Anatomy Team
MED 439

MED439
KING SAUD UNIVERSITY

Revised & Approved by: Shayma Abdullah Alghanem, Faisal Alotaibi

Anatomy of the kidney

Renal Block - Lecture 1

Color index:
Important
In male's slides only
In female's slides only
notes
Extra information, explanation

Don't forget to check the Editing File

@anatomy439

Objectives:

- Discuss Components of the urinary system
- Kidney :
    1. Shape & Position
    2. Surface anatomy
    3. External features
    4. Hilum & its contents
    5. Relation
    6. Internal features
    7. Blood supply
    8. Lymph drainage
    9. Nerve supply

Overview

◇Every day, each kidney filters liters of fluid from the **bloodstream**

◇Although the **lungs** and the **skin** also play roles in excretion,
The kidneys bear the major responsibility for eliminating nitrogenous wastes(nitrogen-containing), toxins, and drugs from the body.

Function of kidney

1 - **Excretes most of the waste** products of metabolism.

2 - **Erythropoietin** hormone stimulates bone marrow for **RBCs formation**.

3 - Converts **vitamin D to its active form**.

4 - **Regulates the blood pressure** By rennin enzyme

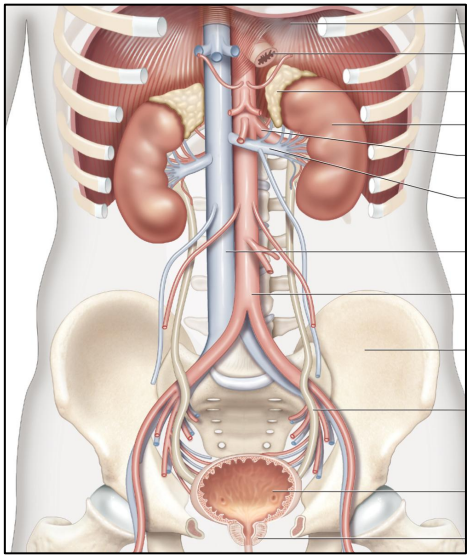
5 - Controls **water & electrolyte balance** of the body.

6 - Maintain **acid-base balance** of the blood.

The kidney

- Kidneys are **reddish brown** in color.
- Lie **behind** the peritoneum (retroperitoneal) on the posterior abdominal wall on either side of the **vertebral column.**
- They are largely under cover of the costal margin. kidney lies between T12-L3.
- With contraction of the diaphragm (during inspiration) the kidney moves downward as much as 2.5 cm.

	Right kidney	Left kidney
Location	lies slightly lower than the left due to the large size of the right lobe of the liver.	Higher than the right
Upper border of the kidney	Lies at the level of **11th intercostal space**	Lies at the level of **11th rib**



Notice the level difference

the shape of kidney

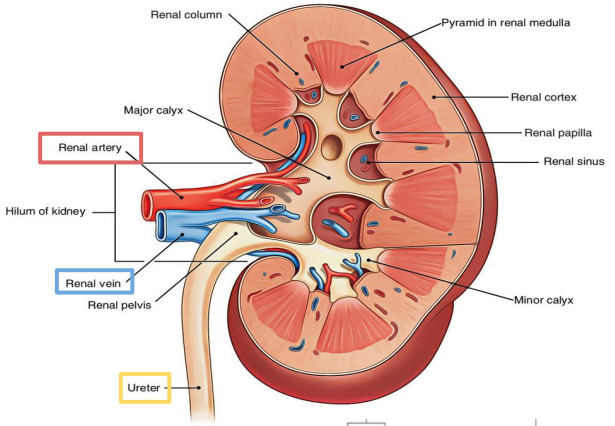
◇ The lateral border is convex, while the medial border is convex at both ends but it is concave at its middle where it shows a vertical slit called the **hilum**.

Hilum:

◇ The hilum extends into a large cavity called the **renal sinus.**

◇ The hilum transmits the from the front backward V.A.U.A.

1. **Renal vein**
2. **Two branches of renal artery**
3. **Ureter**
4. **Third branch of renal artery**



There are 4 structures covering of the kidney

2,3&4 support the kidney in position

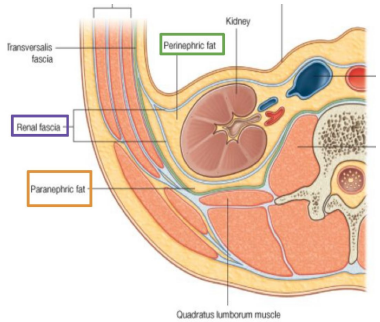
Iner → Outer

1 - Fibrous capsule: It surrounds the kidney

2 - Perirenal (perinephric) fat : It covers the fibrous capsule

3 - Renal fascia: It encloses the kidneys and suprarenal glands

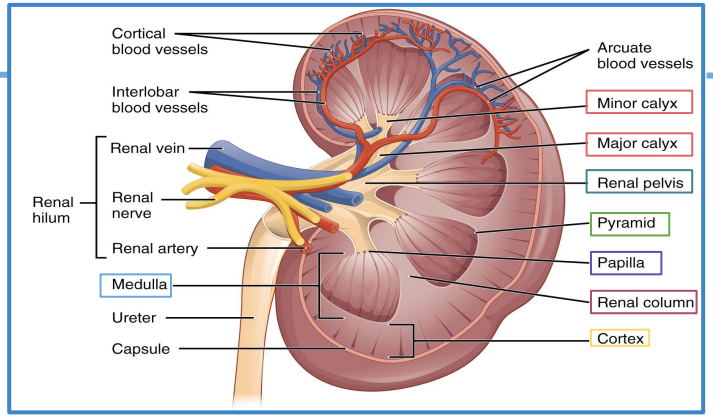
4 - Pararenal (paranephric) fat : It lies external to the renal fascia, and forms part of the retroperitoneal fat.



Renal structure

Outer **Cortex**

extends into the medulla between adjacent pyramids as the **renal column**



Inner **Medulla**

is composed of about 12 **renal pyramids.**

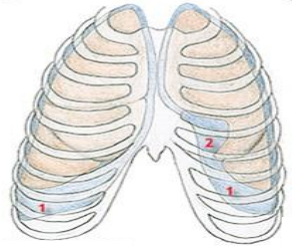
Base of each pyramid: is directed toward the cortex

Apex (the renal papilla): is projecting medially

- Extending from the bases of the renal pyramids into the cortex are striations known as **medullary rays**.
- The renal sinus within the hilum, contains the upper expanded end of the ureter, **the renal pelvis**.
- Renal pelvis divides into two or three **major calyces**, which divides into two or three **minor calyces**.

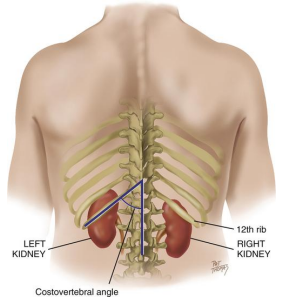
Posterior Relation to the kidney

- Costodiaphragmatic pleural recess.

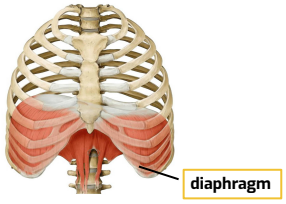


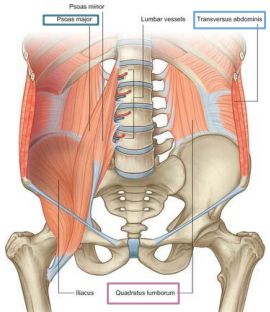
- **Twelfth rib**

  Left kidney reaches 11th rib

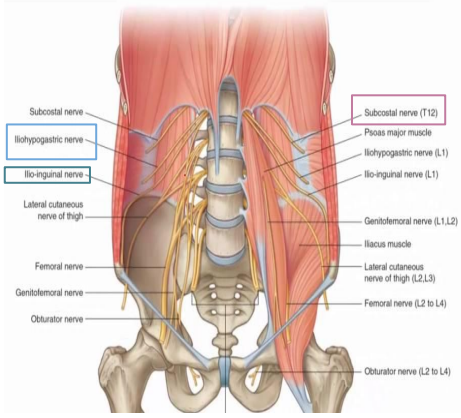


- **4 muscles**
  1. Quadratus lumborum
  2. Transversus abdominis
  3. Diaphragm
  4. Psoas major





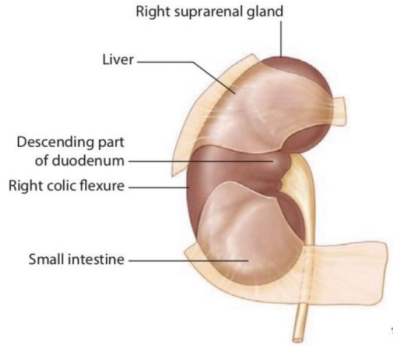
- **3 nerves**
  1. Subcostal nerve (T12)
  2. Iliohypogastric nerve (L1)
  3. Ilioinguinal nerve (L1)

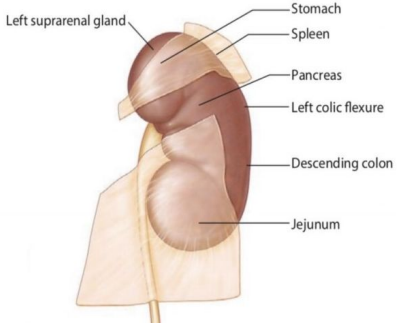


Anterior Relation to the kidney and segmentation

Anterior Relations

Right kidney	Left kidney
1. Right suprarenal gland 2. Liver(right lobe).* 3. 2nd part of the duodenum 4. Right colic flexure 5. Coils of small intestine*	1. Left suprarenal gland 2. Stomach* 3. Spleen* 4. Pancreas 5. Left colic flexure 6. Descending colon 7. Coils of jejunum*





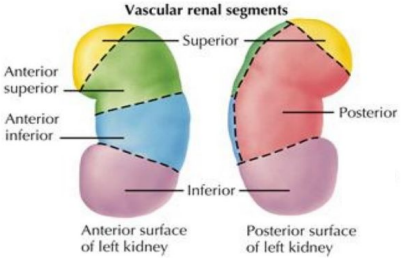
* (Not directly , but with peritoneum instead)

Segmentation of The kidney

Males slides

consists of **5** segments
each has its own blood supply:

1. Apical (superior)
2. Anterior superior
3. Posterior
4. Anterior inferior
5. Caudal (inferior)

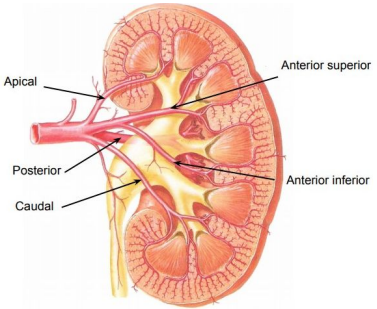


Segmentation of The Renal artery

Divides into **5** segmental branches:

Males slides

1. Apical
2. Anterior superior
3. Posterior
4. Anterior inferior
5. Caudal



Blood supply

◇The renal artery arises from the aorta at the level of the **2nd lumbar** vertebra.

◇Each renal artery divides into : 5 segmental arteries that enter the hilum of the kidney, four in front and one behind the renal pelvis. They are distributed to different segments of the kidney.

◇Lobar artery arises from each segmental artery, one for each renal pyramid.

◇Each lobar artery gives off 2 or 3 interlobar arteries

◇The interlobar arteries run **toward the cortex** on each side of the renal pyramid.

◇Interlobar arteries give off the arcuate arteries at the junction of the cortex & medulla.

◇The arcuate arteries give off several interlobular arteries.

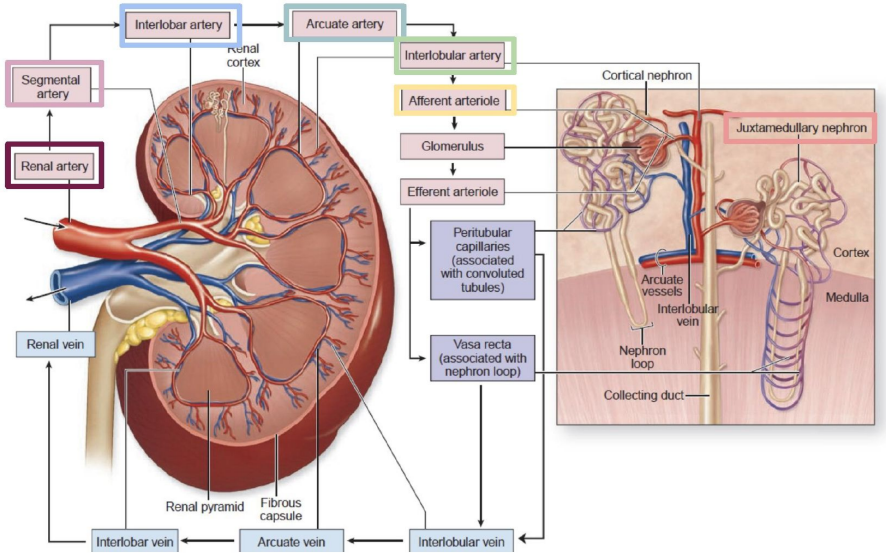
◇Interlobular artery gives off afferent glomerular arterioles.

◇ Each nephron is associated with **2** capillary beds:
The glomerulus & **The peritubular** capillary bed.
◇ The glomerulus is both fed and drained by arterioles:

1. The afferent arteriole,which arises from an interlobular artery, is the "feeder vessel"

2. the efferent arteriole receives blood that has passed through the glomerulus.

Renal arteries >>5 segmental arteries>>>lobar artery>>>interlobar arteries>>>arcuate arteries>>>interlobular arteries>>>afferent glomerular arterioles



Venous Drainage, Lymph Drainage and Nerve Supply

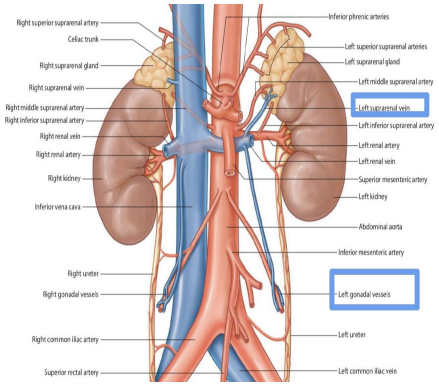
Venous Drainage

◇ Renal vein emerges from the hilum in front of the renal artery and drains into the IVC.
The Left renal vein enters the IVC a little above the R. vein.

◇**The LEFT renal vein**
1. It's (7.5cm) three times longer than the right (2.5 cm). So, for this reason the left kidney is the preferred side for live donor nephrectomy.

2. It's receives **the left gonadal** (enters the left renal vein from below) & **the left suprarenal** (enters the left renal vein from above) veins.

3. It runs from its origin in the renal hilum, **from left to right** behind: Splenic vein, Body of pancreas. Then it across anterior **the abdominal aorta**, just below the origin of **the superior mesenteric artery.**



◇ **The RIGHT renal vein** lies behind the 2nd part of the duodenum. Sometimes it lies behind the lateral part of the head of the pancreas.

Lymph Drainage

◇Lateral aortic lymph nodes around the origin of the renal artery

Nerve Supply

◇ Renal sympathetic plexus.

◇ The afferent fibers that travel through the renal plexus enter the spinal cord in the 10th, 11th, and 12th thoracic nerves.

MCQ

Q1: The left renal vein in relation to the splenic vein & pancreas is

A. Anterior
B. Posterior
C. Medial
D. Superior

Q2: Which organs are directly related to the kidney

A. Liver
B. Costodiaphragmatic recess
C. Lower 1\2 of muscles+upper 1\2 of diaphragm
D. Pancreas

Q3: Which one of the following drains into the left renal vein

A. Left gonadal vein
B. Inferior mesenteric vein
C. Superior mesenteric vein
D. Right gonadal vein

Q4: The renal sinus contains the upper expanded part of the ureter called

A. Renal papilla
B. Renal pelvis
C. Renal ureter
D. Renal urethra

Q5: Which one of the following is related to the left kidney from the posterior surface

A. 12th rib
B. 11th & 12th ribs, last intercostal space
C. Right colic flexure
D. Left colic flexure

Q6: What is the major organ that plays a role in excretion

A. Lung
B. Kidney
C. Skin
D. Bladder

answer key:
1: B
2: C
3: A
4: B
5: B
6: B

MCQ

Q7: One of the following is not a function of the kidney

A. Vitamin C activation
B. Vitamin D activation
C. Electrolyte balance
D. Acid base balance

Q8: Medulla is composed of

A. 13 renal pyramids
B. 12 renal pyramids
C. 23 renal pyramids
D. 22 renal pyramids

Q9: The renal papilla is

A. Apex of the cortex
B. Base of the cortex
C. Apex of the medulla
D. Apex of the pelvis

Q10: What is the structural unit of the kidney

A. Efferent
B. Afferent
C. Naphron
D. Nephron

Q11: Which of the following forms the anterior relation of the left kidney

A. Liver
B. Duodenum
C. Ascending colon
D. Stomach

Q12: Which of the following is the most anterior structure placed at the renal hilum

A. Renal vein
B. Renal artery
C. Ureter
D. Subcostal nerve

answer key:
7: A
8: B
9: C
10: D
11: D
12: A

SAQ :

1 : List the functions of the kidneys.

2 : List the structures that covers the kidney, and support it in position.

3 : There are 4 muscles related posteriorly to the kidney list them

4: Where does the lymph from the kidneys drain?

SAQ Answers :

1 : -Converts vitamin D to its active form.
-Maintain acid-base balance of the blood.
-Controls water & electrolyte balance of the body.
-Excretes most of the waste products of metabolism.

2 : -Perirenal (perinephric) fat.
-Renal fascia.
-Pararenal (paranephric) fat.

3 : Quadratus lumborum
Transversus abdominis
Diaphragm
Psoas major

4: Lateral aortic lymph nodes

Team leaders

Abdullah Alsubaihi

Abeer Awwad

Sub-leader

Ibrahim Alabdulkarim

Organizer

Shaden Alsaiedan

Team Members :

- Shayma Abdullah
- Sumo Abdulrahman
- Fatimah Saad
- Ghada Aljedaie
- Joud alnujaidi
- Osama Alharbi
- Nawaf Al-Shahrani
- Bader Alrayes
- Nawaf Alsaadi
- Mohammed Akresh

This lecture is done by :

Contact us:
Anatomy439@gmail.com