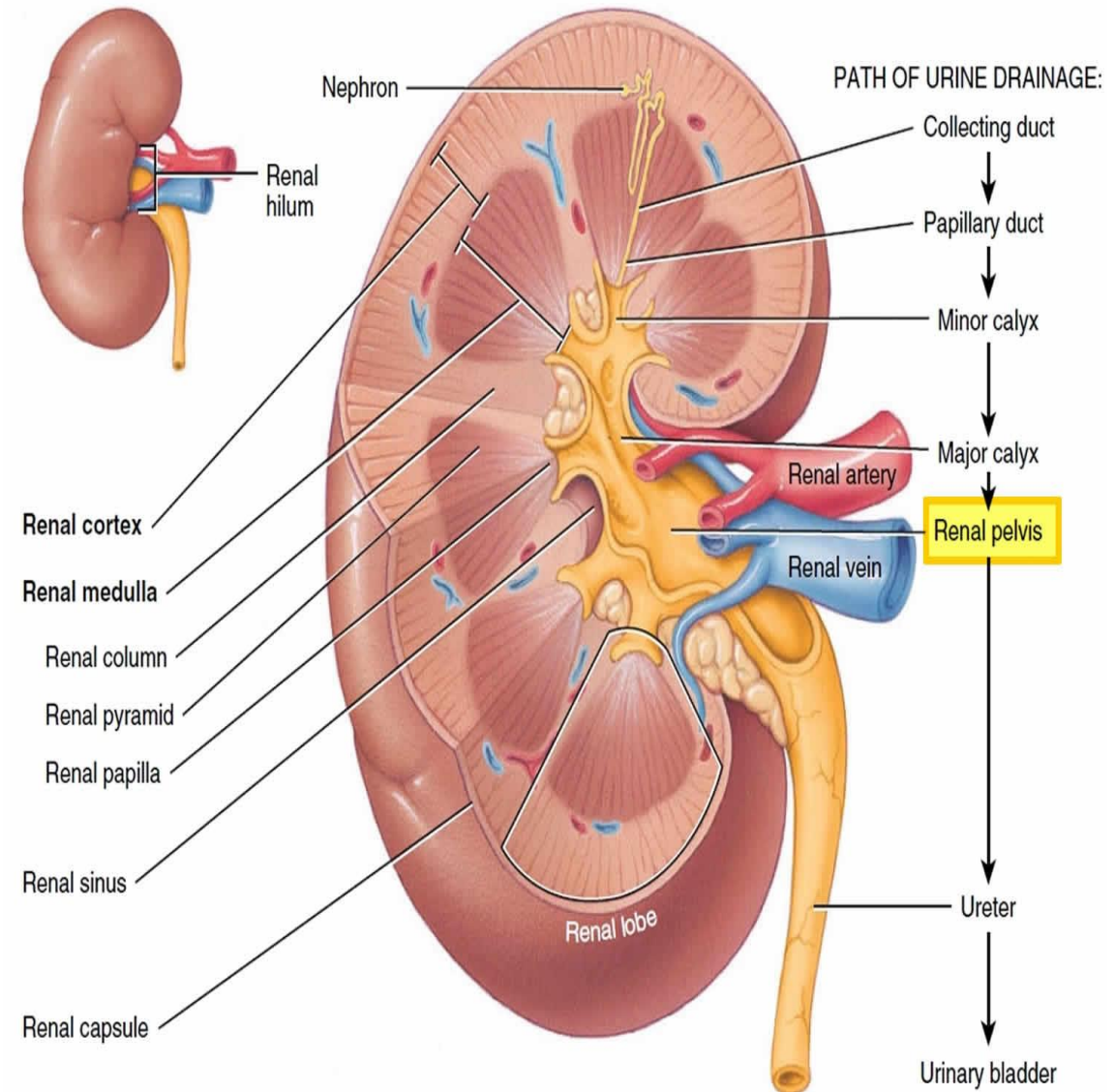
Abdominal Part of Ureter

- It is continuous superiorly with the renal pelvis (**Pelvis of the ureter**).

✿ It has pelvicureteric junction between abdominal part of ureter and tunnel

Pelvis of the ureter: shaped part the pelvis

- It is a funnel-shaped **lies** partly inside the renal sinus and partly outside it.  **Renal pelvis**
- It **divides into (2- 3) major calyces** each of which divides into (2- 4) minor calyces, each **minor calyx** receives the tips of 1 -3 **renal papillae**.
- It **tapers** as it passes inferomedially, **traversing** the renal hilum to become **continuous with the abdominal part of ureter at the Pelviureteric junction**.



(a) Anterior view of dissection of right kidney

Abdominal part of Ureter

Course:

- It runs vertically downward.
- It is continuous with the pelvic part of ureter by crossing the beginning of the external iliac artery.

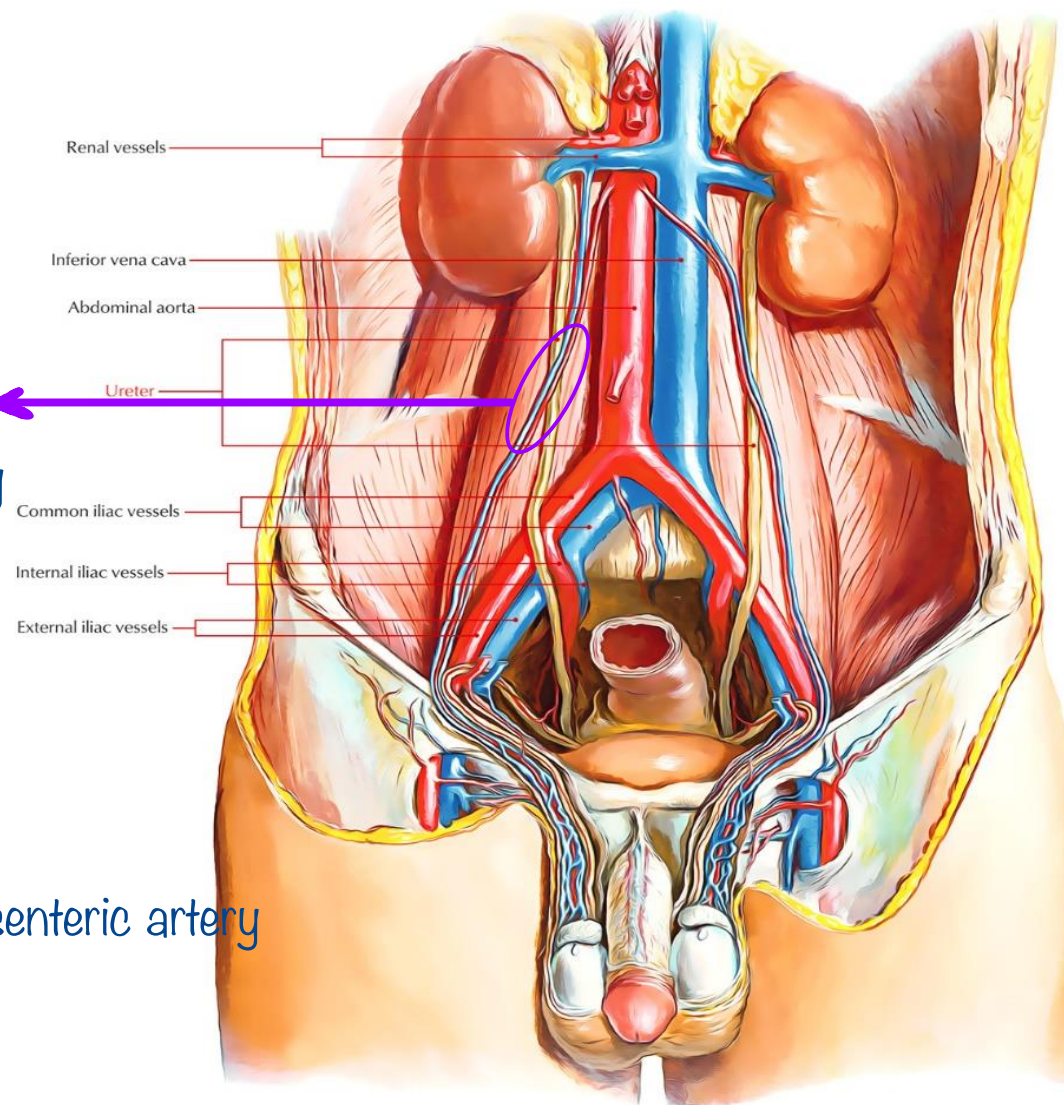
Anterior Relations:

Different in both sides

→ In anterior relation like kidneys but similar
A-Right Ureter: in posterior relations

- Its upper part covered by the second part of duodenum.
- It is crossed by the following structures:
 - Right colic and ileocolic vessels. → Branches of superior mesenteric artery
 - Right testicular or ovarian vessels. → Gonadal vessels
 - Terminal part of the ileum.

* Gonadal vessels cross both right and left ureters anteriorly



Abdominal part of Ureter

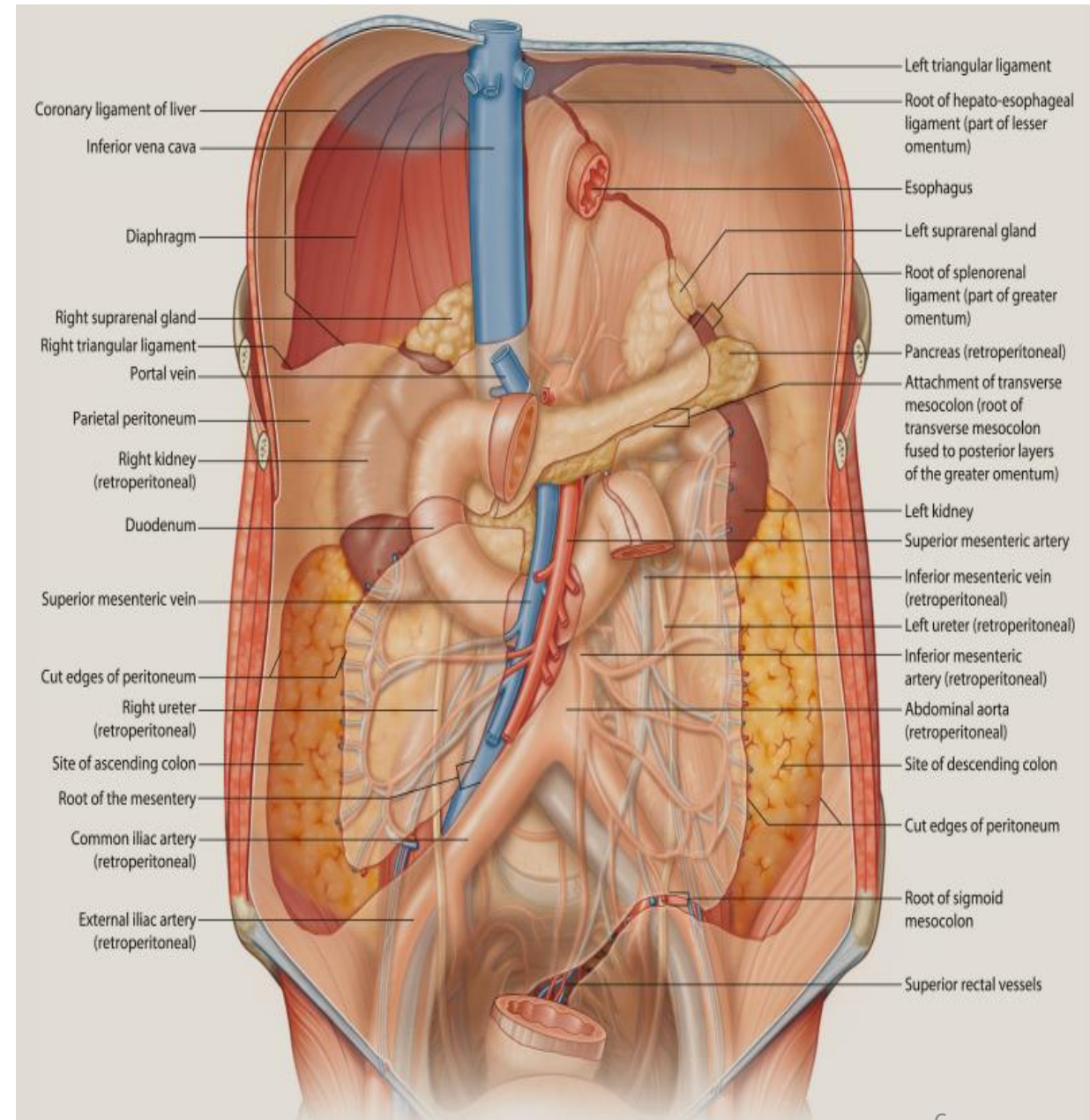
B- Left Ureter:

▪ It is crossed by the following structures:

- Left colic vessels.
- Left testicular or ovarian vessels.

□ Posterior Relations: → The same of both sides

- Corresponding **psoas major muscle**, which separates it from the tips of the transverse processes of the lumbar vertebrae.



Pelvic part of Ureter

Once the ureter crosses external iliac vessels it the pelvic part starts and abdominal part ends, why external iliac vessels? Because

they run on pelvic rim

Course:

- The ureter **enters the pelvis by** crossing the beginning of the external iliac artery.

Firstly it courses downward and backward

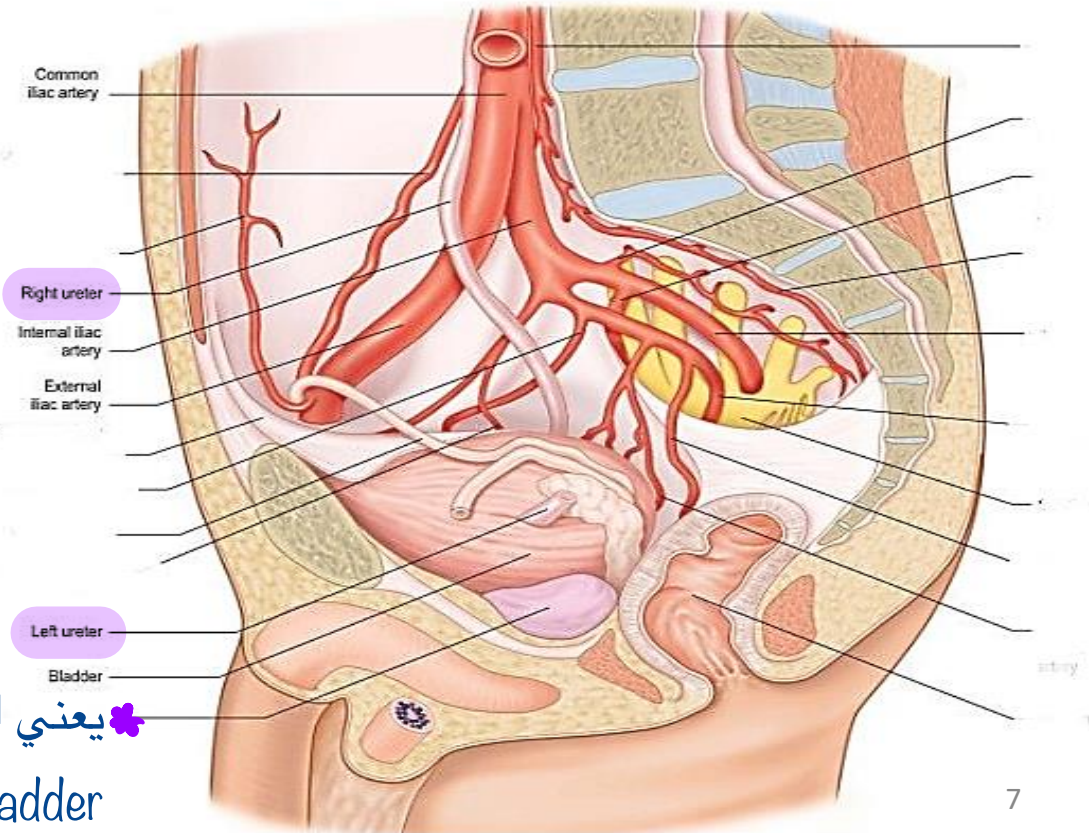
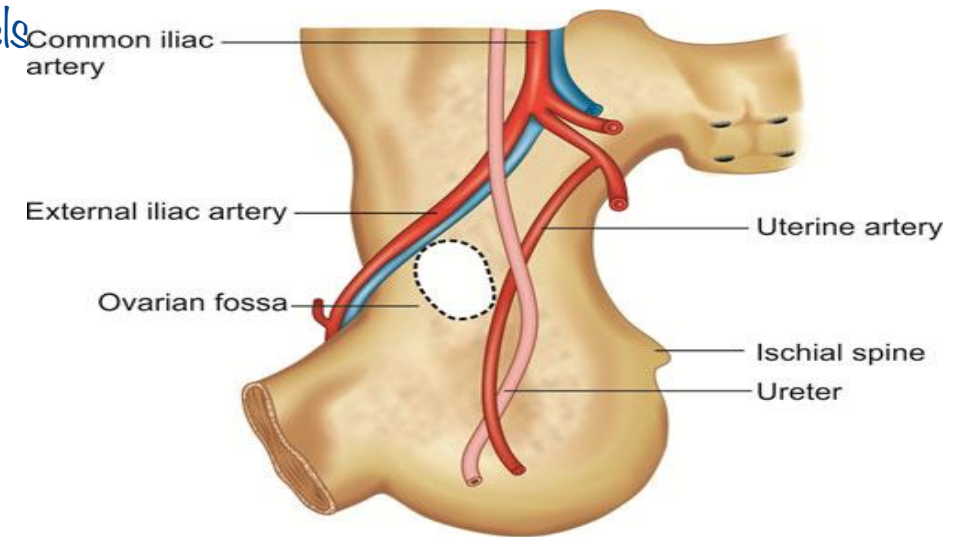
- Each ureter **then runs** down on the **lateral wall of the pelvis** to the level of the ischial spine.

- **Then turns forward & medially** on the **floor of the pelvis** to **open into** the base of the **urinary bladder**.

Midline organ, most anterior organ in the lesser pelvis

- The ureter **passes obliquely** through the wall of the bladder (**intramural part of ureter (1.9 cm)**) before opening into it. This provides **a valve like action**, which prevents a reverse flow of urine toward the kidneys.

يعني اخر 2 سم هدول بكونوا ماشيين بال bladder بعدين بفتحوا فيها ما بفتحوا بنفس المكان الي دخلوا فيه



Relations of pelvic part of ureter

↳ The same at both sides but differs between 2 sexes

A- Relations common in both sexes:

- On the side of the pelvis, the ureter **descends in front of internal iliac artery** and it **lies on obturator internus muscle**.

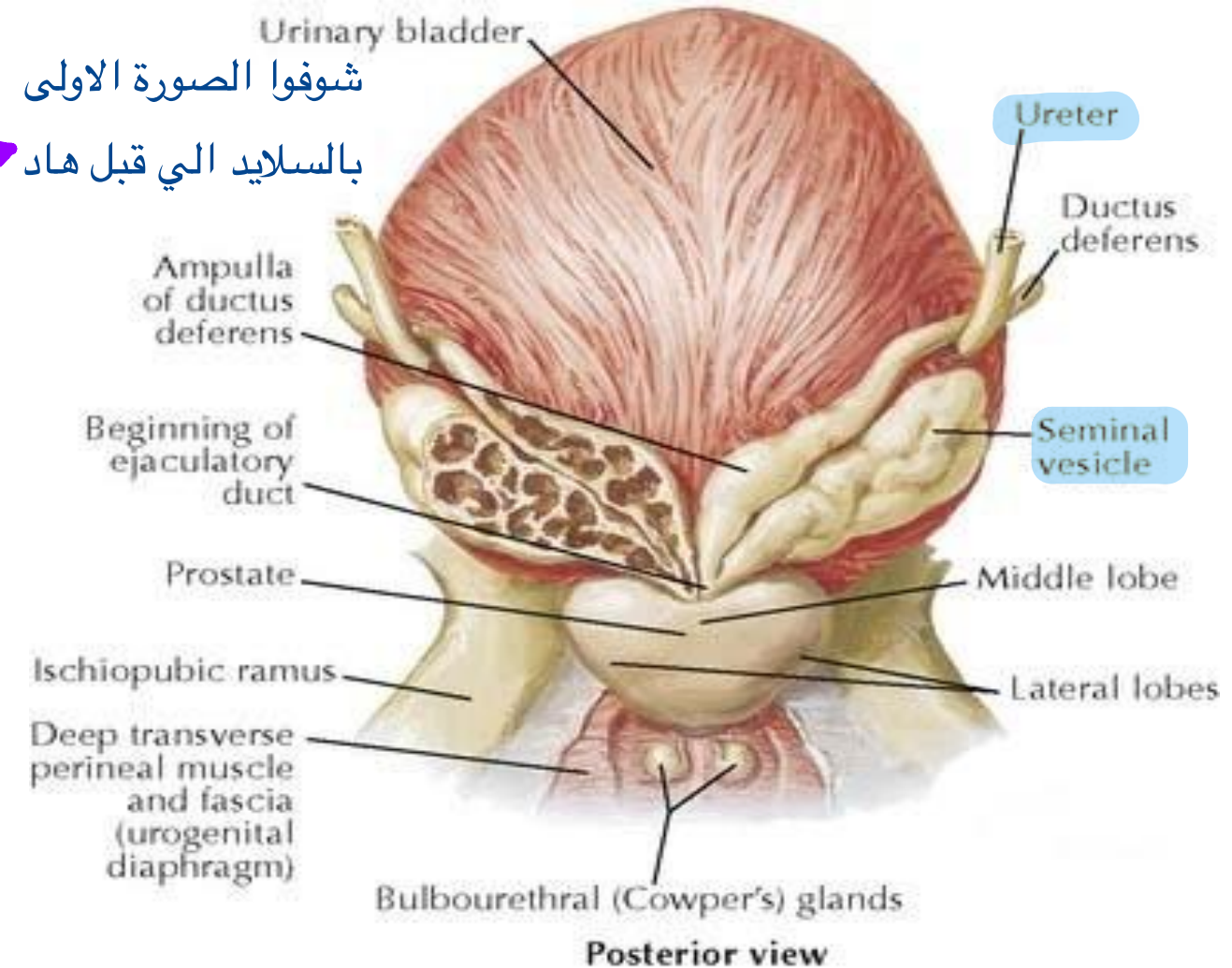
B- Different Relations according to the sex.

In males:

- **On the base of bladder, the ureter lies just above the seminal vesicle.**
- It is **crossed by the vas deferens.**

✿ Ureter ends at posterosuperior angle of the urinary bladder

✿ Posterior view of the base of the bladder :—



Relations of pelvic part of ureter

هاي transverse section و احنا بنطلع عليها من فوق !

In females:

On the lateral wall of pelvis;

للتوضيح انه ال ureter هو الي بكون تحت

ال broad ligament و ليس العكس

- The ureter lies behind the ovary.

❖ Muscle of the floor of pelvis is elevators ani
❖ فال ureter و هو ماشي بال floor بكون ماشي على هاي

العضلة + بكون ماشي بال root of broad ligament

On the floor of the pelvis:

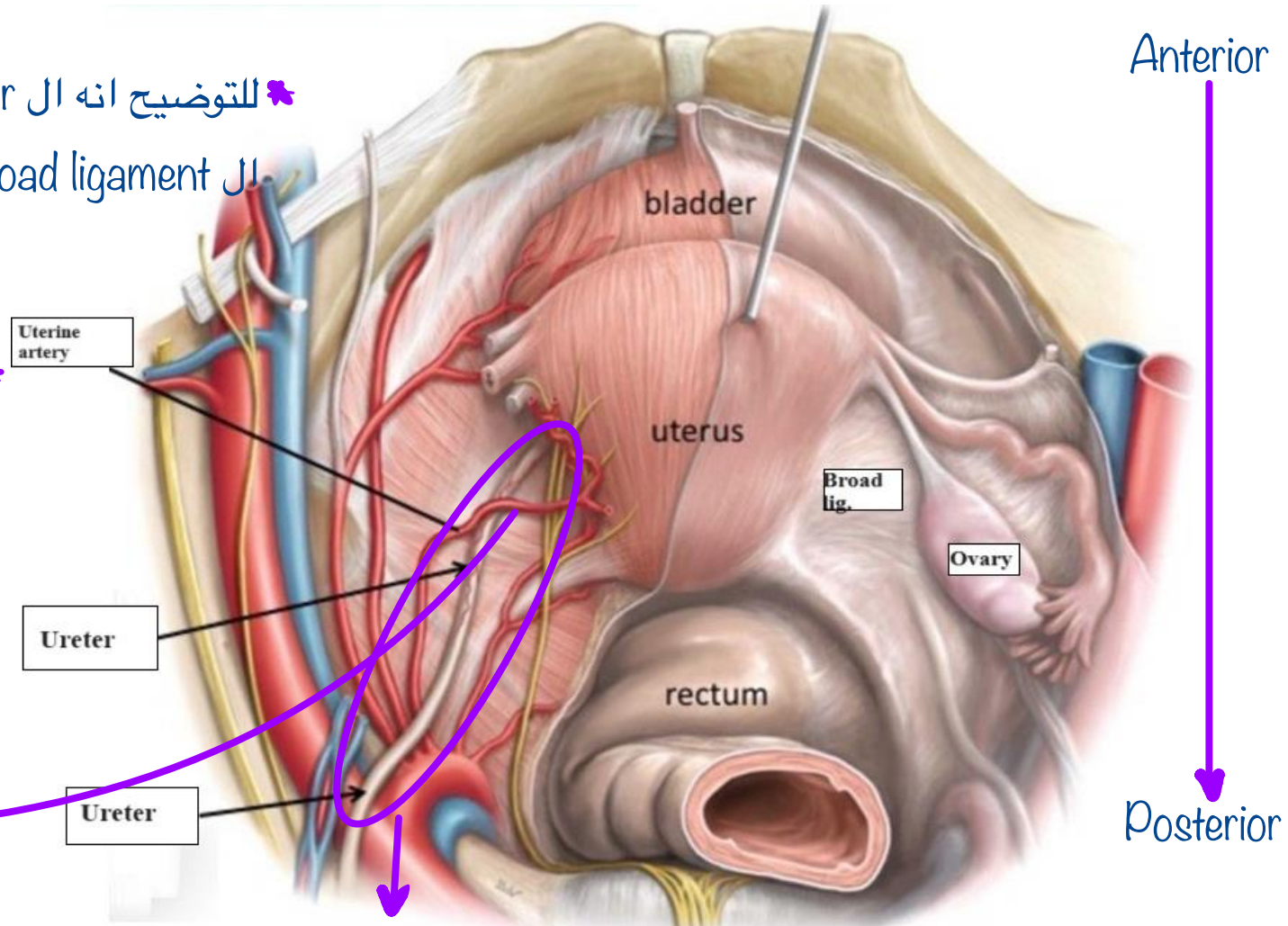
- It runs in the root of the broad ligament.

Peritoneal fold related to uterus

- It is crossed by the uterine artery.

❖ Branch of internal iliac artery which is responsible of blood supply of uterus

لاحظوا هون كيف عمل crossing لل external iliac artery و ماشي على ال lateral wall of the lesser pelvis و بكون in front of internal iliac artery بعديها بمشي على ال floor of pelvis



Normal sites of constrictions of the ureter

Importance » prevents regurgitation of urine

1- At the pelvi-ureteric junction.

Between renal pelvis and abdominal part of ureter

2- At the pelvic brim (where the ureter crosses the artery).

↳ Where it crosses external ilia vessels

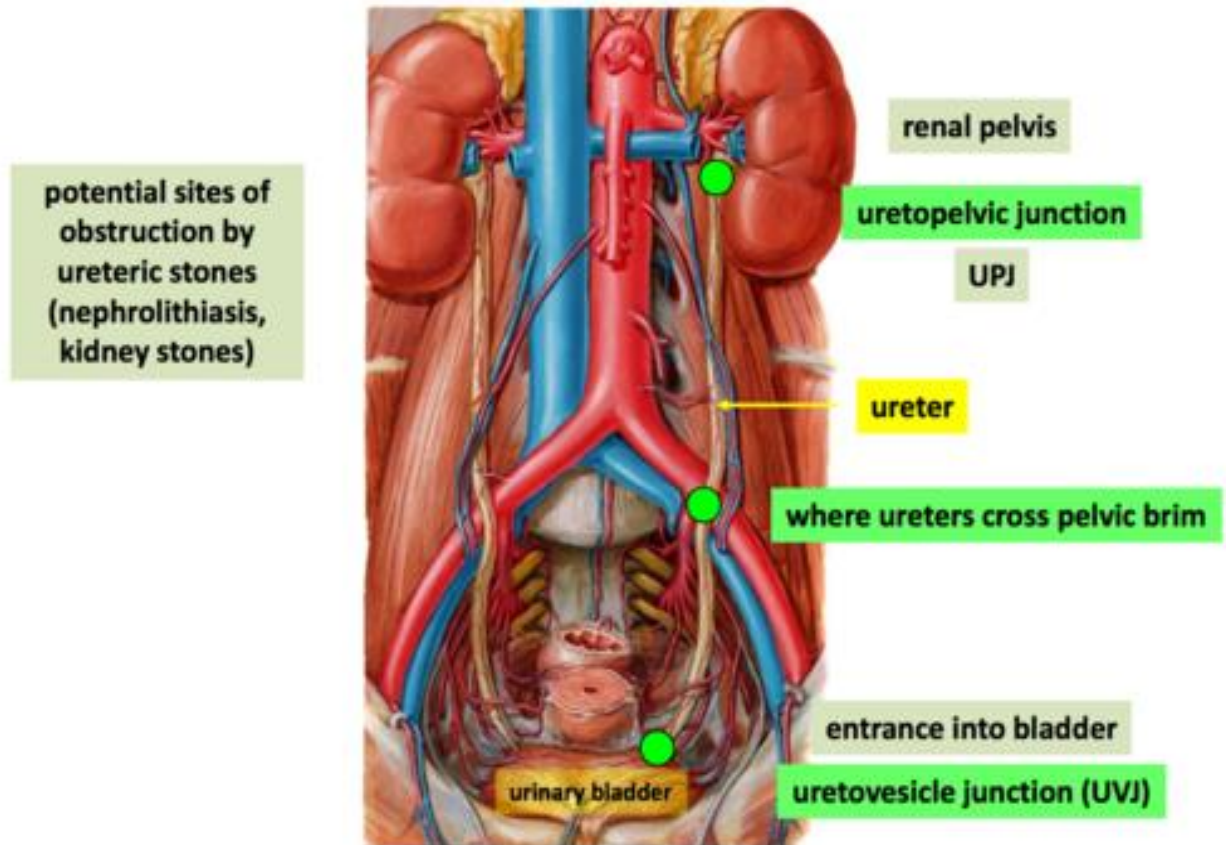
3- Intramural part of the ureter.

✳ Clinical importance ! —

❖ A stone may be impacted in the ureter at any one of these sites.

✳ اي جراح بعمل عملية ال hysterectomy الي هي ازالة الرحم لازم بالبداية يعمل ligation لل uterine arteries على الجهتين و لازم ينتبه ما يعمل ال ligation لل ureters بالغلط

There are several normal sites of ureteric constriction



Ureter

Blood Supply:

Arteries:

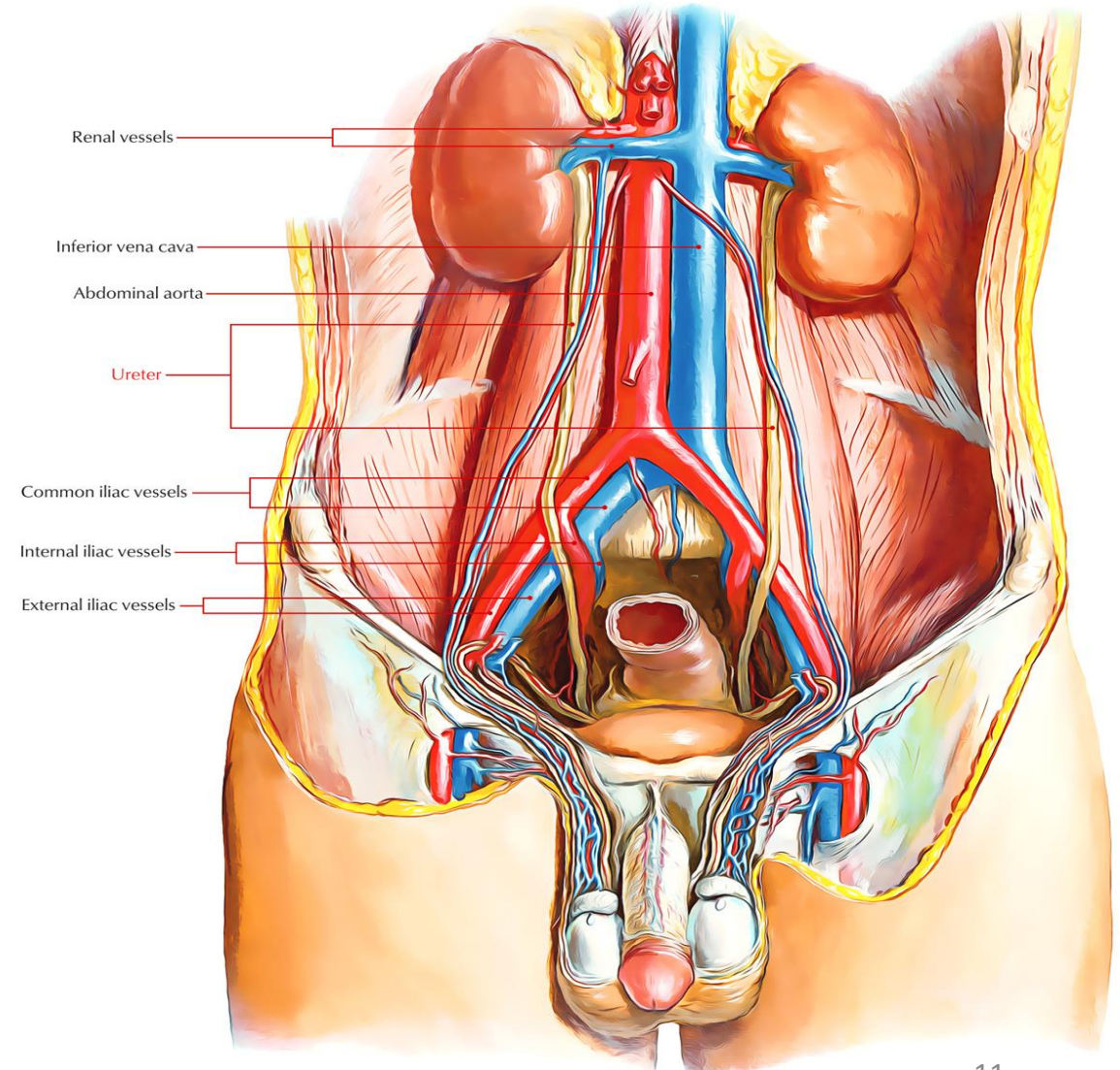
- It is supplied by branches from the **renal, gonadal, the abdominal aorta, common iliac, internal iliac, vesical and uterine arteries.**
- There is longitudinal anastomosis between these branches on the wall of the ureter.

Veins:

- Into **veins that correspond to the arteries.**

Lymph Drainage:

- It drains into the **para-aortic nodes** and the **iliac nodes.**



Ureter

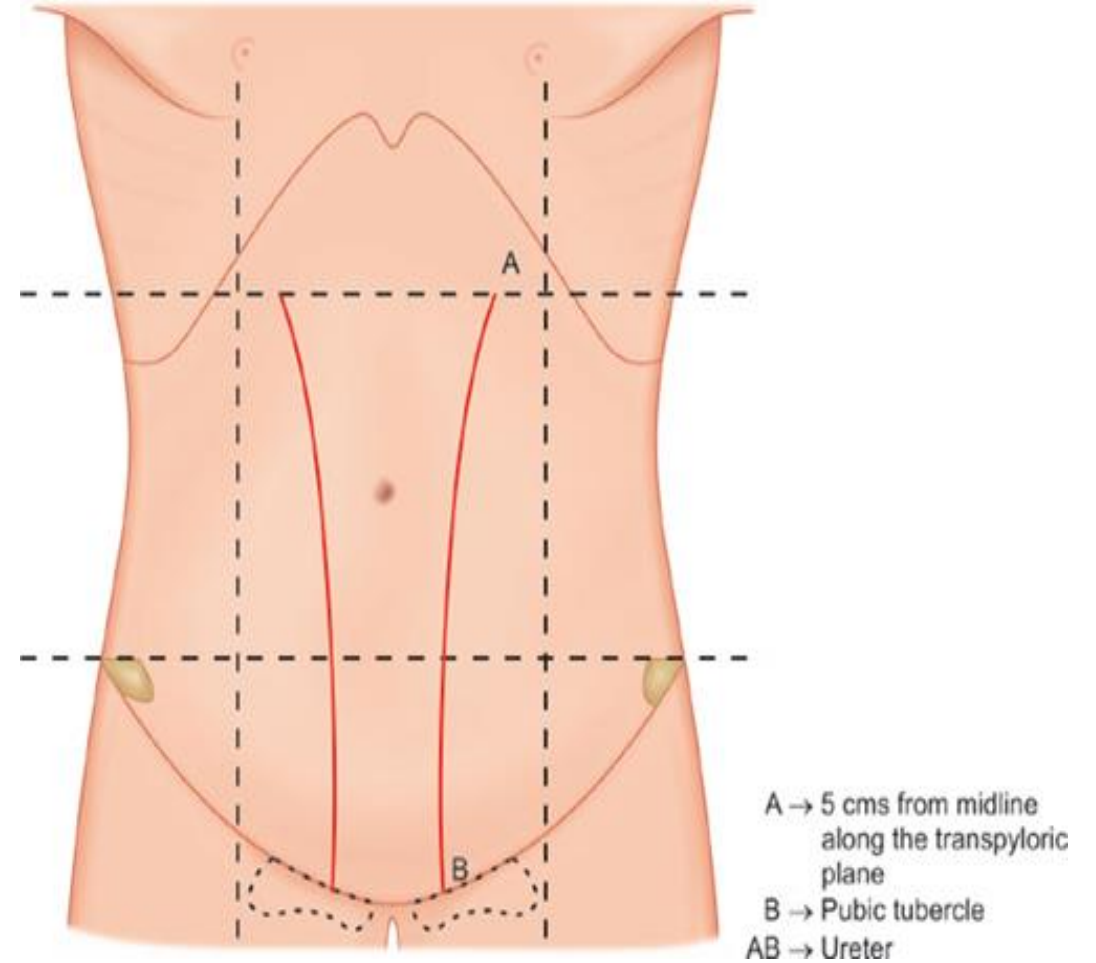
Identify ureter in operation:

- Thick muscular tube.
- Longitudinal blood vessels.
- Show peristalsis.
- Aspiration of urine. ↴

زي كانه بياخذ عينة بول من ال ureter ب ابرة

Surface anatomy:

- From point at transpyloric plane (L1), 2 inches from median plane.
- To point at pubic tubercle.



Nerve Supply of Ureter

- The ureter is supplied by **sympathetic fibers** from T10 – L1 spinal segments.
- **Parasympathetic** by pelvic splanchnic nerves.

↳ S2, S3, S4

Ureteric (Renal) Colic:

- Excessive distension of the ureter or spasm of its muscle may be caused by a stone and gives rise to severe pain (ureteric colic).
- In ureteric colic, strong peristaltic waves of contraction pass down the ureter in an attempt to pass the stone.
- Pain is referred to the skin areas that innervated from spinal segments which supply the ureter (loin, groin..
- Pain of ureter radiated to scrotum- thigh due to stimulation of genitofemoral nerve which supply these area.
 - ↳ Causes irritation in the nerve
 - ↳ If the patient was a male it will radiate to scrotum if it was a female it will radiate to labia majora

↳ Runs in front of psoas major

Urinary Bladder

- It is a **hollow muscular organ**. It is a **reservoir**.

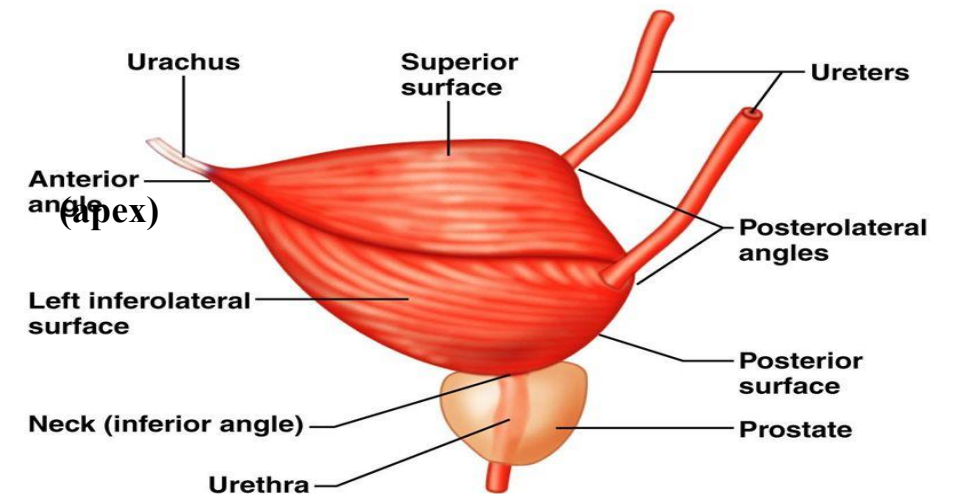
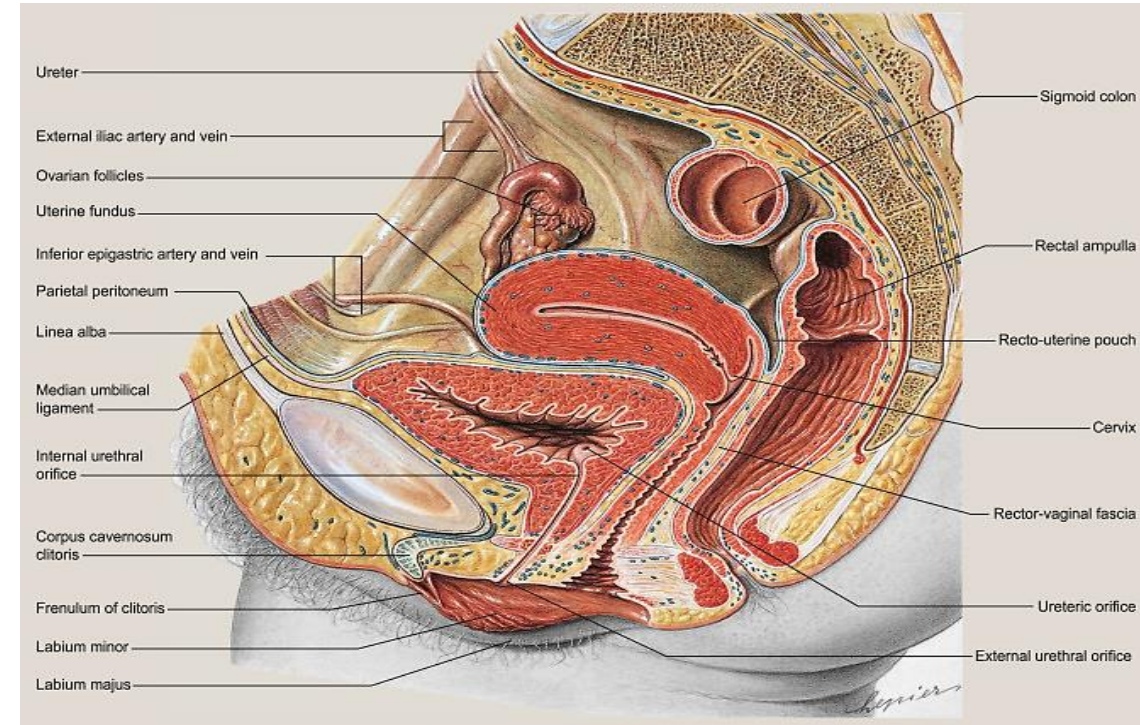
Site:

- When the bladder is empty, it lies entirely in the lesser pelvis, but as it distends it expands anterosuperiorly into the abdominal cavity.
- After birth, it lies completely in abdominal cavity, as the pelvis enlarge it descends gradually into the lesser pelvis.

Capacity of the adult bladder is about 300- 500 ml.

Shape: empty bladder has a pyramidal shape with:

- Base.** → Directed backward
- Apex.** → Directed forward
- Neck.** → Directed inferiorly **Most inferior part**
- Three surfaces;** superior and two inferolateral surfaces.



Relations of Urinary Bladder

□ Superior surface:

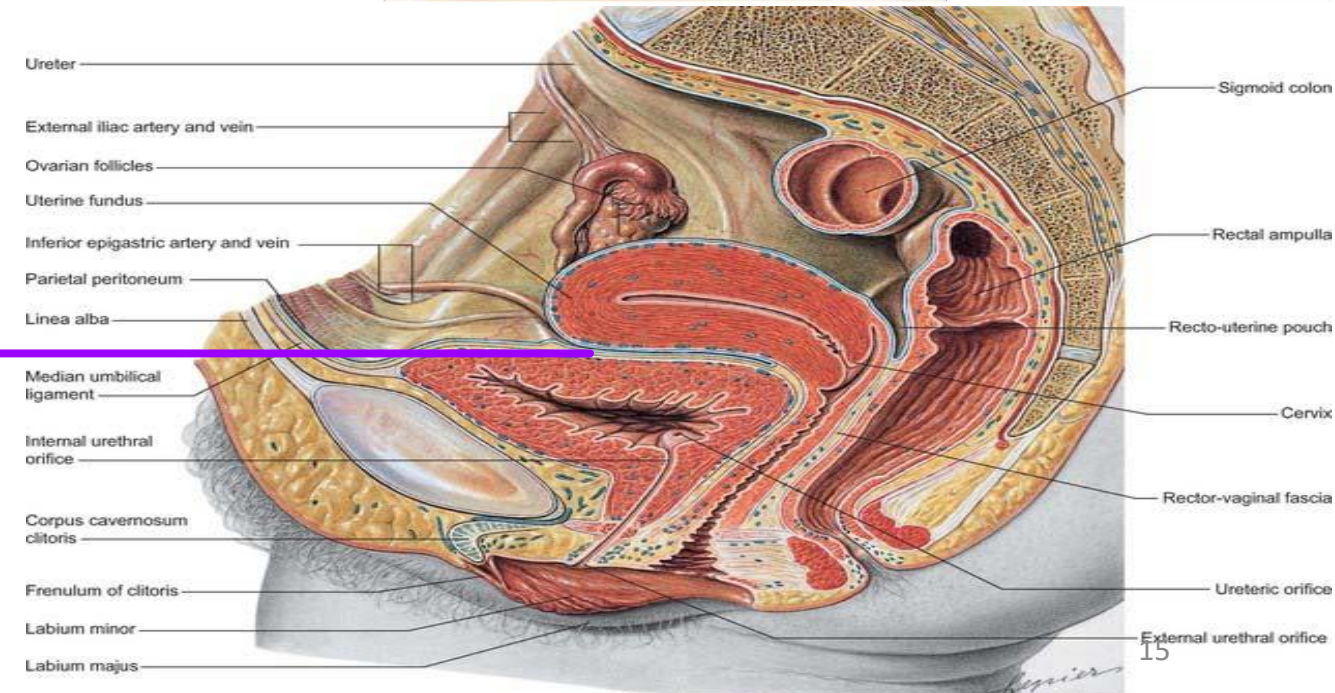
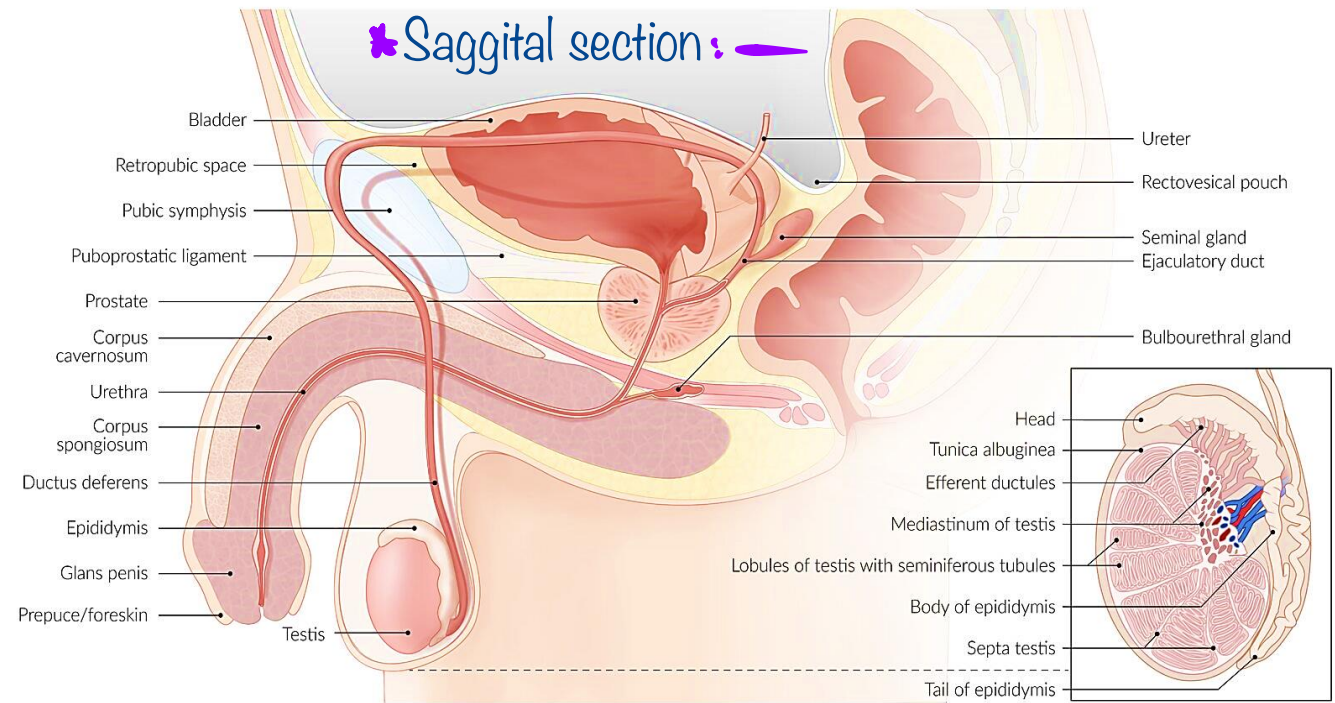
- It is triangular in outline.

In males:

- It is completely covered by peritoneum and related to sigmoid colon and coils of ileum.

In females:

- Its anterior 2/3 is covered by peritoneum and is separated from uterus by uterovesical pouch.
- Its posterior 1/3 is not covered by peritoneum and is related to supravaginal part of the cervix.



Relations of Urinary Bladder

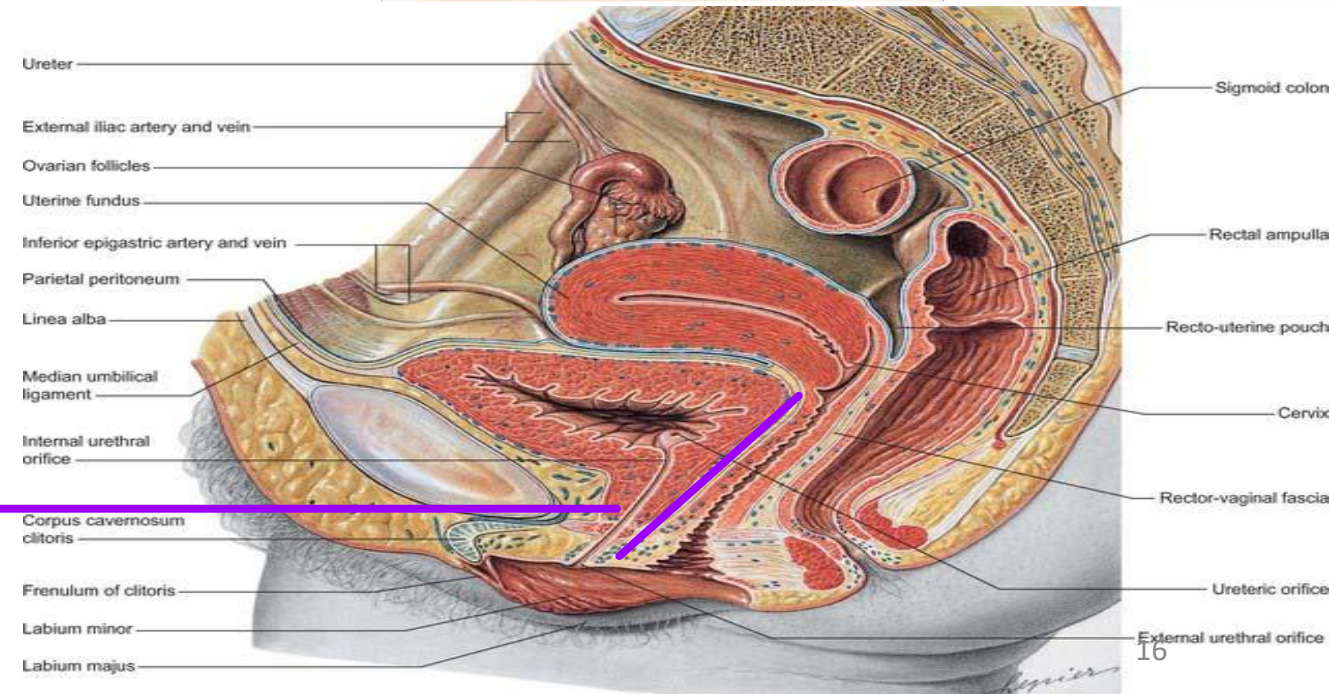
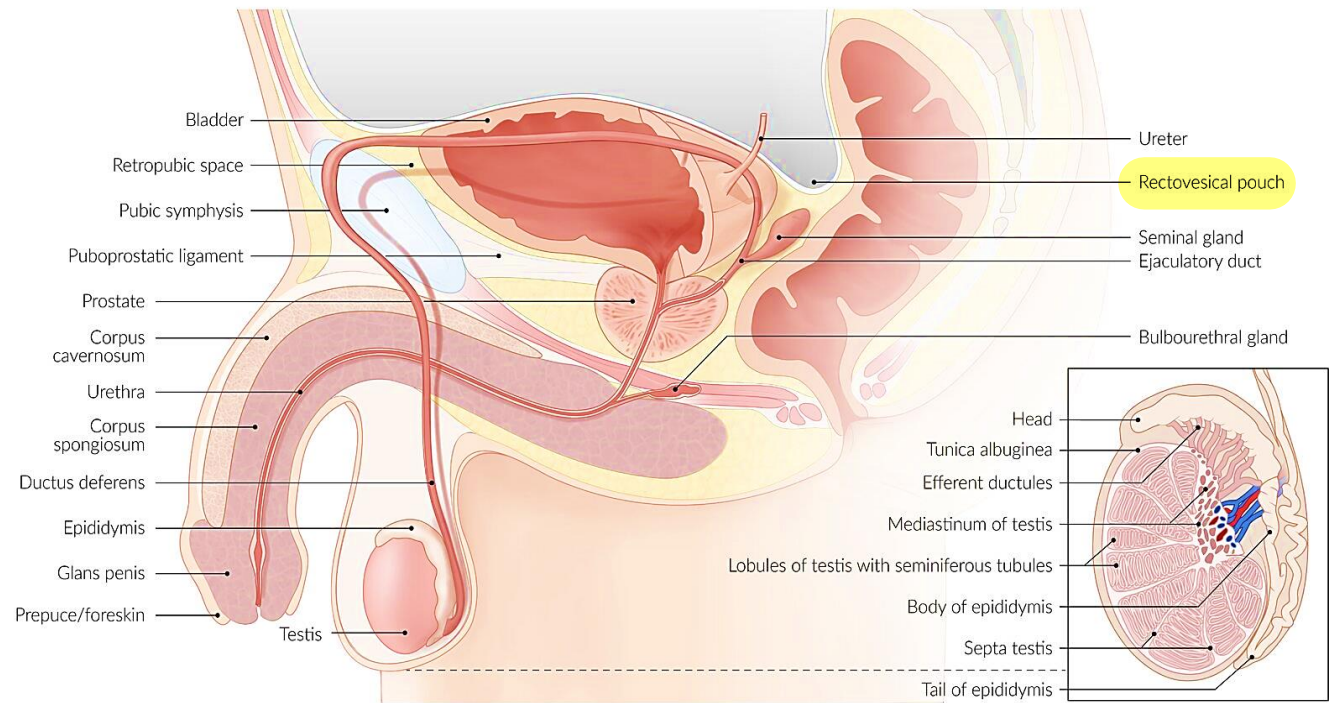
□ Base:

In males:

- Upper part is related to rectovesical pouch.
- Lower part is related to two seminal vesicles and two vasa deferentia.
- These structures separates the base from the rectum.

In females

- It is related to the vagina.



This line represents base of the bladder ←

Relations of Urinary Bladder

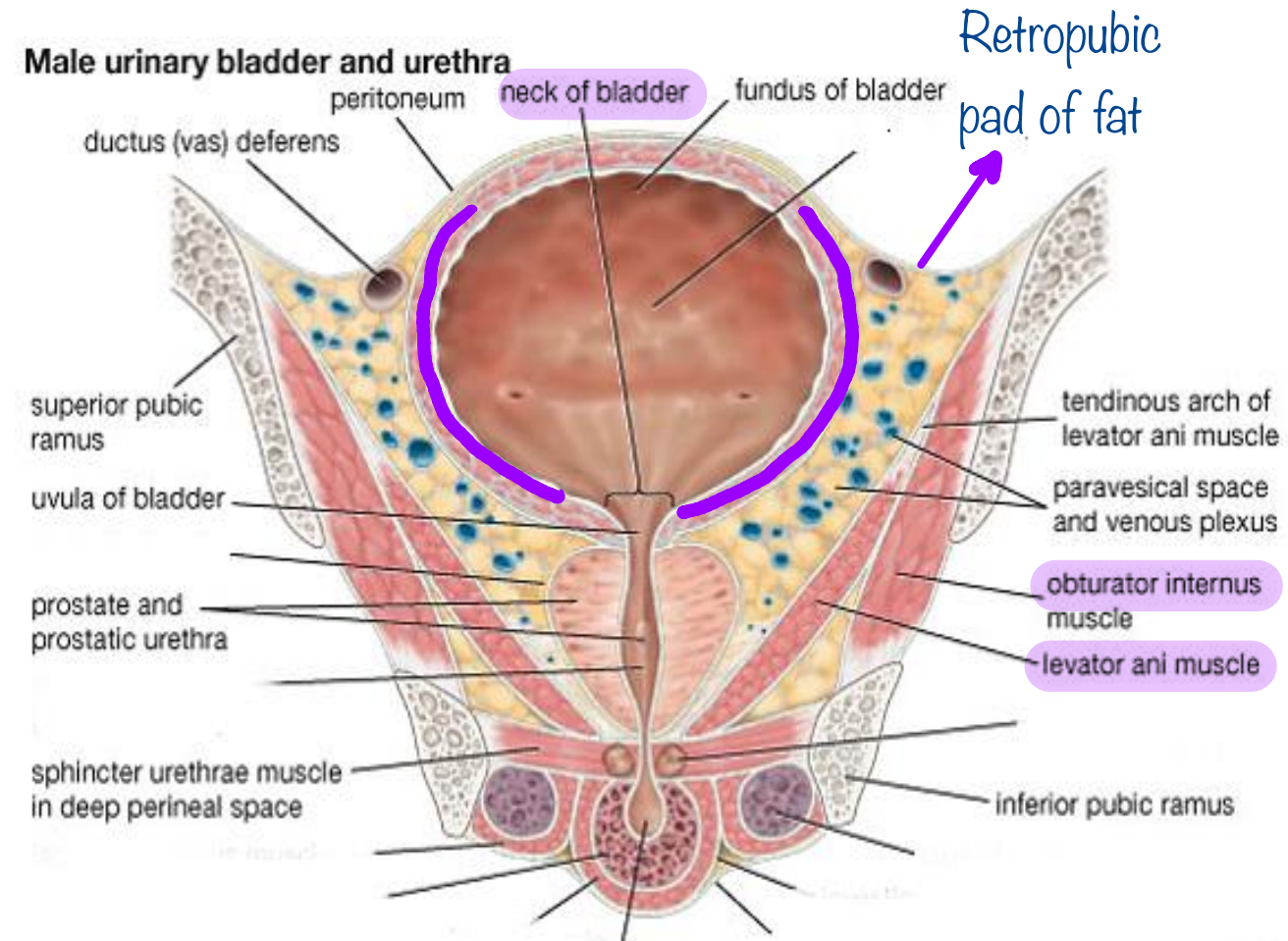
□ Inferolateral surface of the bladder:

- It have no peritoneal covering.
- **It is related to** the retropubic pad of fat which separate the surface from the pubis, obturator internus and levator ani muscle.

□ Neck of the bladder:

- **It lies** most inferiorly.
- **It is continuous** with the urethra at the internal urethral orifice.
- **In males;** it is surrounded by the base of the prostate

* Coronal section : —



* الخطين الي بالنهدي بمثلوا ال inferolateral surface

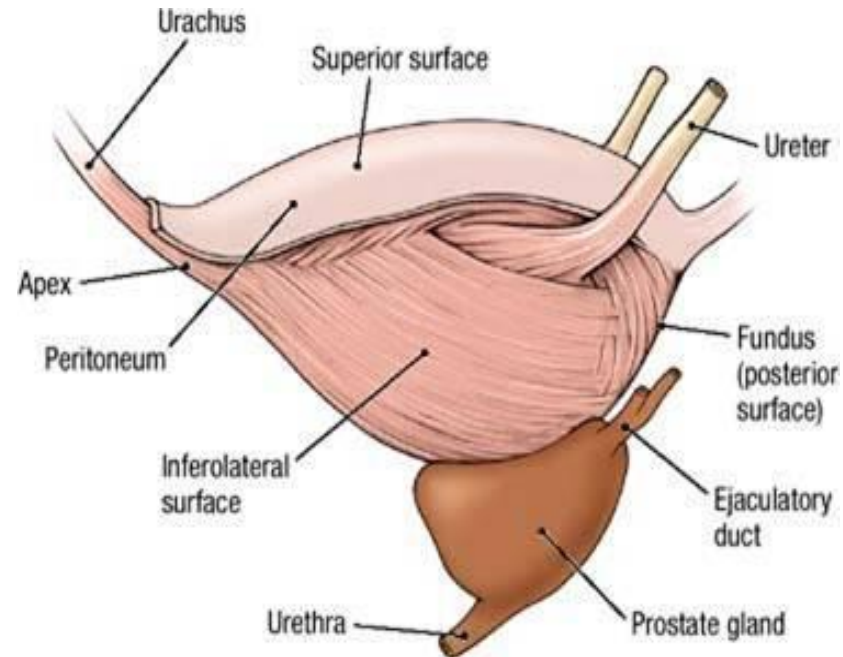
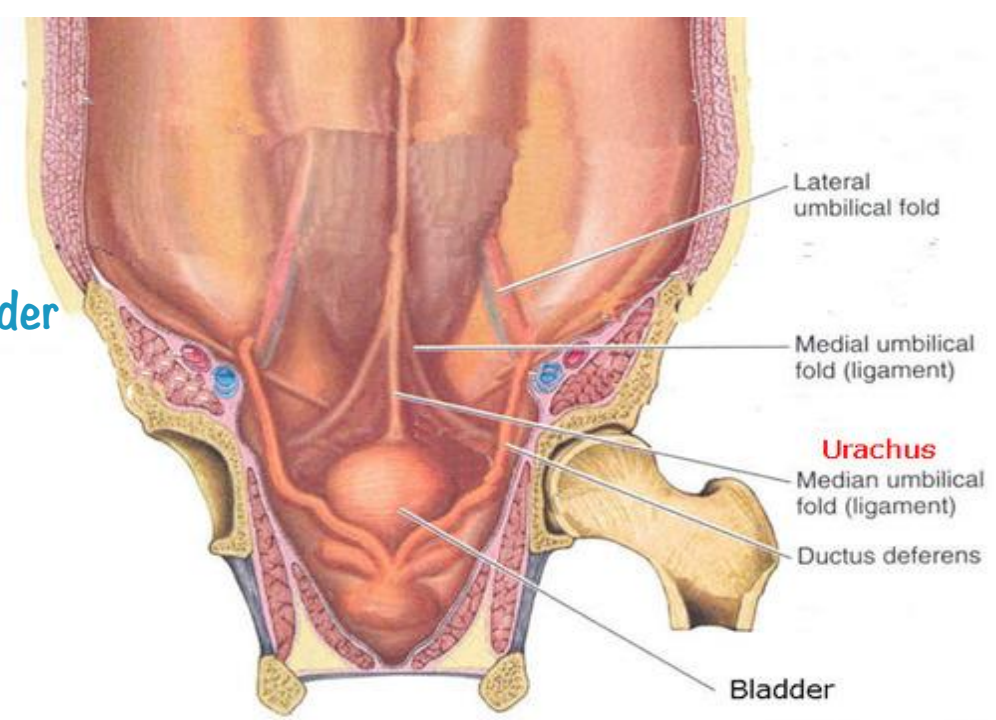
Relations of Urinary Bladder

□ Apex of the bladder: Another name is anterior angle of the bladder

▪ It is directed forwards towards the upper border of symphysis pubis.

▪ Median umbilical ligament extends from apex to the umbilicus, this ligament represents the obliterated urachus.

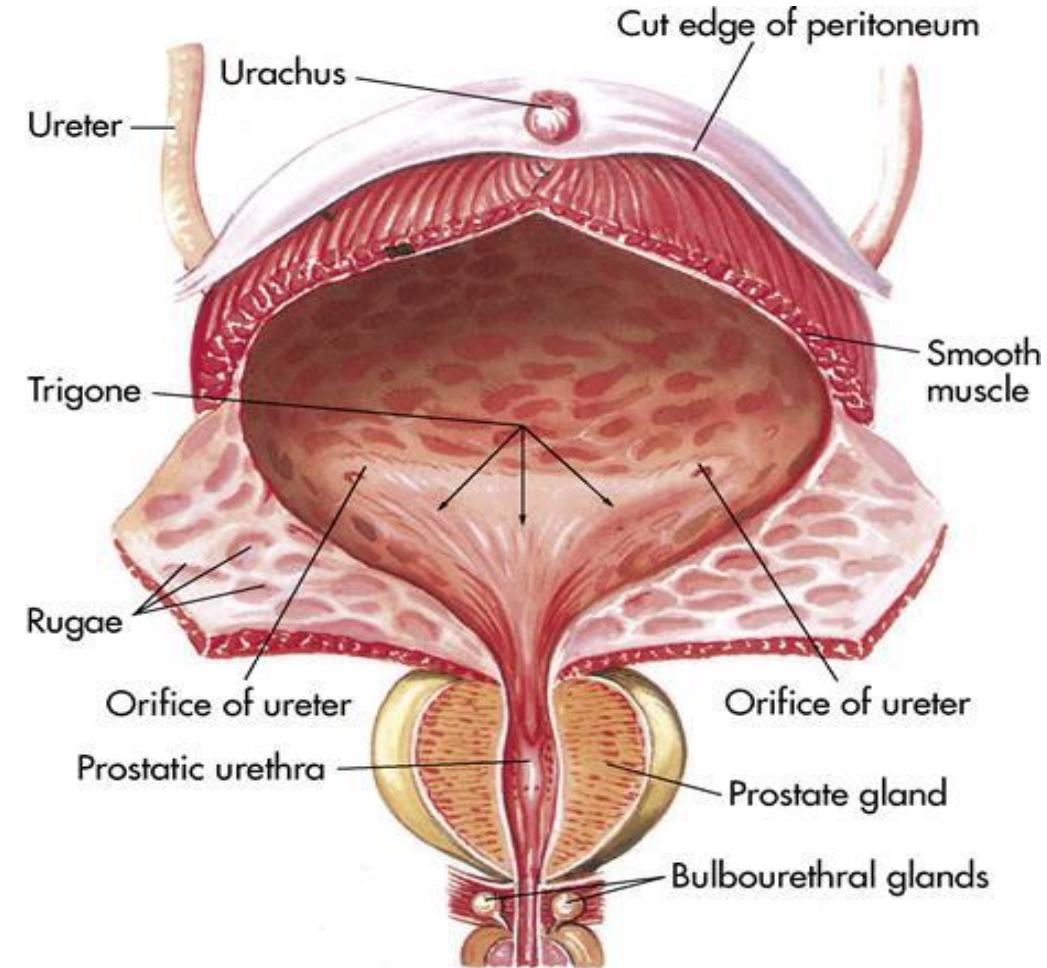
↳ intruterine life هاد structure كان موجود بال بعدين بتحول ل median umbilical ligament



Cavity of the Bladder (Bladder Interior)

□ Examination in the living using cystoscopy.

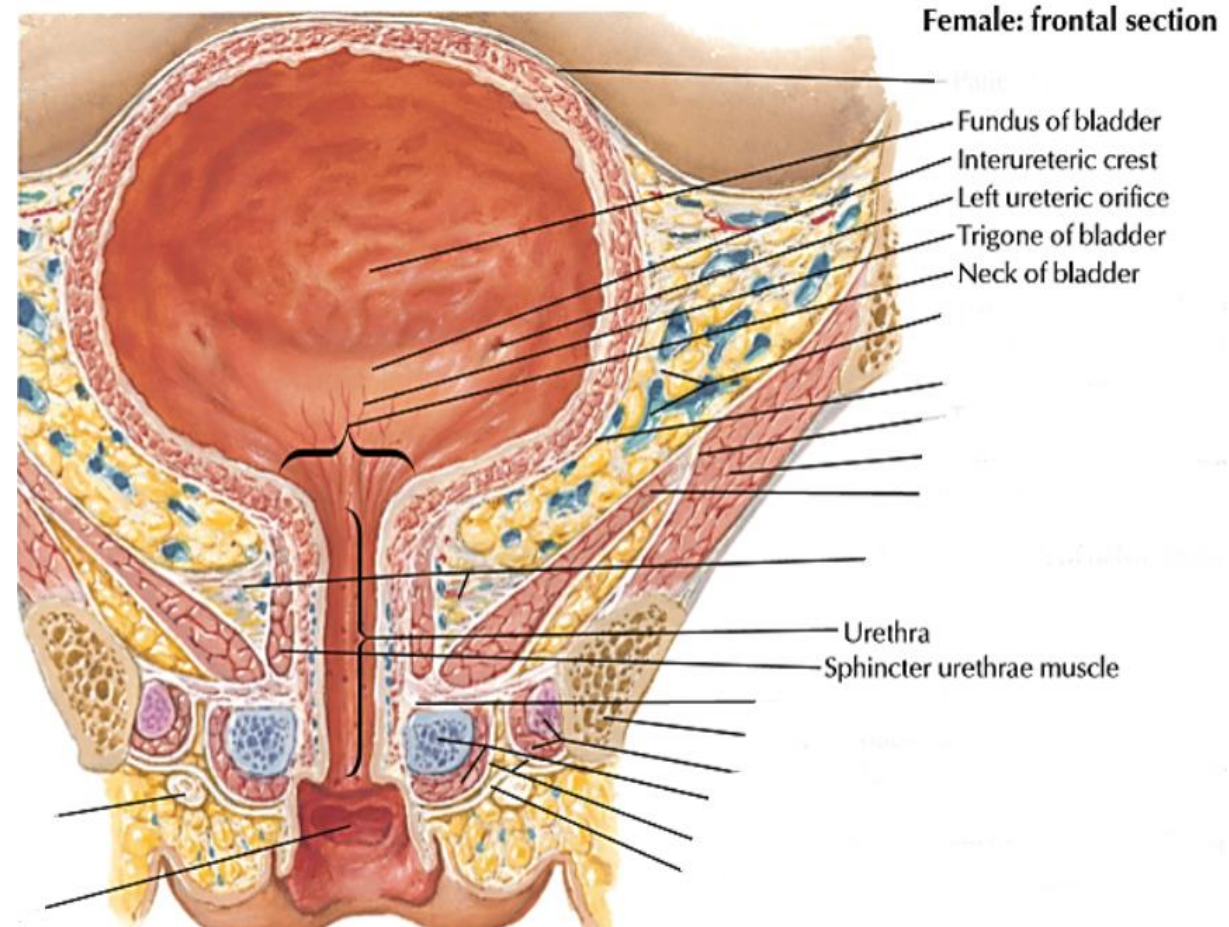
- The mucous membrane of the greater part of the empty bladder is thrown into folds that disappear when the bladder is full.
↳ Not smooth
- The area of mucous membrane covering the internal surface of the base of the bladder is called the **trigone**. Here, the mucous membrane is always smooth, even when the bladder is empty, because the mucous membrane is firmly adherent to the underlying muscular coat.



Cavity of the Bladder (Bladder Interior)

Trigone of the bladder:

- It is **triangular area**.
- The **superior angles** of the trigone correspond to the two **ureteric orifices**.
Right and left
- The **inferior angle** (apex of trigone) is formed by the **internal urethral orifice**.
- **Base of trigone** is directed upward and is formed by a muscular ridge (**interureteric ridge**) which extends between the two ureteric orifices.
Between two superior angles
- The **interureteric ridge** forms a **guide** during the **introduction of catheter into the ureter**.



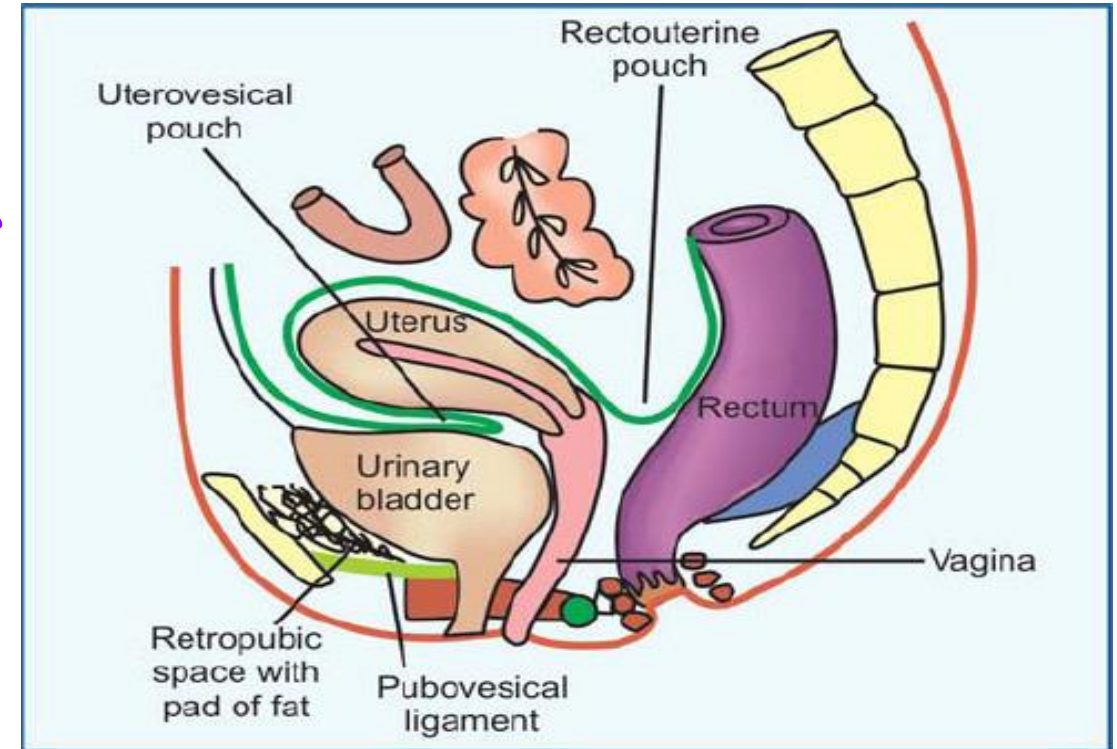
Ligaments of the Bladder

□ True ligaments:

- Median umbilical ligament: Between apex of bladder & umbilicus.
- Pubo-prostatic ligament in male: Between prostate & pubis. هاد نفس ال ligament بس بتختلف التسمية حسب هو male او female ↷
- Pubovesical ligament in female: Between neck of bladder & pubis. ↶
- Lateral ligament: Between side of bladder & tendinous arch of obturator fascia.

□ False ligaments: (peritoneal folds):

- Sacrogenital fold.
- Lateral fold.



Blood Supply of the Urinary Bladder

- Superior and inferior vesicle arteries are branches of internal iliac artery

Arterial supply:

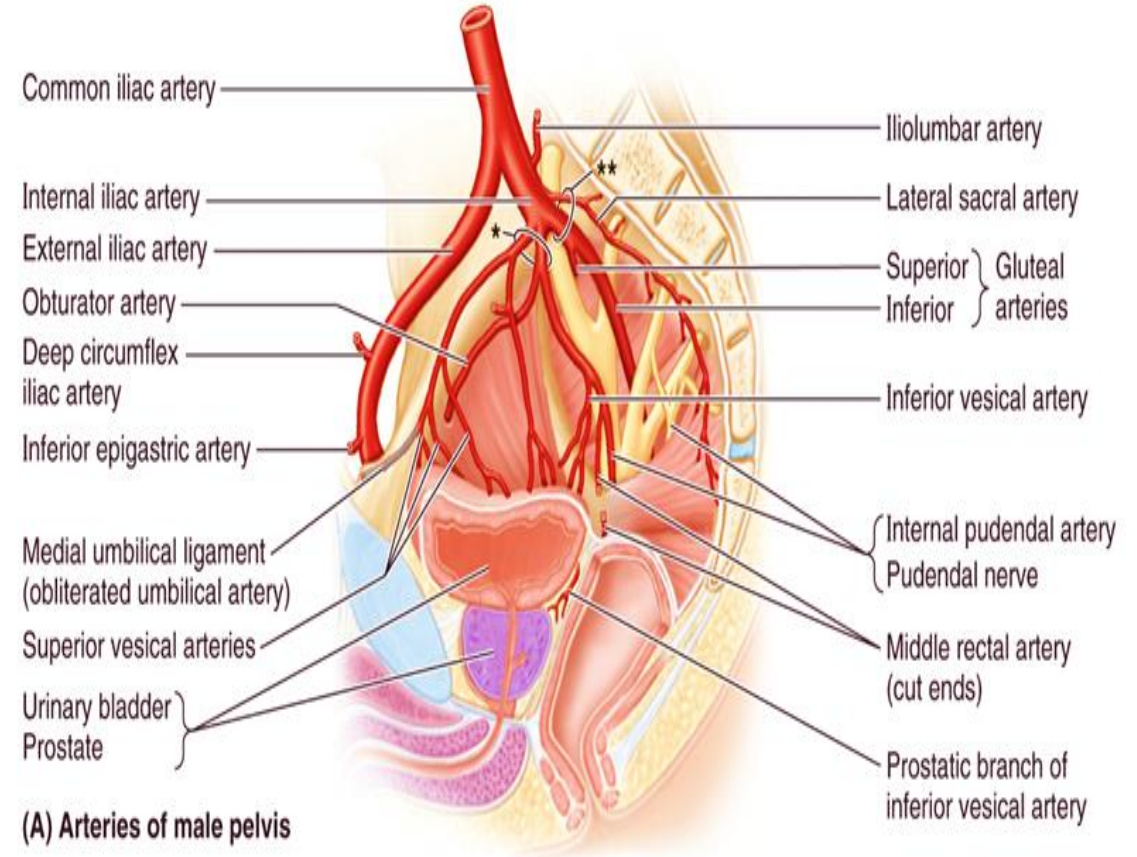
- Superior vesical artery.
- Inferior vesical artery in male or vaginal artery in female.

Venous Drainage:

- It is through the vesical plexus which drains into the internal iliac veins.

Lymphatic drainage:

- Into the iliac lymph nodes.



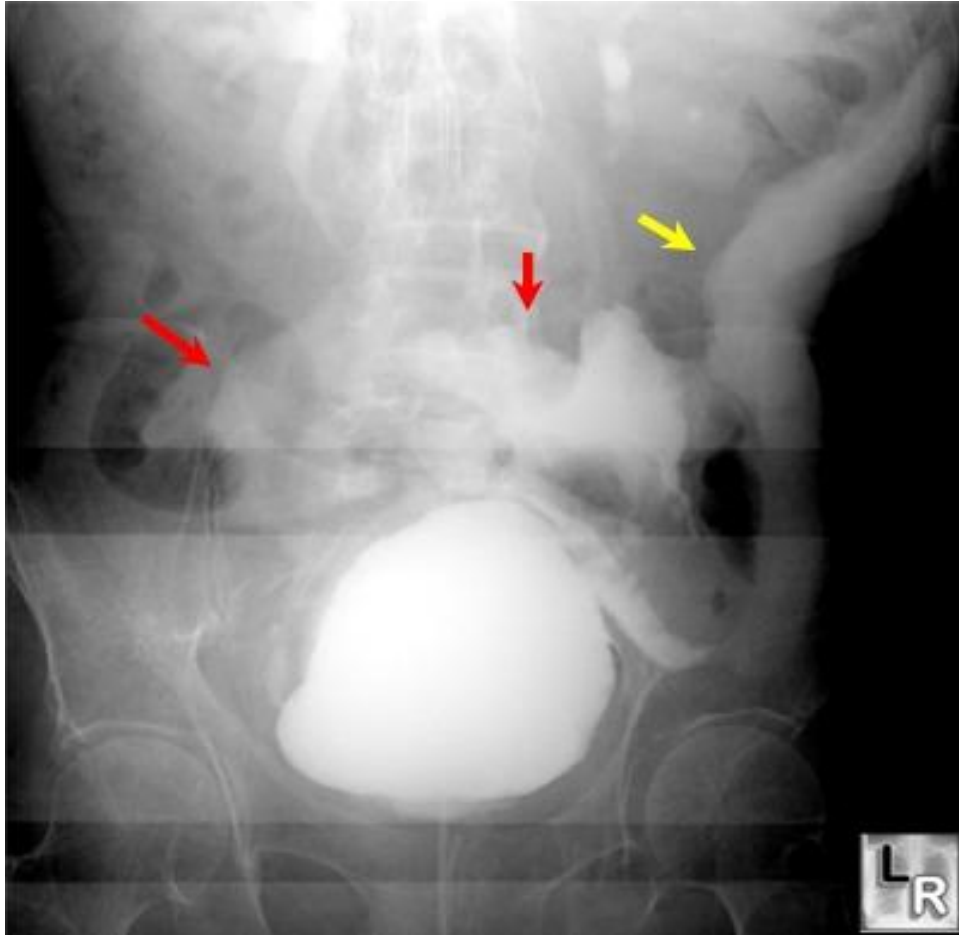
Nerve Supply of Urinary Bladder

- **Sympathetic fibers** are derived from **L.1&2** segments of the spinal cord.
- **Parasympathetic fibers** by the **pelvic splanchnic nerve**.

Intraperitoneal and Extraperitoneal Rupture of Urinary Bladder

* Intraperitoneal and extraperitoneal injuries because urinary bladder is not completely covered by peritoneum

	<u>Intraperitoneal Rupture</u>	<u>Extraperitoneal Rupture</u>
Incidence	Less common (20%)	More common (80%)
Cause	Direct blow (Blunt trauma) on distended bladder.	Penetrating injury/ Pelvic fractures.
Part of urinary bladder	It involves superior surface of urinary bladder & its covering peritoneum.	It involves the anterior part of the bladder wall below the level of the peritoneal reflection.
In this case	Urine & blood escape freely into the peritoneal cavity.	Urine extravasate to the perivesical space.
Imaging findings Cystography	Extraluminal contrast extends into paracolic gutters & around bowel loops.	Extraluminal contrast limited to perivesical space. Adjacent to wall of urinary bladder ↙
	Highest morbidity and mortality is associated with intraperitoneal rupture because of development of peritonitis.	



In intraperitoneal bladder rupture. Note the extraluminal contrast (red arrows) outside the confines of the normal bladder and spreading into the peritoneal cavity. There is contrast in the left paracolic gutter (yellow arrow).

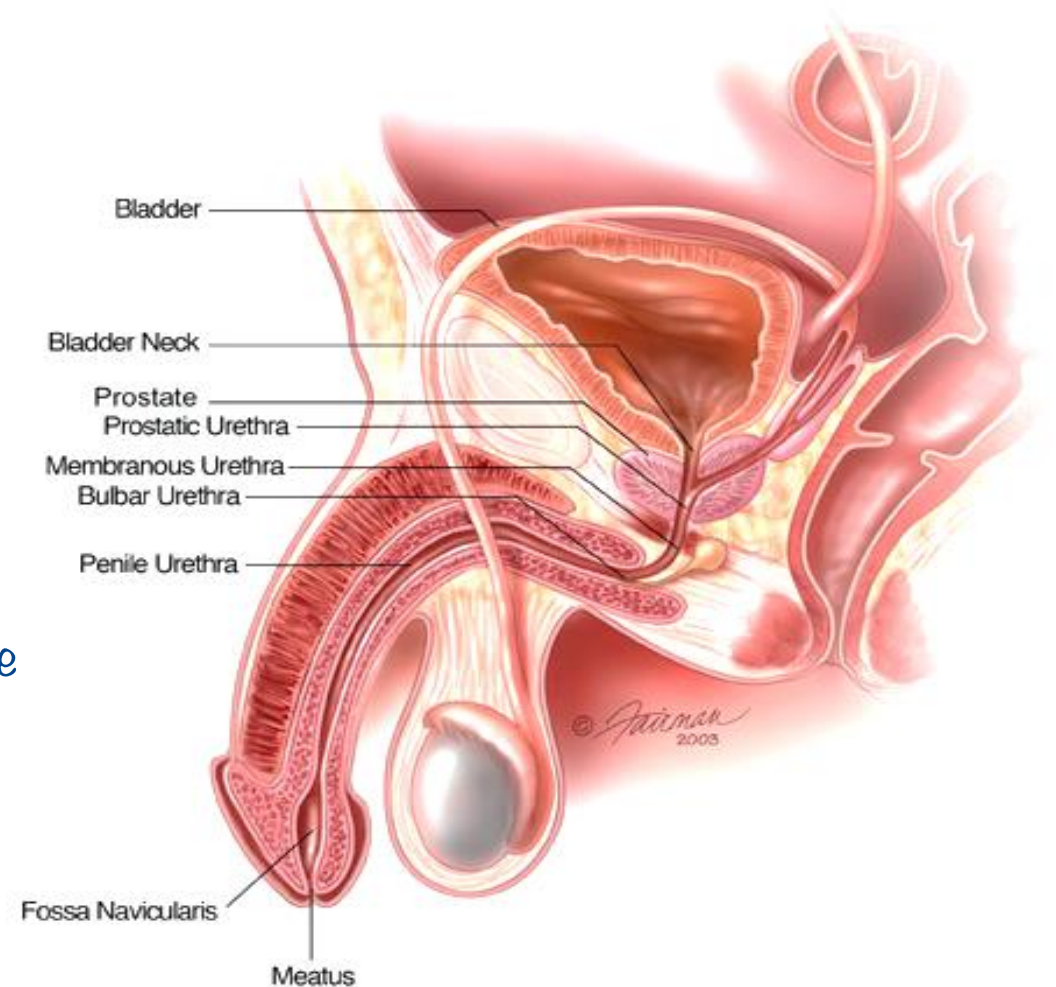


In extraperitoneal bladder rupture, shows a flame-shaped density adjacent to right lateral wall of bladder representing extra-peritoneal contrast from a bladder rupture.

Male Urethra

- **Male urethra:** a common canal for passage of urine and semen to outside the body.
- It **measures** about 18-20 cm long.
- It **extends** from the internal urethral orifice at the neck of the bladder **to** the external urethral orifice at the tip of the glans peins.
- **It is formed of 3 parts;**
 - ✓ **Prostatic urethra.**
 - ✓ **Membranous urethra.**
 - ✓ **Spongy urethra**

✿ The lesser pelvis ends at the apex of the prostate



Male Urethra

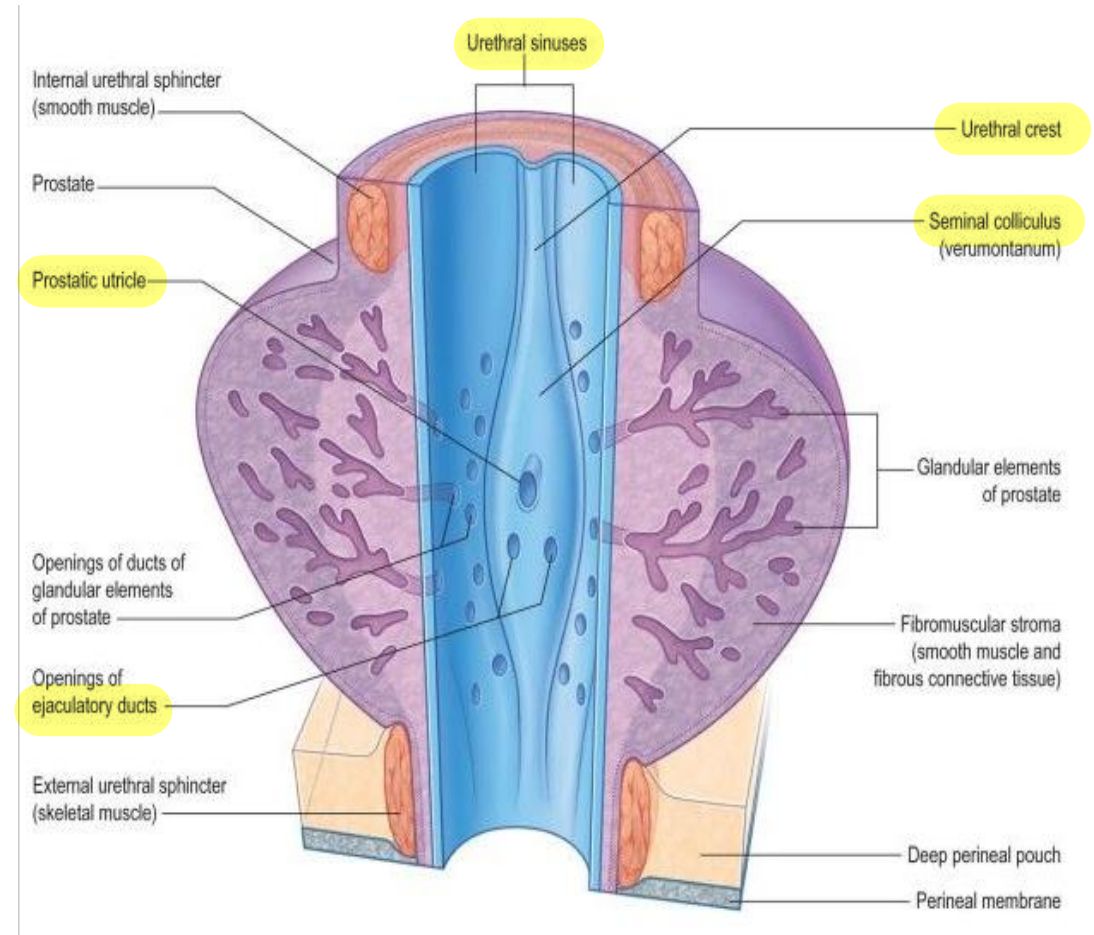
Prostatic Urethra:

- It is the widest part & about (3cm) in length.
- It **runs through** the prostatic gland.

Posterior wall of the prostatic urethra shows;

- A narrow longitudinal elevation in the midline called the **urethral crest**.
- A small circular elevation of the urethral crest called **seminal colliculus** which have 3 orifices;
 - ✓ Central one for the **prostatic utricle**.
 - ✓ Two orifices for the two ejaculatory ducts.
- A depression is formed on each side of the **urethral crest** called the **urethral sinus** which perforated by the prostatic gland orifices.

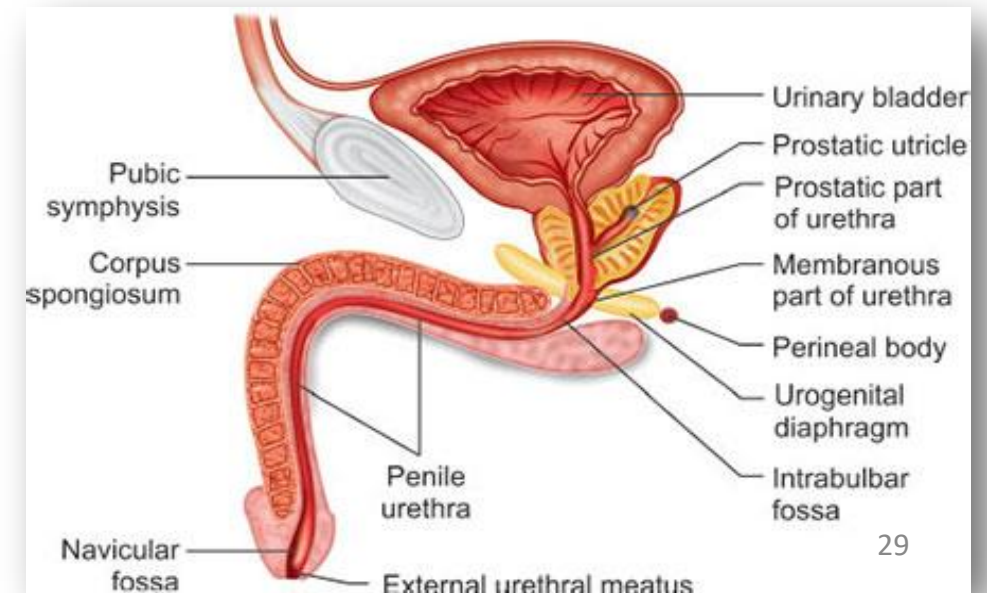
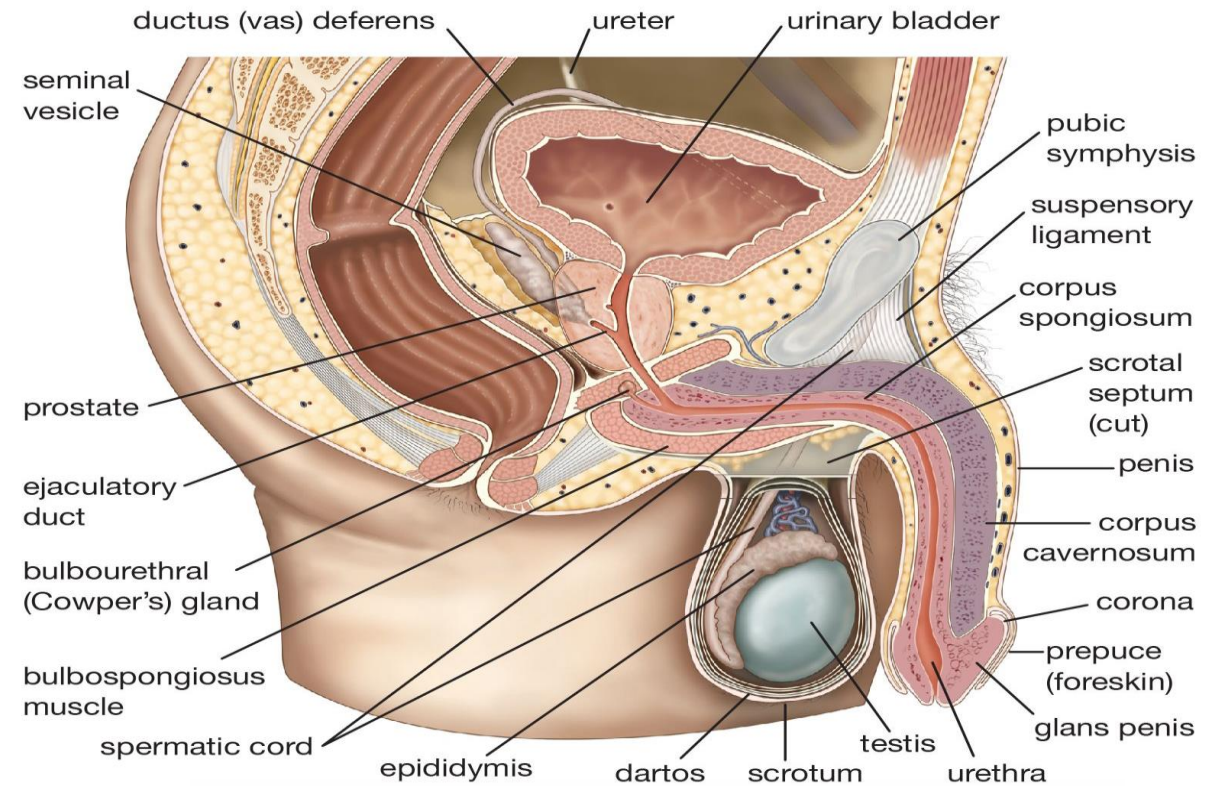
* Coronal section ! —



Male Urethra

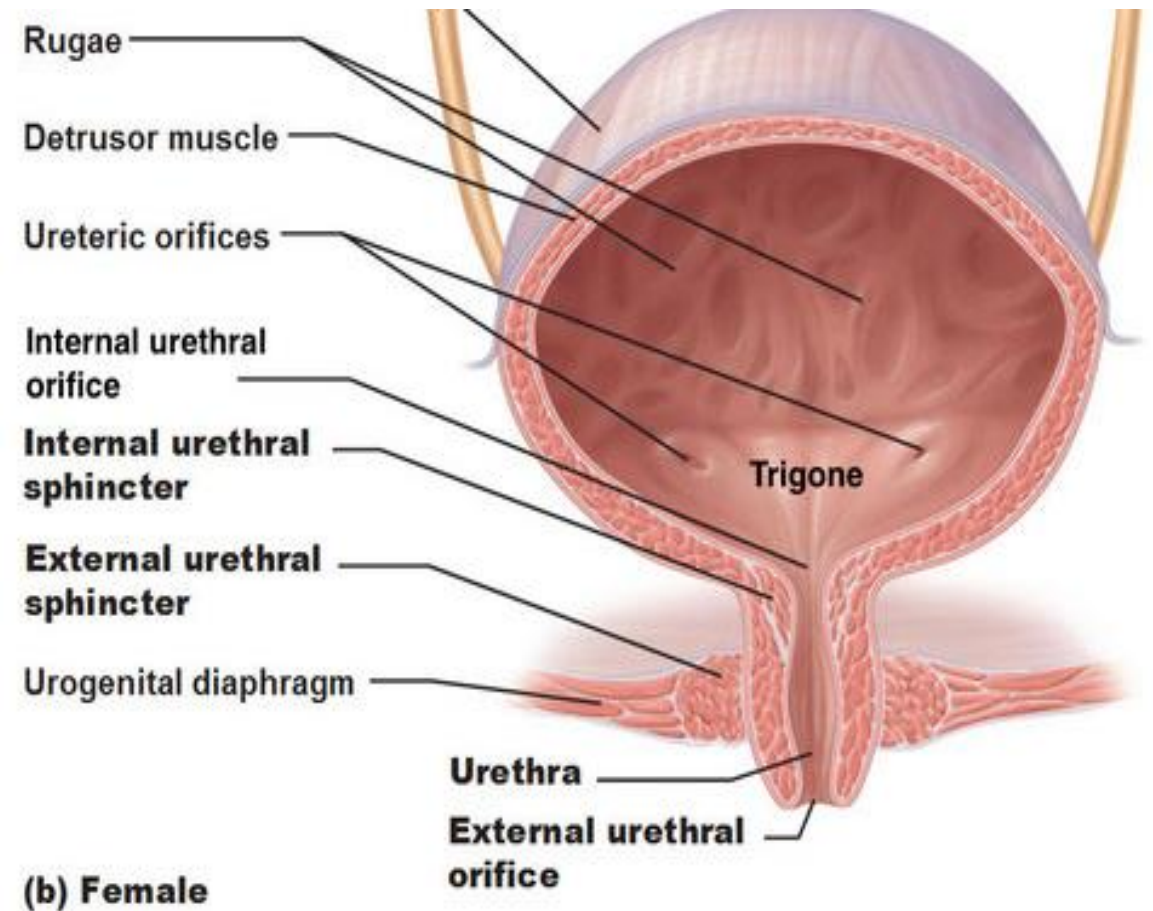
□ Spongy (Penile) Urethra:

- It is the **longest part** about 15 cm in length.
- It **traverses** the whole length of the **corpus spongiosum** of penis.
- It **extends** from the end of the membranous urethra to the external urethral orifice on the glans penis.
- It has 2 dilatations;
 - **Intrabulbar fossa** at its beginning.
 - **Navicular fossa** at its termination.
- It **receives** the opening of ducts of **bulbourethral glands**.



Female Urethra

- Female urethra is **short** measure about 4– 5 cm in **length**.
- It **extends from** the internal urethral orifice at the neck of the bladder, **to ends at** the external urethral orifice in the vestibule between the clitoris and the vaginal opening.
- It **traverses** deep perineal pouch.
 - ↳ + Surrounded by skeletal muscle fibers which represent external urethral sphincter



Urethral Sphincter

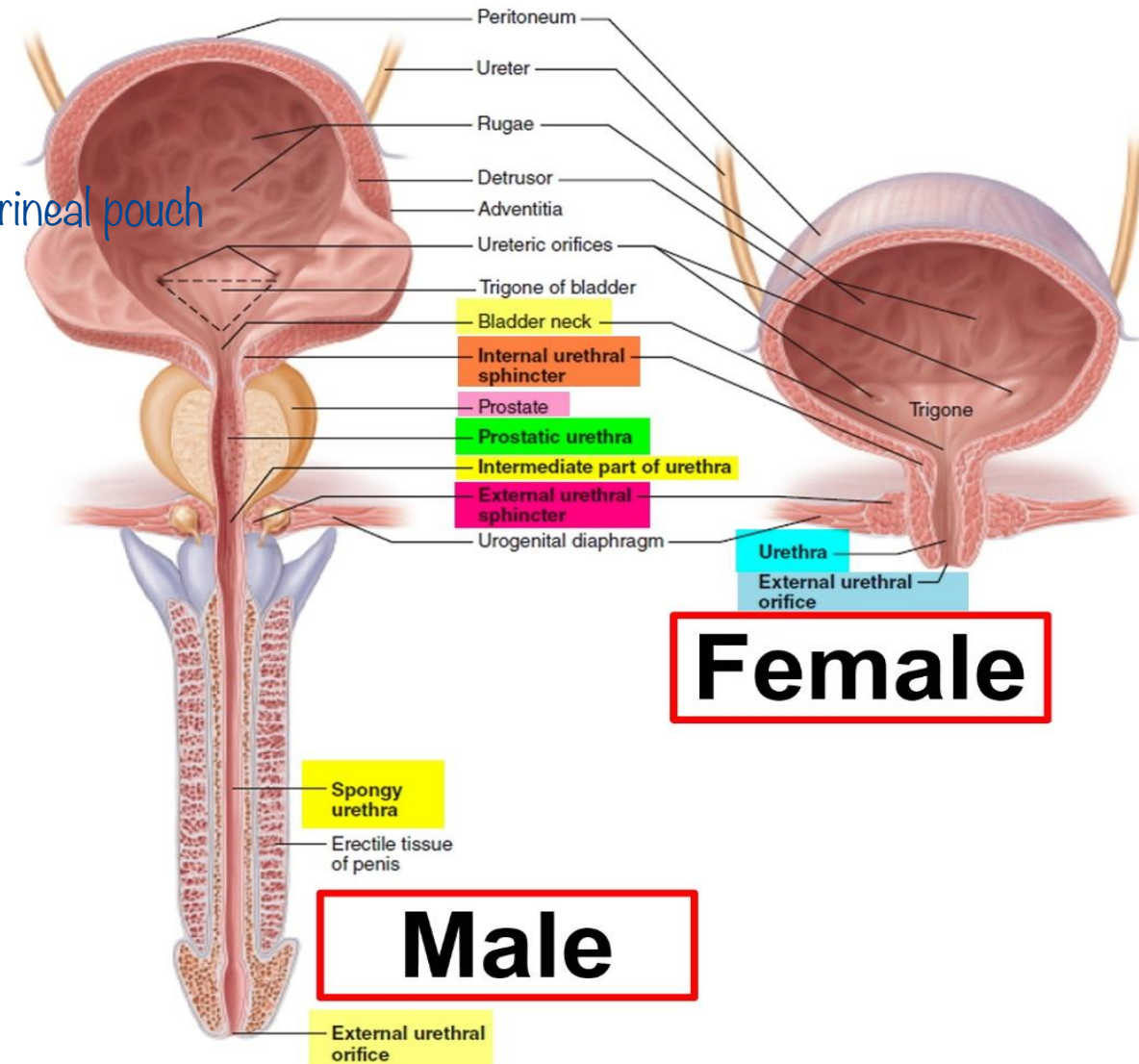
1-Sphincter Urethrae (External urethral sphincter):

- It is **voluntary sphincter** filling most of the deep perineal pouch and surround the membranous urethra. In males + part of female urethra that traverses deep perineal pouch
- It is **formed of two parts:** superficial & deep parts.
- It is **supplied by the pudendal nerve.**

↳ Somatic nerve

2-Sphincter Vesicae (Internal urethral sphincter)

- It is **thickened circular component** of smooth muscle fibers at the bladder neck.
- It **prevents retrograde flow** of ejaculate into bladder in male.
- It is **supplied by autonomic fibers.**



Urethra

Blood supply:

- Prostatic and membranous parts of male urethra supplied by inferior vesical and internal pudendal artery.
- Spongy part of male urethra by urethral artery from internal pudendal artery.
- Female urethra by the vaginal artery.

Lymphatic drainage:

- Prostatic and membranous parts of the male urethra- Female urethra drain into the internal iliac lymph nodes.
- Spongy part of male urethra into deep inguinal lymph node.

Histology of the Ureter

It has narrow **stellate-shaped lumen**.

Its wall consists of:

✳ نوع خاص بال renal system الها اسم تاني urothelium بتكون الخلايا

Mucosa:

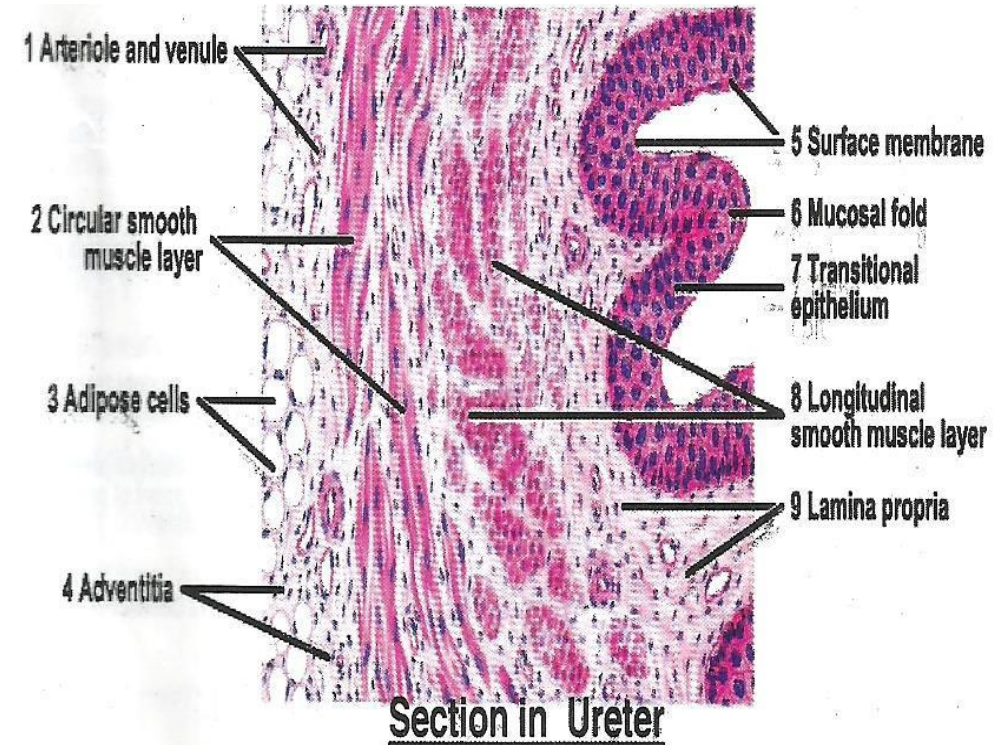
مترتبة ب layers بتغير عددها حسب الحالة هل هي empty or full

- **Transitional Epithelium.**
- **Lamina propria:** areolar connective tissue rich in **elastic fibers.**

Musculosa:

- **Upper 2/3:** inner longitudinal, outer circular smooth muscle fibers.
- **Lower 1/3:** Inner longitudinal, middle circular, outer longitudinal smooth muscle fibers.

Adventitia: Fibro elastic C.T.



Histology of the Urinary Bladder

The wall of the urinary bladder is thicker than that of the ureter and its lumen is wider.

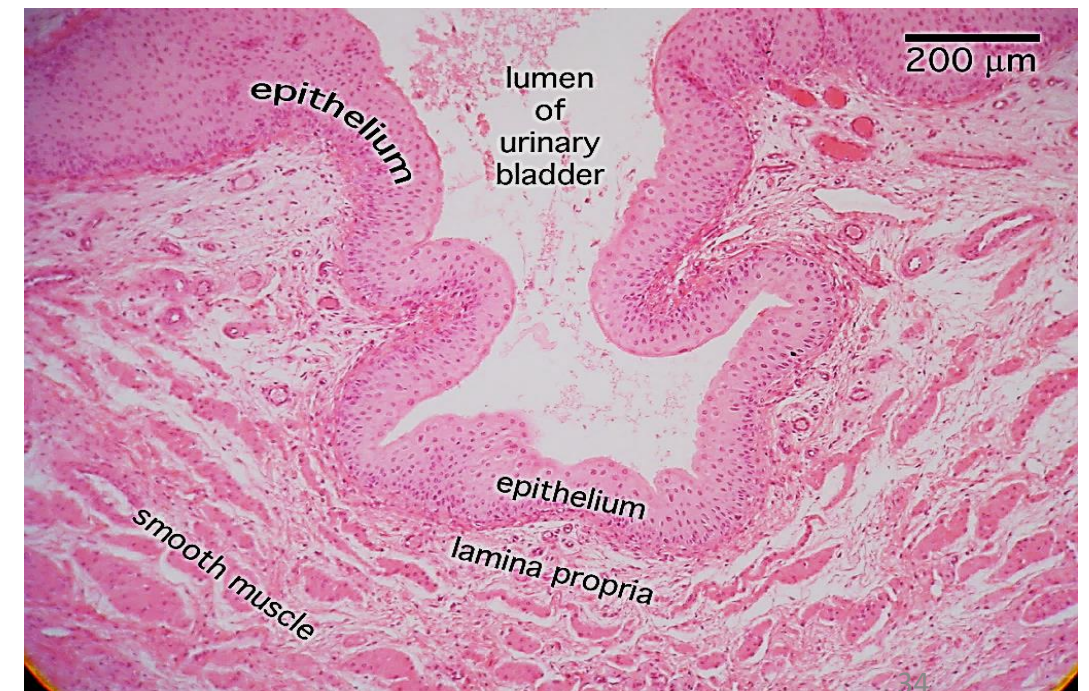
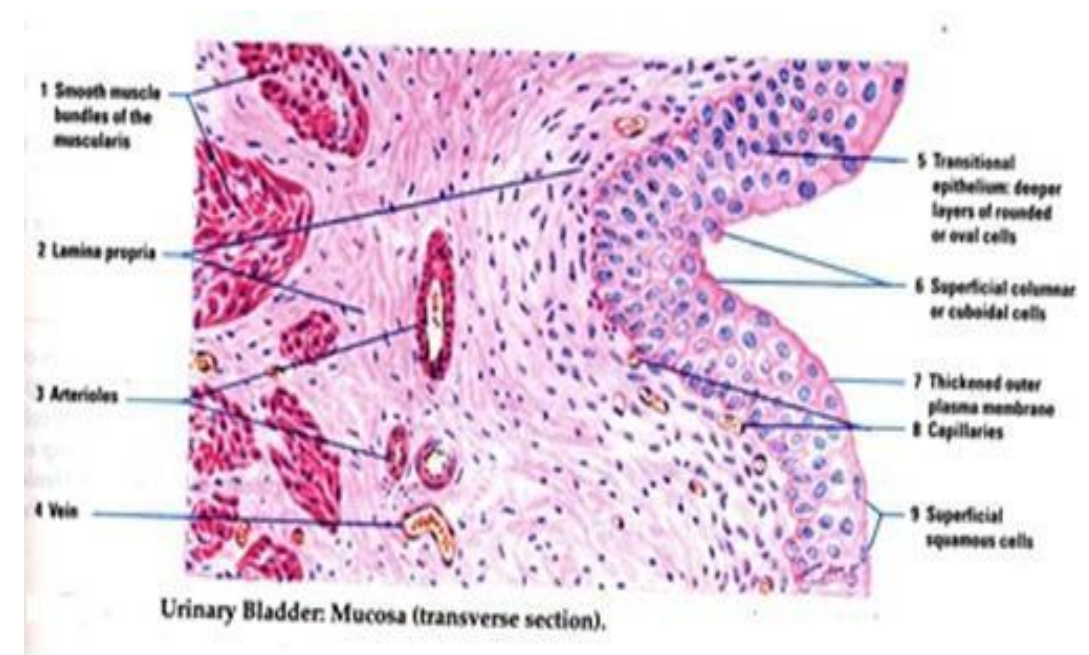
Mucosa:

- **Transitional Epithelium.**
- **Lamina propria:** areolar connective tissue rich in elastic fibers.

Musculosa:

- **Detrusor smooth muscle,** fibers are arranged in:
 - Inner longitudinal, middle circular & outer longitudinal.

Adventitia: Fibro elastic C.T.

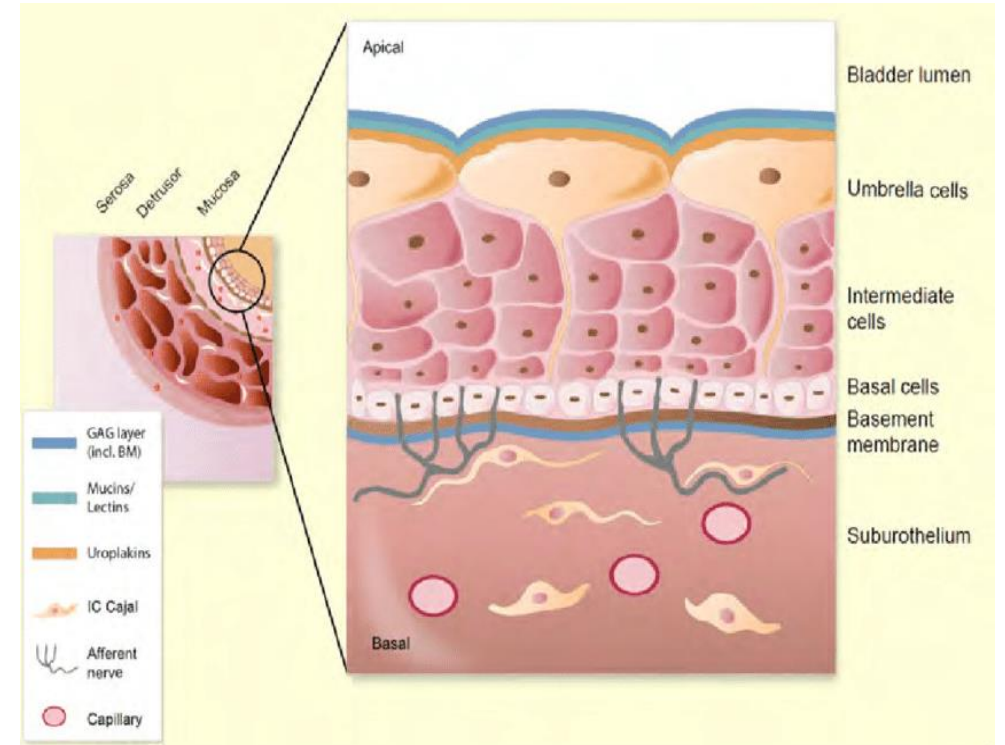


Urinary bladder barrier:

- Thickened apical membrane of the dome-shaped cells (umbrella cells).
- Occluding junction between these cells.

Function:

- Protect the epithelium from toxic wastes in urine.
- Prevent leakage of urine into the extracellular spaces.
- Prevent dilution of hyperosmotic urine by the capillaries in lamina propria.



Histology of Male Urethra

Prostatic urethra:

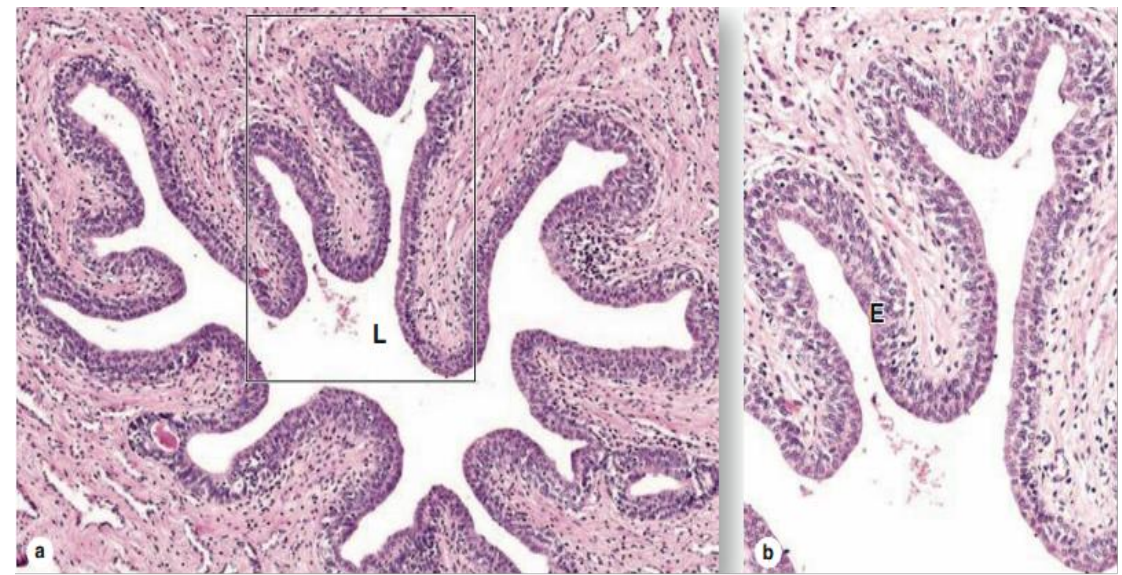
- Lined with **transitional epithelium**.

Membranous urethra:

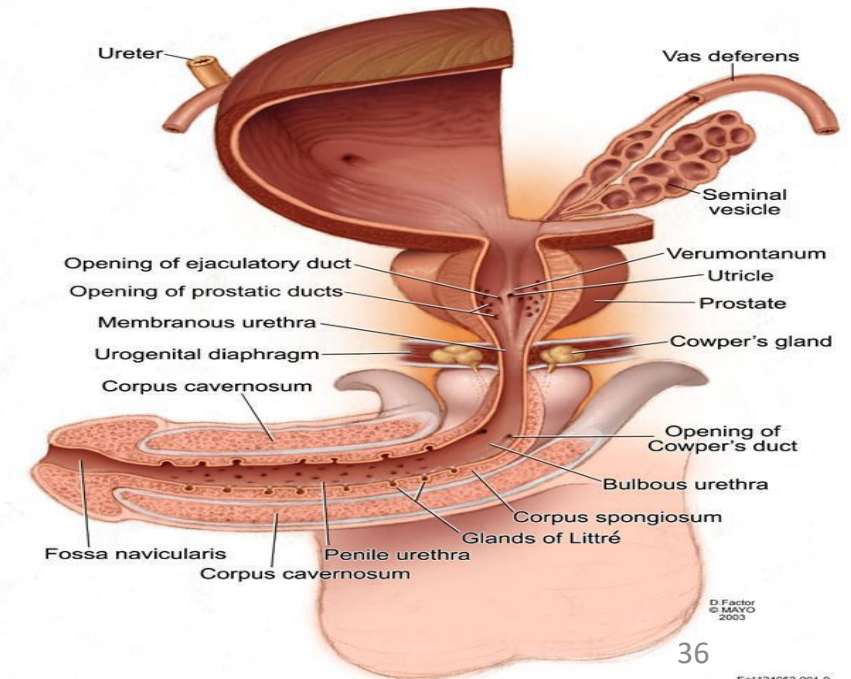
- Lined with **pseudostratified columnar epithelium**.
- Surrounded by **striated muscle fibers** (**external sphincter**).

Penile urethra:

- Lined with **stratified columnar epithelium** and **stratified squamous** at its end.
- **Mucus secreting cells** interspersed in epithelial lining.
- **Glands of Littre** (**urethral mucous glands**): present in the **connective tissue** of the penile urethra.



(a) A transverse section shows that the mucosa has large longitudinal folds around the lumen (L). (b) A higher magnification shows the stratified columnar epithelium (E).



Histology of the Urethra

Female urethra:

- It is lined with **Transitional, pseudostratified columnar epithelium, stratified squamous epithelium.**
- There are **numerous shallow invaginations of the epithelium lined with mucous cells.**

Thank You