



General Anatomy

التشريح العام

First Stage

2nd Semester


Lecture 5

The Urinary System

الدكتور طارق جواد الربيعي

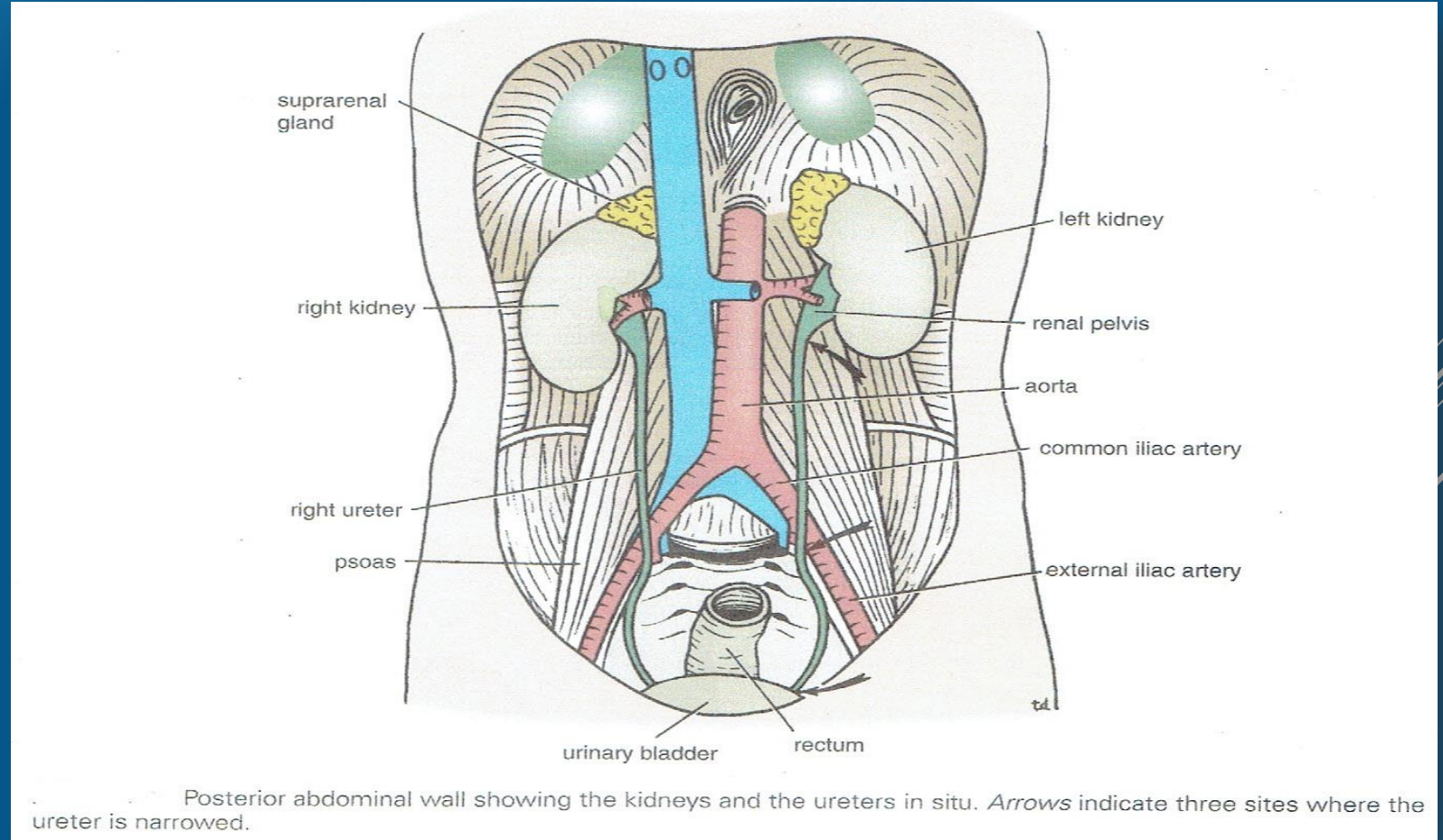
M.B., Ch.B., P.G.D.M.R.C.S.

Outline

- **The Urinary System**
 - **The Kidneys**
 - **The Ureters**
 - **The Urinary Bladder**
 - **The Urethra**
- 

The Urinary System

- Organs of the urinary system:
 1. The kidneys.
 2. The ureters.
 3. The bladder.
 4. The urethra.



The Urinary System

Functions of the urinary system

Help maintain homeostasis by complex combination of processes, that involve:

1. Filtration of wastes of metabolism from blood.
 2. Selective reabsorption of water and solutes.
 3. Excretion of wastes, and excess water as urine.
- Urine produced in the kidneys passes through the ureters to the bladder for temporary storage, and is then released to the exterior through the urethra.



The Kidneys

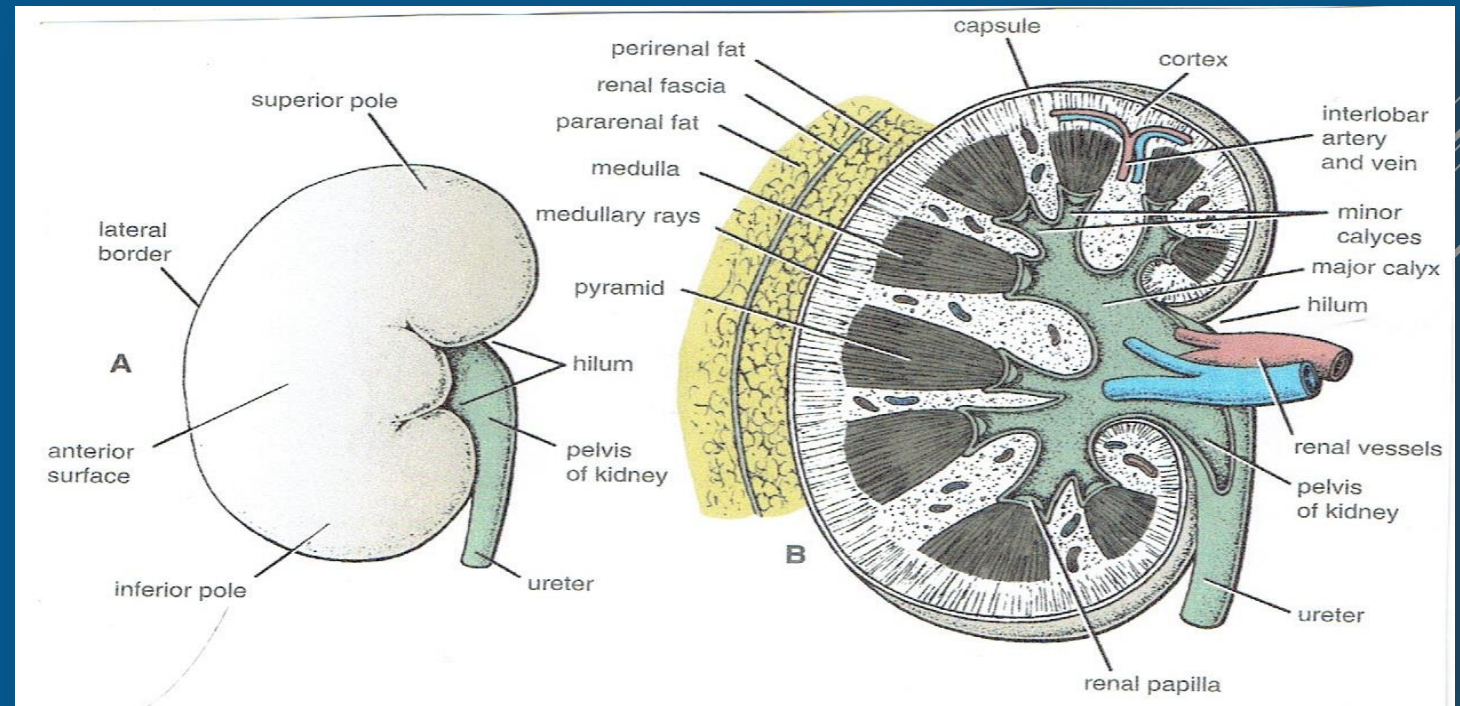
- They are two reddish-brown organs.
- Situated in the posterior part of the abdomen.
- One on each side of the vertical column, behind the peritoneum (retroperitoneal).
- Surrounded by a mass of adipose connective tissue.
- The upper end at the level upper border of twelfth thoracic vertebra.
- The lower end with the third lumbar vertebra.
- The right kidney is lower than the left kidney (probably on account of the liver).
- Each kidney is about (11 cm) in length, (6 cm) in breadth, and (3 cm) in width.
- The average weight of each kidney is about (150 gm.) in male and (135 gm.) in female.



The Kidneys

Features of a kidney

- The kidney is bean-shaped.
- It has a convex lateral border, and a concave medial border.
- On the medial border is a vertical slit called the (hilum) (bounded by thick lips of renal substance)
- The hilum transmits
 1. Renal vein
 2. Branches of renal artery
 3. Ureter
 4. Lymphatics
 5. Sympathetic nerve fibers



The Kidneys

Renal structure

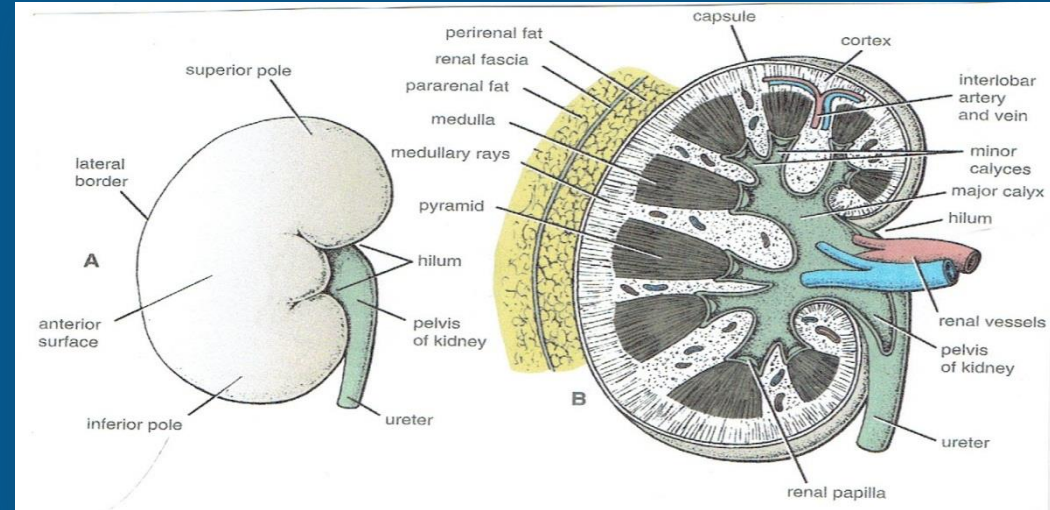
- Each kidney has two parts
 1. The Cortex (a dark brown outer part)
 2. The Medulla (a light brown inner part)

The Medulla

- Is composed of about a dozen of renal pyramids
- The renal pyramid: its base oriented toward the cortex, and its apex (the renal papilla) projecting medially.

The Cortex

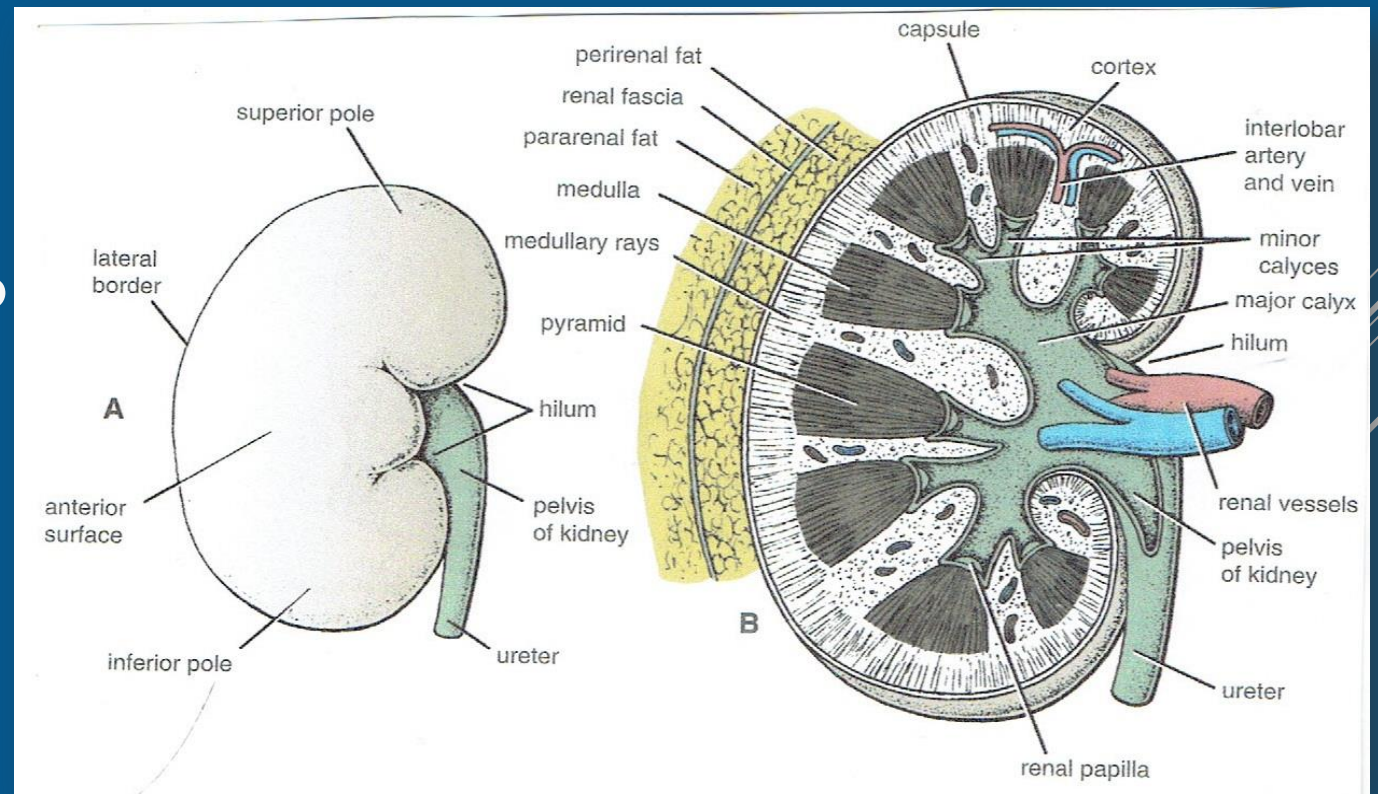
- Extends into the medulla between adjacent pyramids as renal columns
- The medullary rays: extending from the bases of the renal pyramids into the cortex



The Kidneys

Renal structure

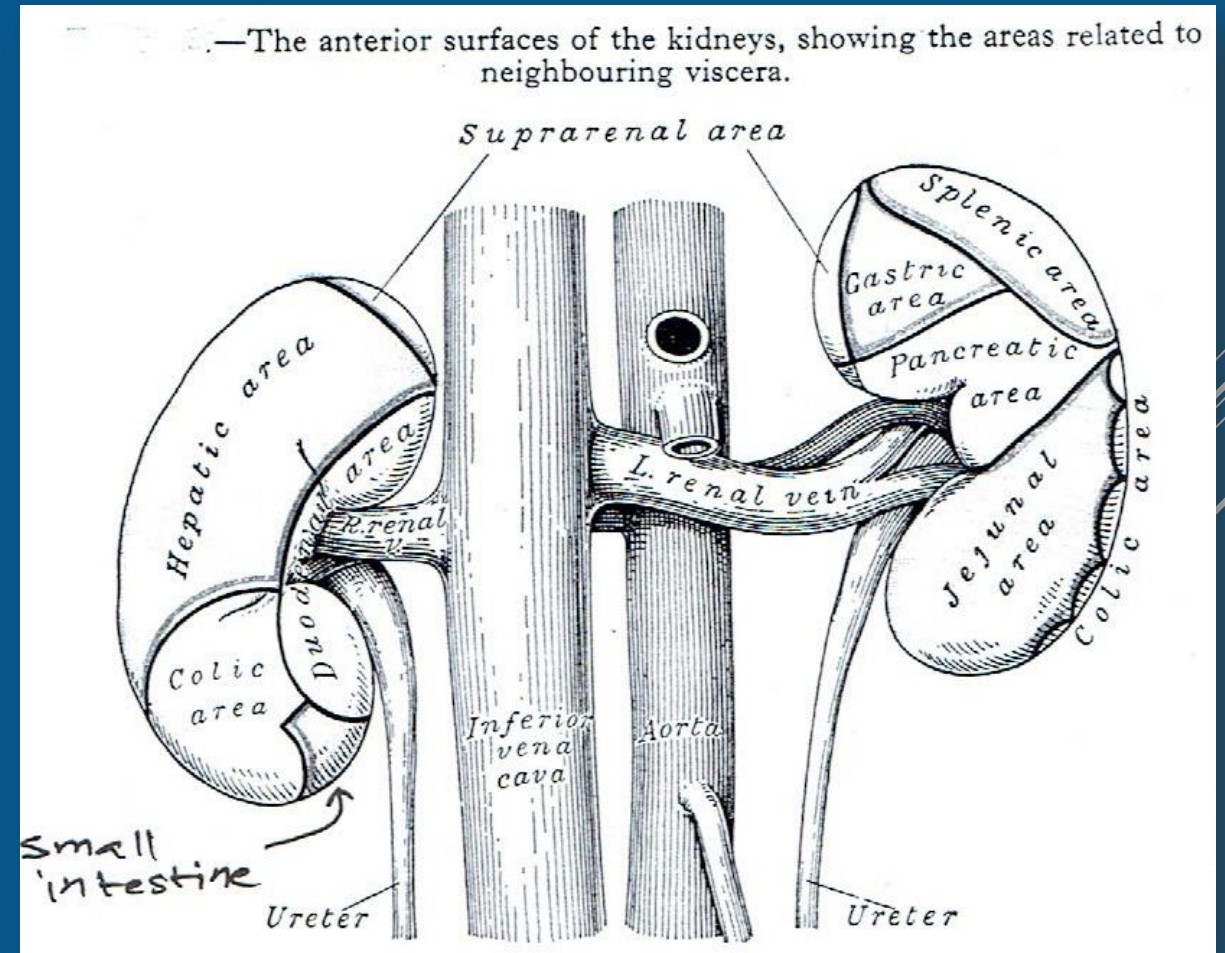
- The renal sinus: is the space within the hilum, contains the upper expanded end of the ureter; the renal pelvis
- The renal pelvis: divides into two or three major calyces.
- Each major calyx: divides into two or three minor calyces
- Each minor calyx: is indented by the renal papilla



The Kidneys

Important Relations

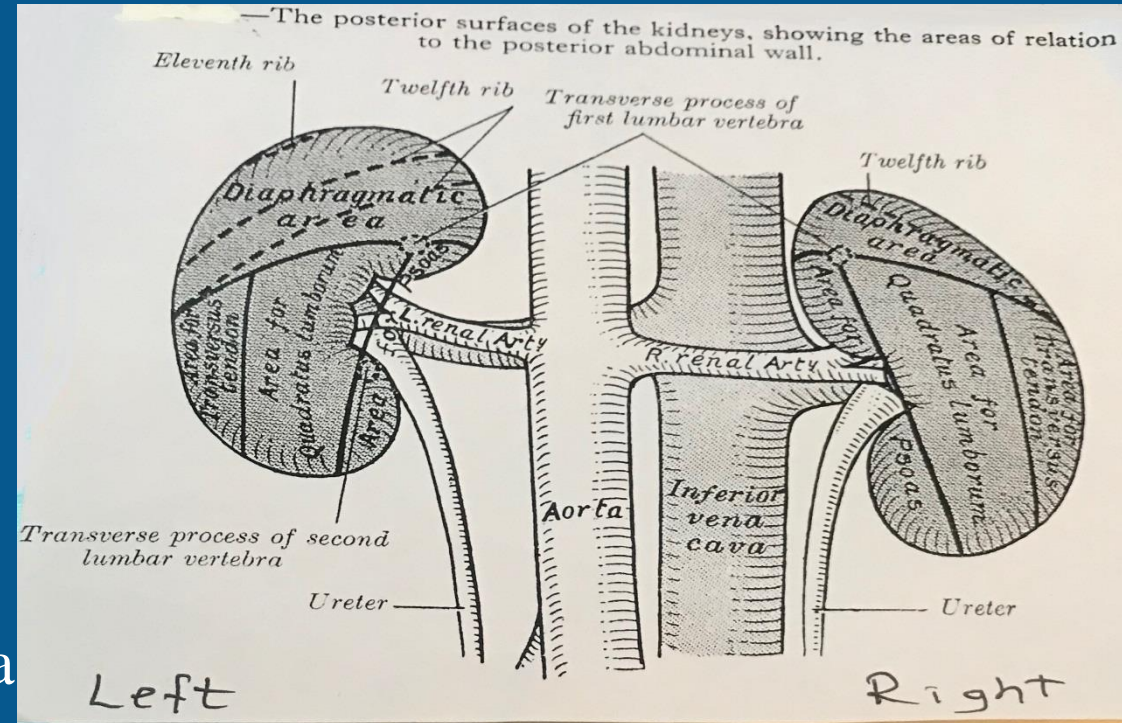
- The right kidney
 - Anteriorly
 1. The right suprarenal gland
 2. the liver
 3. The descending part of the duodenum
 4. The right colic flexure
 5. Small intestine



The Kidneys

Important Relations

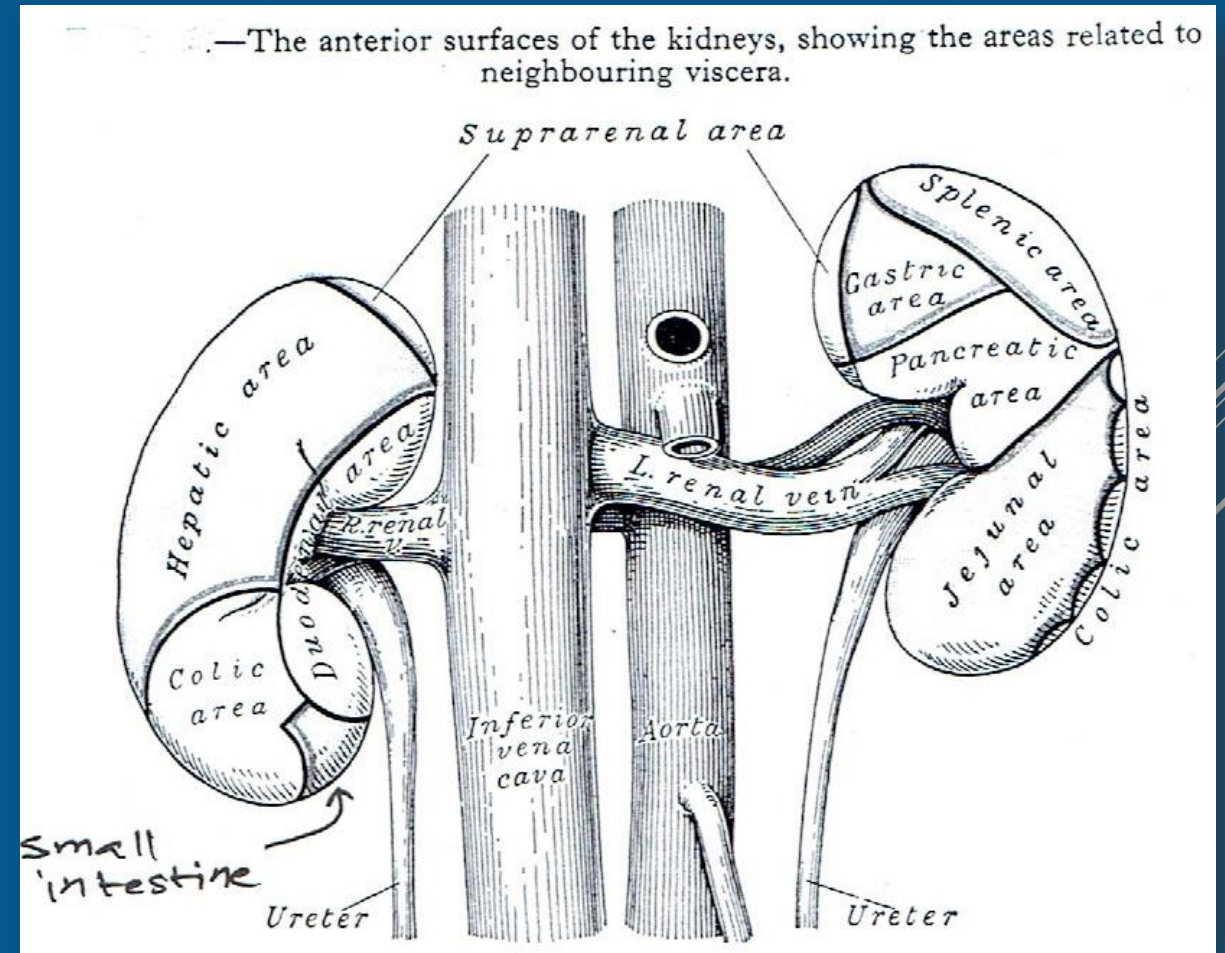
- The right kidney
 - Posteriorly
 1. The diaphragm.
 2. The right twelfth rib.
 3. The right costo diaphragmatic recess of pleura
 4. The psoas, quadrates lumborum, and transverses abdomenus muscles.
 5. The subcostal [T12], Iliohypogastric[L1] and Ilio inguinal[L1] nerves run downward and laterally



The Kidneys

Important Relations

- The left kidney
 - Anteriorly
 1. The left suprarenal gland
 2. the spleen
 3. The stomach
 4. The pancreas
 5. The left colic flexure
 6. Coils of jejunum



The Kidneys

Important Relations

- The left kidney

- Posteriorly

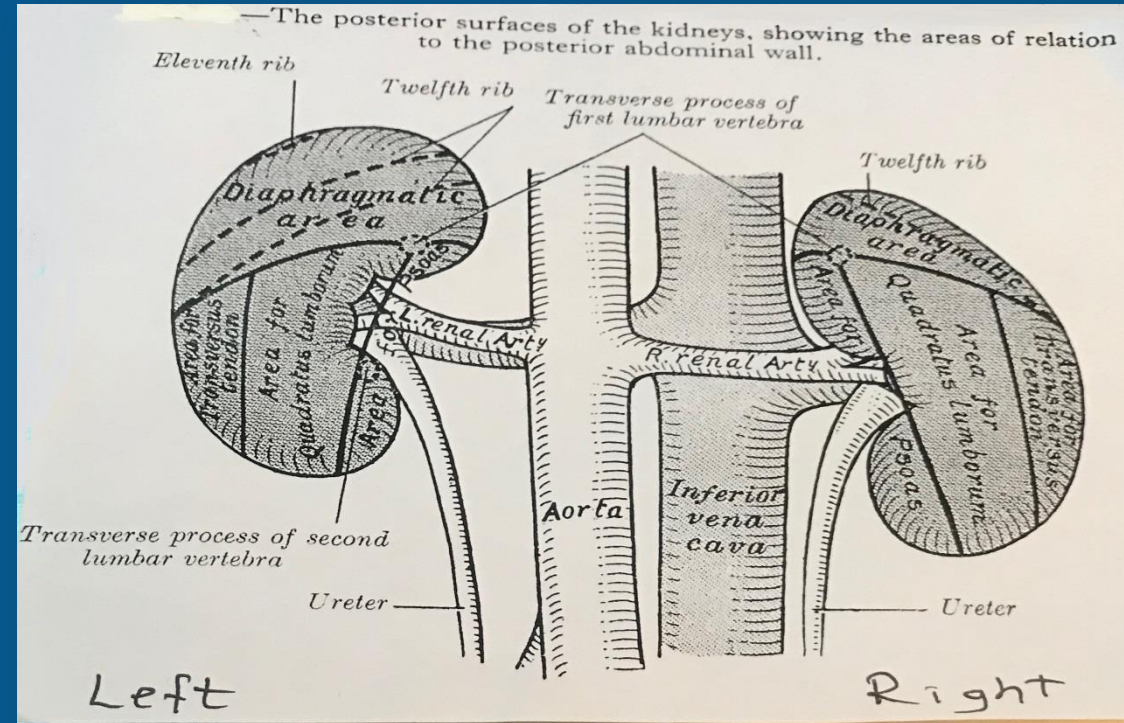
1. The diaphragm.

3. The left costo diaphragmatic recess of pleura.

3. The eleventh and twelfth ribs.

4. The psoas, quadrates lumborum, and transverses abdomenus muscles.

5. The subcostal [T12], Iliohypogastric[L1] and Ilioinguinal[L1] nerves run downward and laterally



The Kidneys

Arterial Blood Supply

- The renal artery: from the aorta at the level of second lumbar vertebra.

Venous Drainage

- Renal veins drain into the inferior vena cava

Lymphatic Drainage

- Lymph drains into the lateral aortic lymph nodes

Nerve Supply

- From the renal sympathetic plexus



The Kidneys

Functions of the kidneys

1. Excretion most of the waste products of metabolism
2. Play a major role in controlling water and electrolyte balance within the body
3. Maintaining the acid-base balance of the blood
4. Production of (renin) a protease that participates in the regulation of blood pressure by cleaving (angiotensinogen) to (angiotensin)
5. Production of (erythropoietin) a glycoprotein that stimulates the production of the erythrocytes
6. Hydroxylation of the (steroid prohormone vitamin D), initially produced in the skin, to an active form (1, 25 dihydroxy vitamin D₃) or (calcitriol) which is involved in regulating calcium balance.



The Ureters

- The two ureters are muscular tubes, that extend from the kidneys to the posterior surface of the urinary bladder.
- Each ureter measures about (25 cm) long
- Have three constrictions along its course
 1. Pelvi ureteric junction: where the renal pelvis joins the ureters.
 2. It is kinked as it crosses the pelvic brim
 3. Uretero vesical junction: where it pierces the bladder wall.
- The renal pelvis is a funnel-shaped expanded upper end of the ureter,
 - It lies within the hilum of the kidney
 - It receives the major calyces

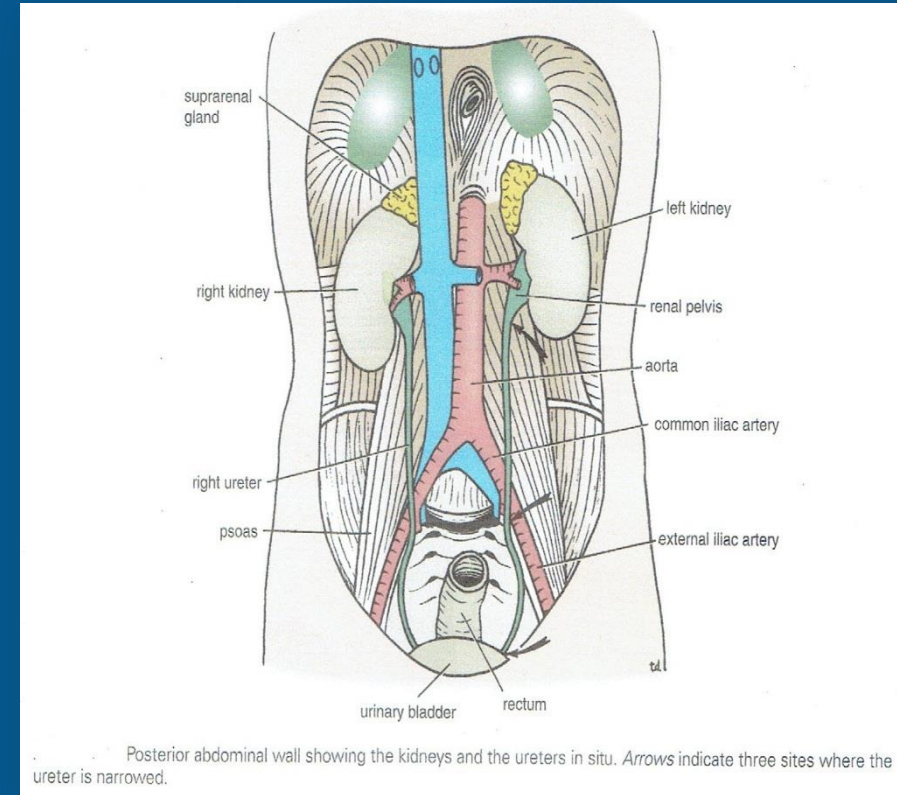


The Ureters

Course of Ureters

A. The abdominal course

- After emerging from the hilum of the kidneys runs vertically downward retro peritoneally
- On the psoas muscle, which separates it from the tips of the transverse processes of the lumbar vertebrae.
- It enters the pelvis by crossing the bifurcation of the common iliac artery, in front of the sacroiliac joint.



The Ureters

Course of Ureters

B. The pelvic course

- Each ureter runs the lateral wall of the pelvis in front of the internal iliac artery to the region of the ischial spine.
- It turns forward to enter the lateral angle of the bladder.

❖ In the male:

- Near its termination it is crossed by the vas deferens

❖ In the female

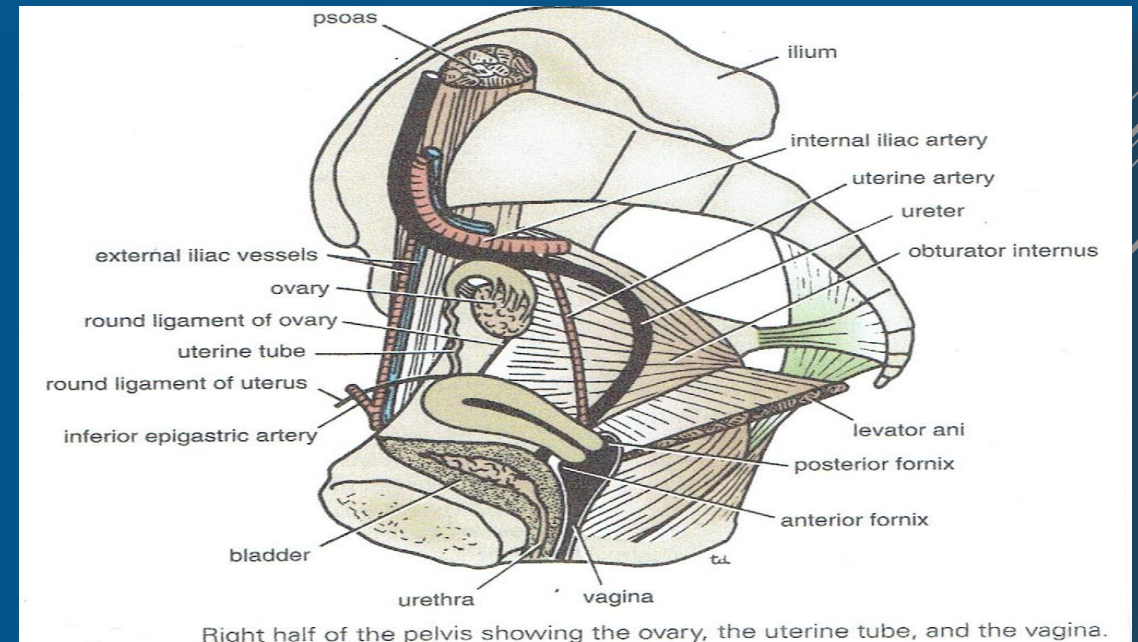
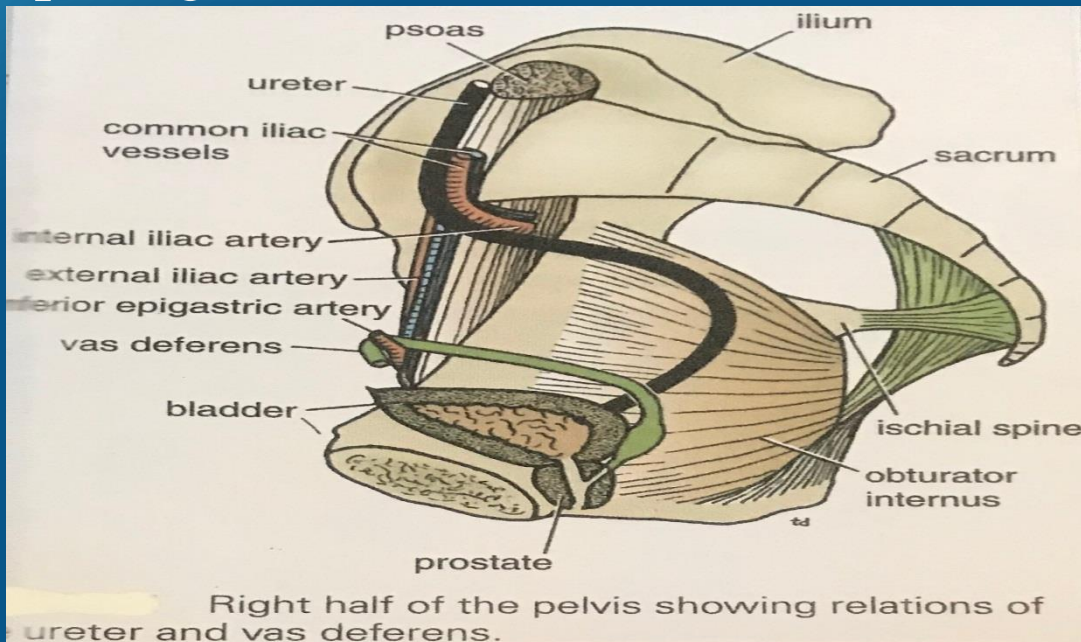
- It lies behind the ovary when it crosses the internal iliac artery
- At the region of the ischial spine, it then turns forward and medially beneath the base of the broad ligament, where it is crossed by the uterine artery.



The Ureters

Course of Ureters

- The ureter then runs forward lateral to the lateral fornix of the vagina to enter the bladder.
- The ureter passes obliquely through the wall of the bladder for about (1.9 cm) before opening into the bladder.



The Ureters

Relations of The Ureters

A. The Right Ureter

- Anteriorly

1. The duodenum.
2. The terminal part of the ileum.
3. The right colic and the ileocolic vessels.
4. The right testicular (or ovarian) vessels.
5. The root of the mesentery of the small intestine.

- Posteriorly

1. The right psoas muscle which separates it from the lumbar transverse processes.
2. The bifurcation of the right common iliac artery.



The Ureters

Relations of The Ureters

B. The Left Ureter

- Anteriorly

1. The sigmoid colon and the sigmoid mesocolon.
2. The left colic vessels.
3. The left testicular (or ovarian) vessels.

- Posteriorly

1. The left psoas muscle which separates it from the lumbar transverse processes.
2. The bifurcation of the left common iliac artery.



The Ureters

- Arterial Blood Supply
 1. Upper end: from renal artery.
 2. Middle portion: from testicular (or ovarian) artery.
 3. In the pelvis: from the superior vesical artery.
- Venous Drainage
 - Into veins corresponding to the arteries.
- Lymphatic Drainage
 - To the lateral aortic nodes and iliac nodes.
- Nerve Supply
 - Renal, testicular (or ovarian) and hypogastric plexus (in the pelvis).



The Urinary Bladder

- It is situated immediately behind the pubic bones, within the pelvis.
- It stores urine, in the adult has a maximum capacity of about (500 ml).
- The bladder has a strong muscular wall.
- The empty bladder in the adult lie entirely within the pelvis.
- The full bladder: its superior wall rises up into the hypogastric region.
- The empty bladder is pyramidal in shape.
- Has an apex, base, and three surfaces; one superior and two infrolateral.



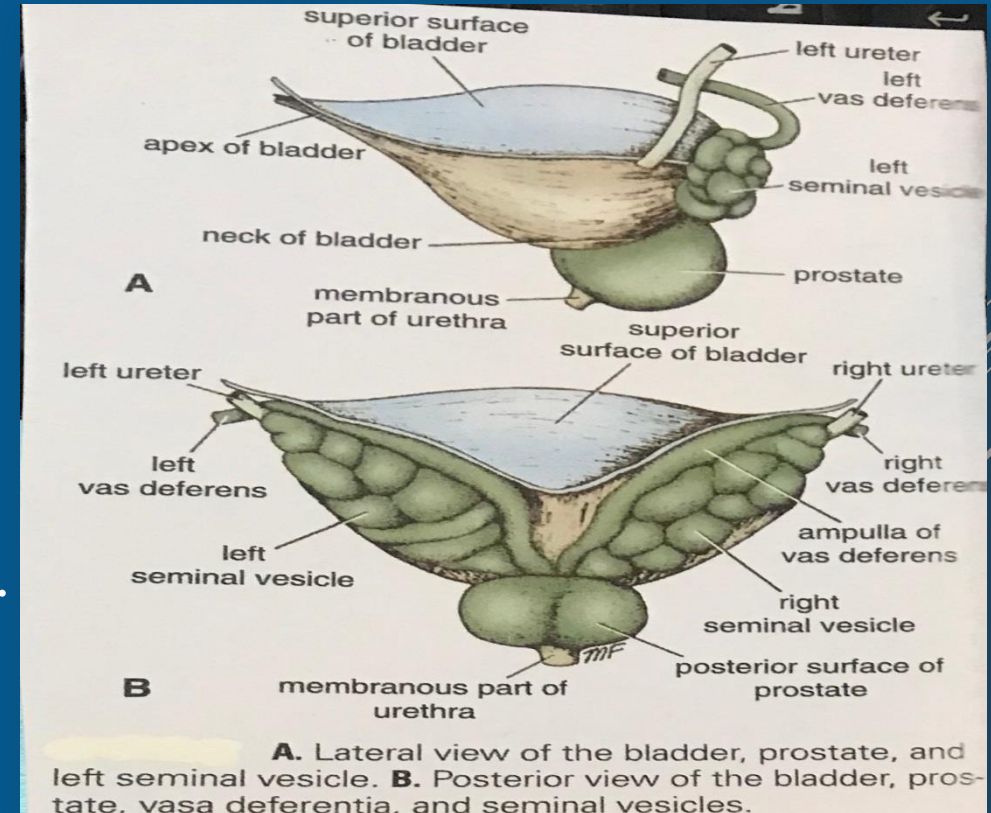
The Urinary Bladder

The apex of the bladder:

- Points anteriorly, lies behind the upper margin of the symphysis pubis.

The Base (or posterior surface) of the bladder:

- Faces posteriorly
- It is triangular
- The superolateral angles are joined by the ureters
- The inferior angle gives rise to the urethra
- The two vasa differentia and seminal vesicles lie on it.
- The upper part of it is covered by peritoneum and forms the anterior wall of the rectovesical pouch.
- The lower part of it is separated from the rectum by the vasa differentia and seminal vesicles and by the rectovesical fascia.



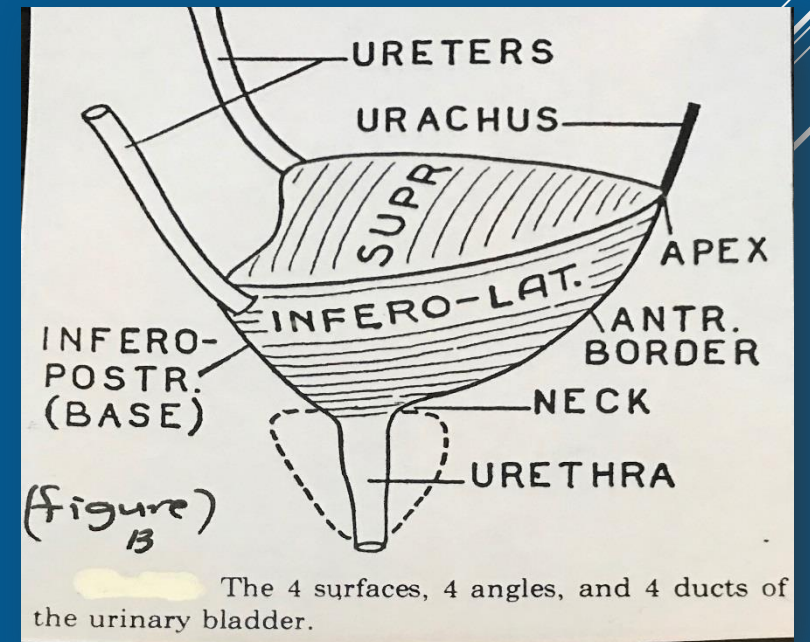
The Urinary Bladder

The Superior Surface of The Bladder

- Covered by peritoneum
- Related to coils of ileum or sigmoid colon
- The peritoneum from its lateral margins passes to the lateral pelvic walls
- When it is filled, this surface bulges upward into the abdominal cavity, and the bladder comes in contact with the anterior abdominal wall

The Inferrolateral Surface

- Are related in front to the retropubic and to the pubic bones.
- More posteriorly:
 - Above: related to the obturator internus muscle
 - Below: related to the levator ani muscle.



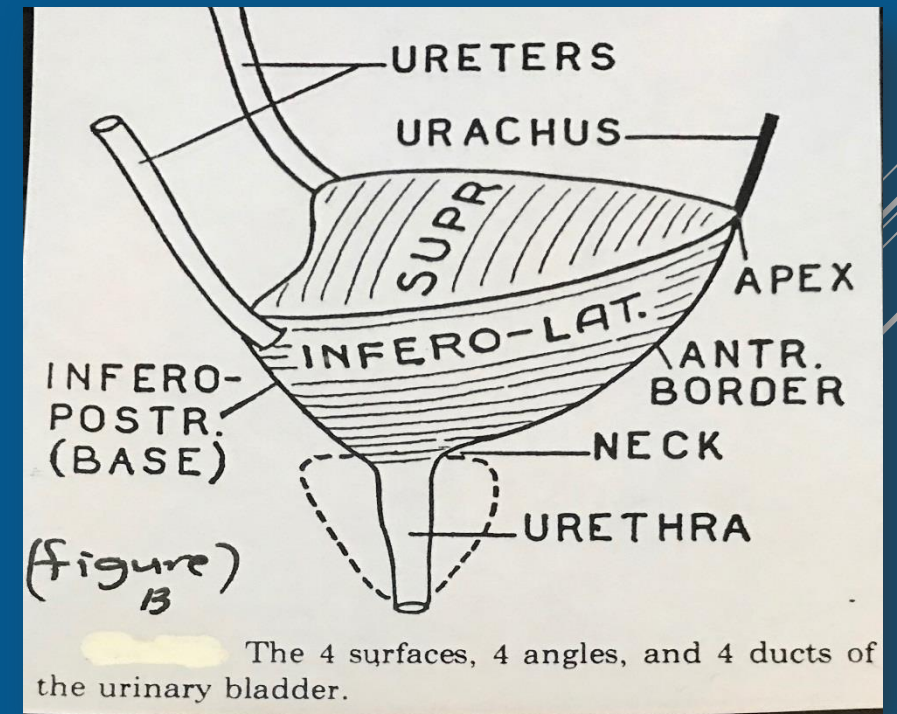
The Urinary Bladder

The Neck of The Bladder

- Lies inferiorly and rests on the upper surface of the prostate.
- It is held in position by the puboprostatic ligaments in the male and by pubovesical ligament in the female.

The Muscular Coat of The Urinary Bladder

- Composed of smooth muscle arranged in three layers of interlacing bundles known as detrusor muscle
- The sphinctor vesicae is at the neck of the bladder and is formed by the circular component of the muscle



The Urinary Bladder

Arterial Blood Supply

- The superior and inferior vesical arteries: branches of the internal iliac arteries

Venous Drainage

- Veins from vesical venous plexus drain into the internal iliac veins.

Lymphatic Drainage

- To internal and external iliac nodes.

Nerve Supply

- To inferior or hypogastric plexuses.

The sympathetic nerves inhibit contraction of detrusor muscles of the bladder wall and stimulate closure of the sphincter vesicae.

- The parasympathetic nerves stimulate contraction of the detrusor muscle of the bladder wall and inhibit the action of the sphincter vesicae.



The Urethra

- Through which the urine is discharged from the urinary bladder to the outside of the body.
- The female urethra is a purely urinary duct.
- The male urethra serves two functions: Urinary and Reproductive.
- Of these the latter is essential and the former function merely utilizes a tube which is almost entirely genital.



The Urethra

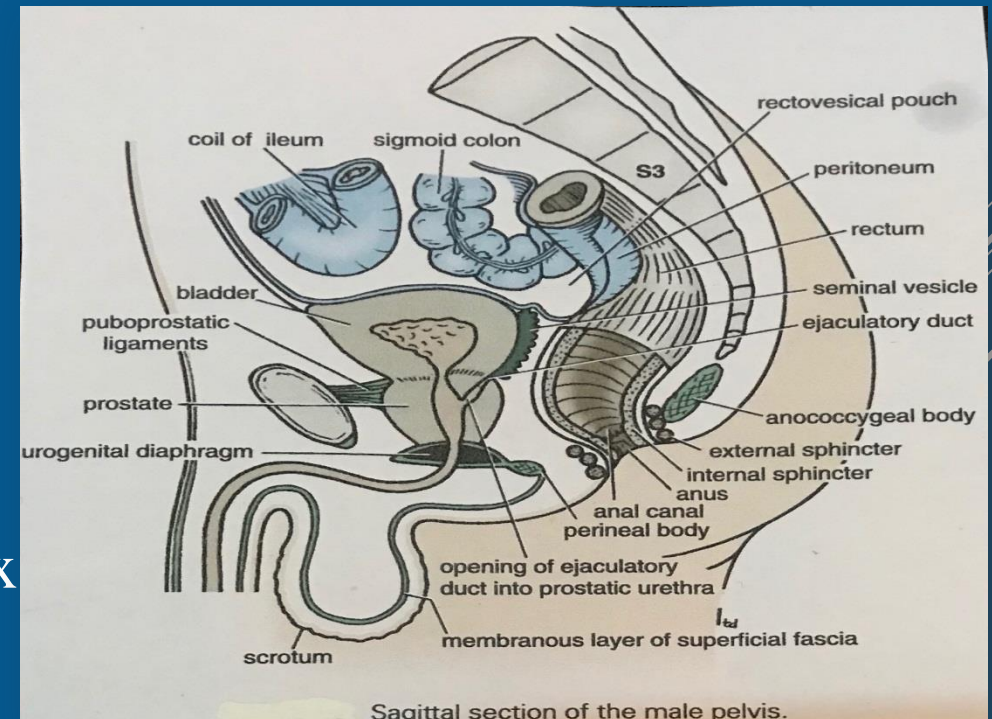
A. Male Urethra

- Is about (20 cm) long
- Extends from the neck of the bladder to the external meatus on the glans penis.

Part of the male urethra

1. The prostatic urethra

- It is about (3 cm) long
- Passes through prostate from base to the apex
- It is the widest and more dilatable portion



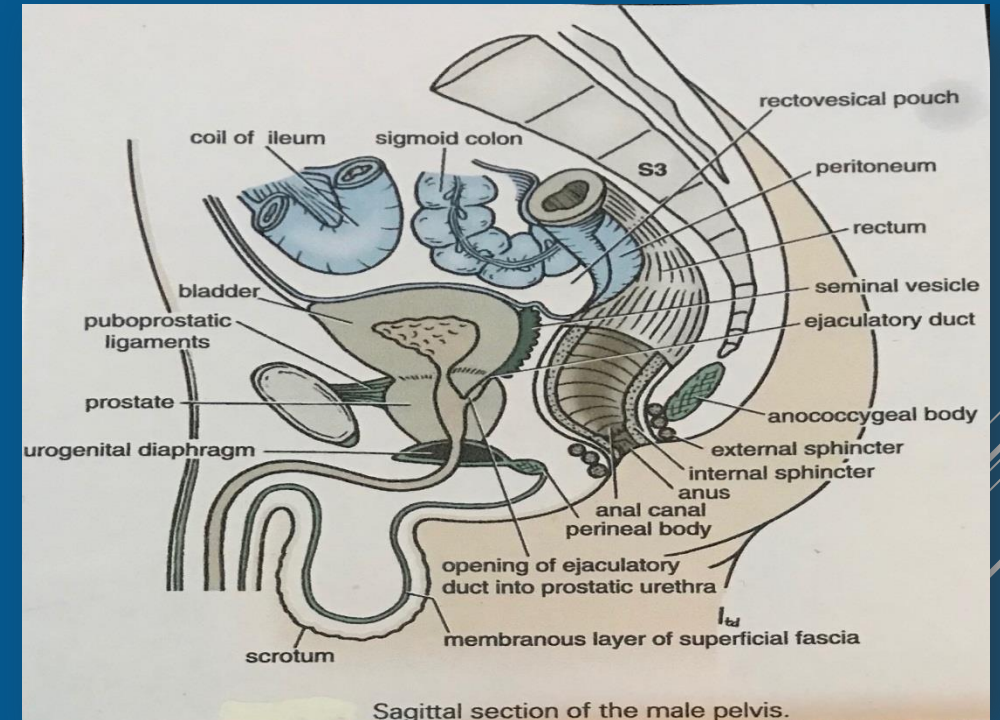
The Urethra

2. The membranous urethra

- It is about (1.25 cm) long
- Lies within the urogenital diaphragm
- Surrounded by the sphincter urethra muscle
- It is the least dilatable portion

3. The spongy urethra

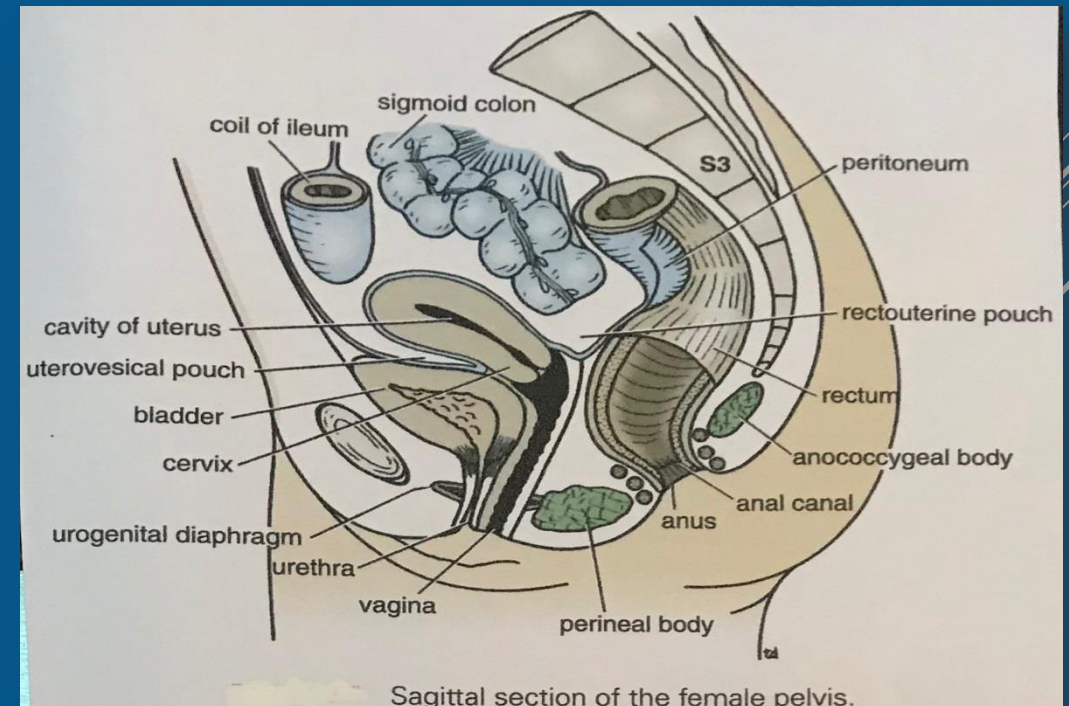
- Is about (15.75 cm) long
- Is enclosed in the bulb and the corpus spongiosum of the penis
- The external meatus is the narrowest part of the entire urethra.



The Urethra

B. The Female Urethra

- It is about (3.8 cm) long
- Extends from the neck of the bladder to the external meatus, where it opens into the vestibule.
- It traverses the sphincter urethra
- Lies immediately in front of the vagina
- The urethra can be dilated relatively easily





Any
Question?