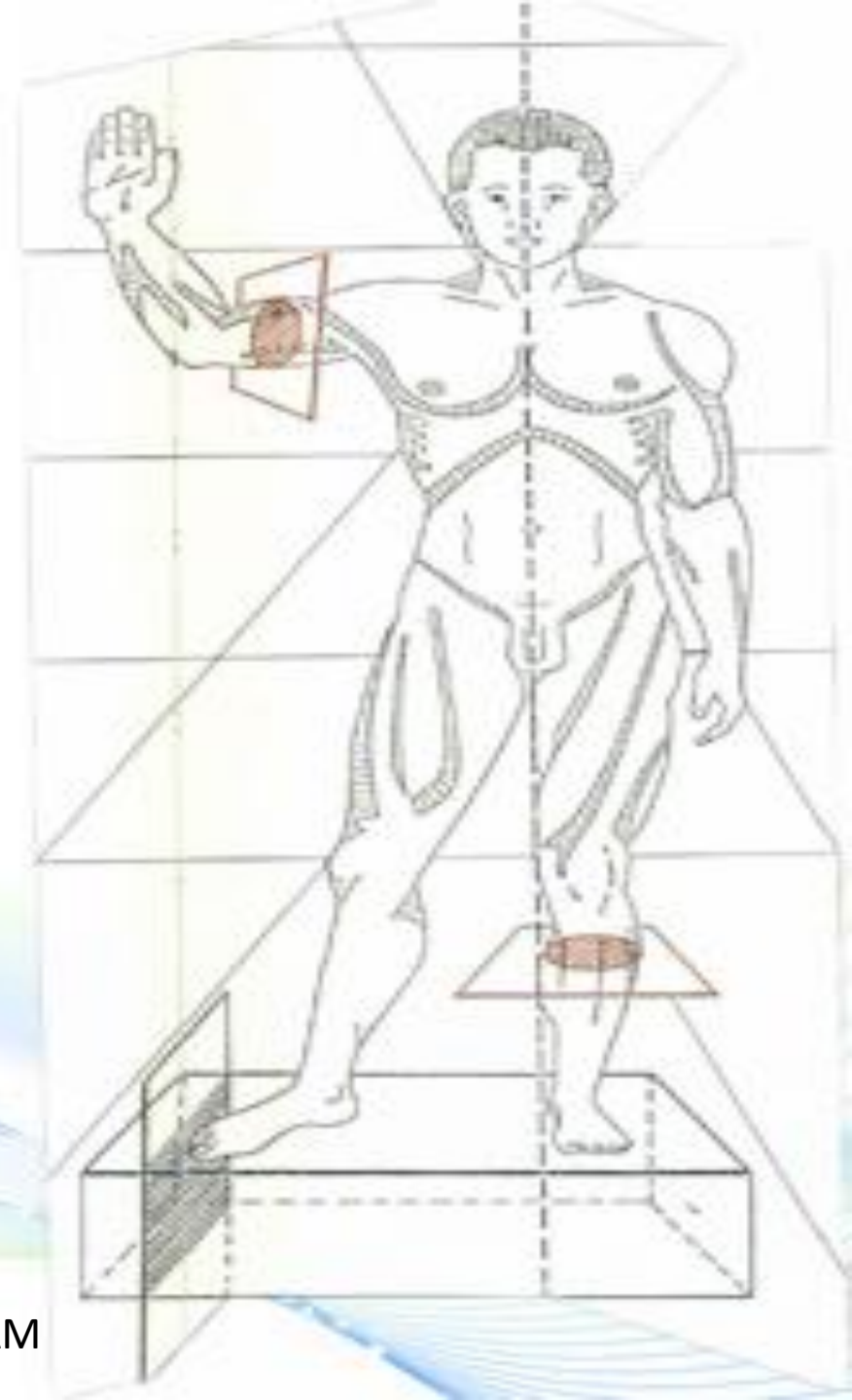
KIDNEYS



Pr. M.D.EL AMRANI Dr. BENTALEB OUSSAMA Dr. BIBORCHI HOUSSAM

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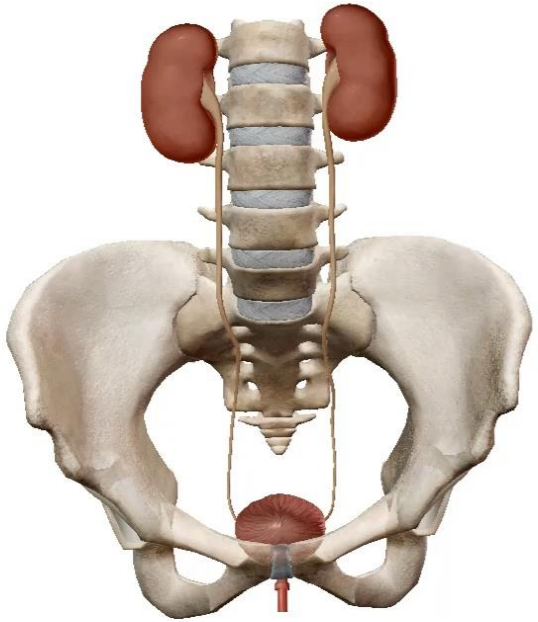
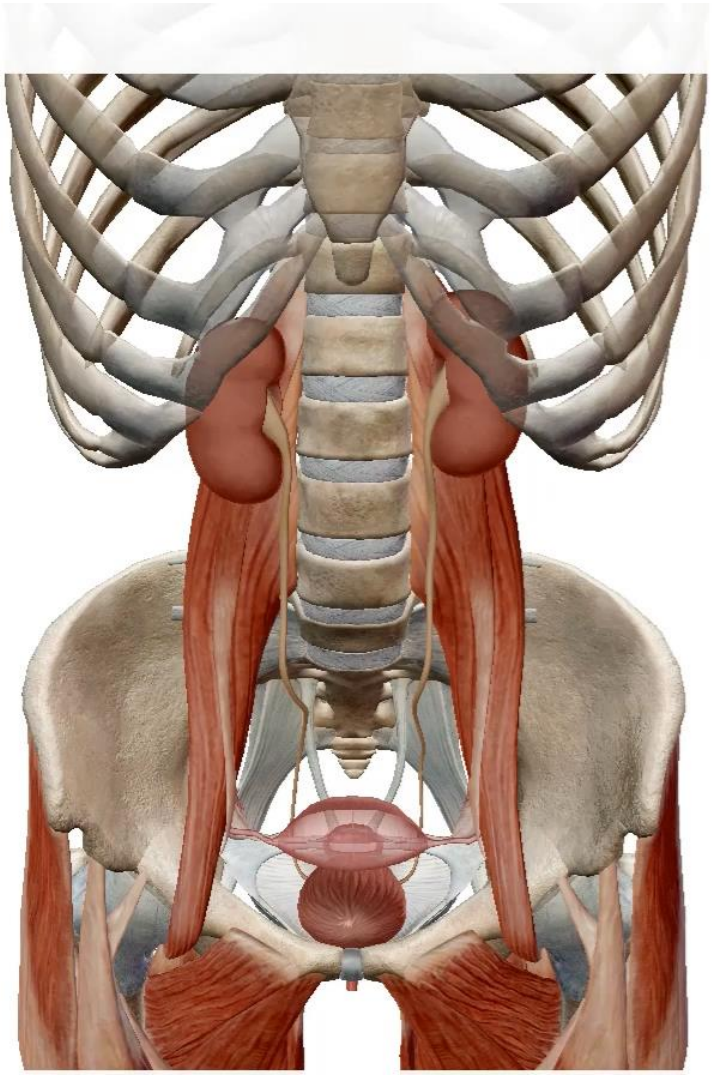


I. INTRODUCTION

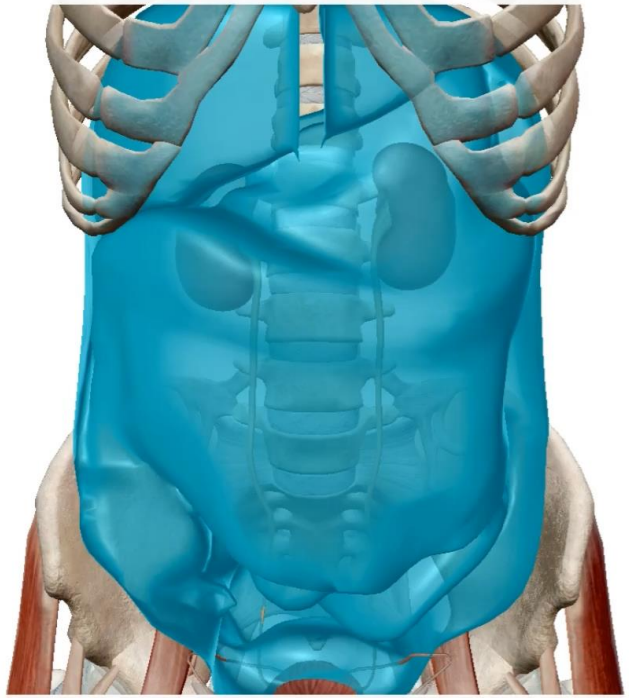
- Paired symmetrical heterocrine glands
- Retroperitoneal
- On each side of the dorsolumbar spine
- Endocrine function
- Exocrine function:
  - -Glomerular filtration
  - -Urine secretion
  - -Hydro-electrolyte and acid-base homeostasis
- Numerous anatomical variations

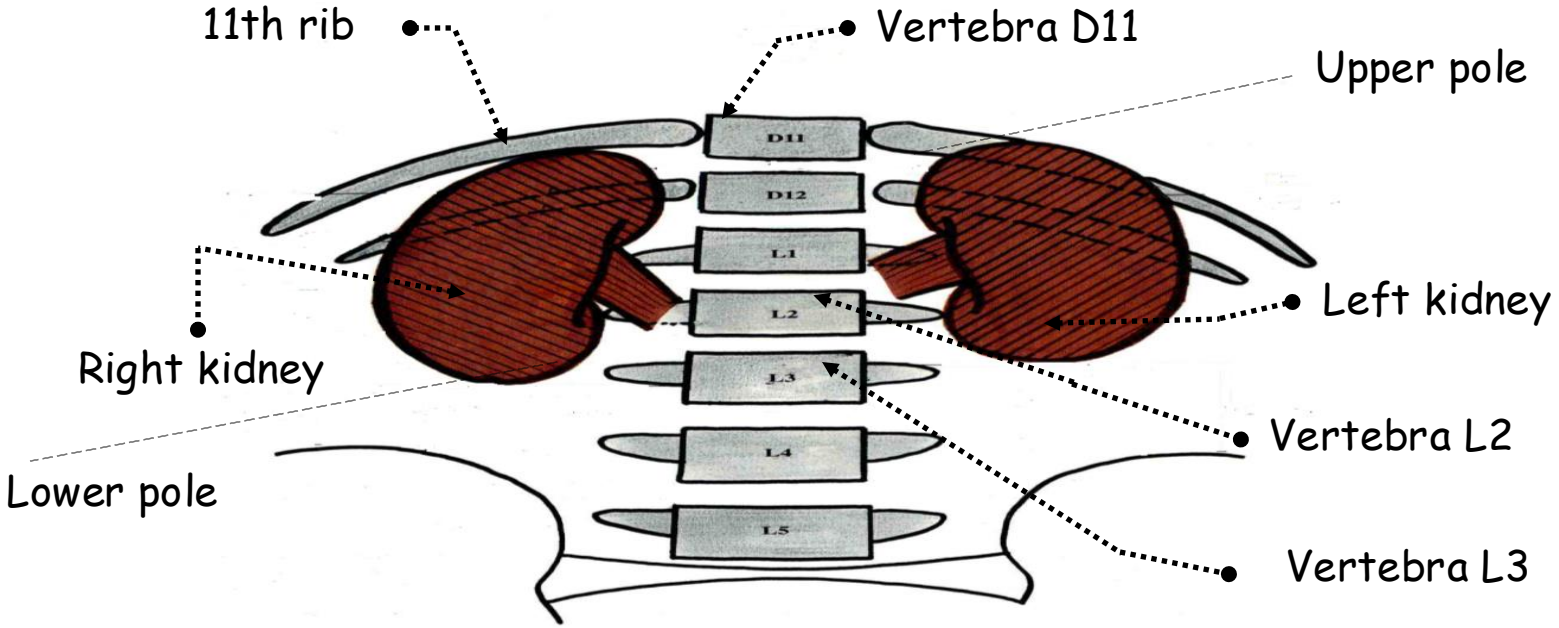


II. DESCRIPTIVE ANATOMY

A. SITUATION

- Lie high up on the posterior abdominal wall behind the peritoneum, largely under cover of the costal margin : lumbar fossa
- Each kidney lies obliquely parallel with the lateral border of psoas major
- The hilum faces somewhat forwards as well as medially
- Its vascular pedicle it lies well back in the paravertebral gutter
- The upper pole of the left kidney may overlie the eleventh rib
- The bulk of the right lobe of the liver accounts for the lower position of the right kidney

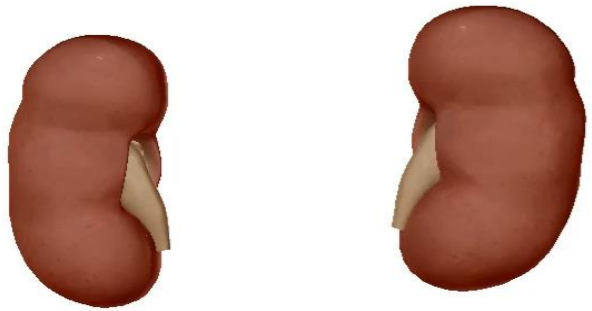


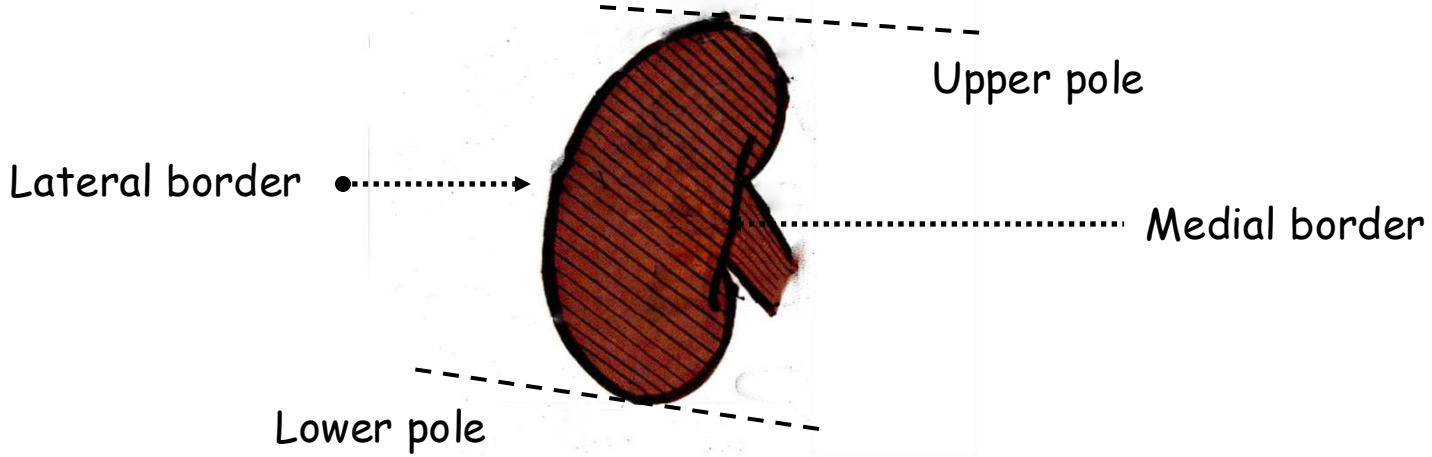


ANTERIOR VIEW OF THE KIDNEYS SHOWING THEIR SITUATION

B. SHAPE

- Bean-shaped
- Flattened anteroposteriorly
- Long oblique axis downwards and outwards parallel to the lateral border of psoas major
- **2 faces:** anterior and posterior convex
- **2 borders:**
  - -Lateral: convex
  - -Medial: vertical slit-like depression transmitting the renal vessels and nerves and the renal pelvis, the hilum
- **2 poles:**
  - -Upper: suprarenal gland
  - -Lower
- Capsule: glistening appearance
- Dark red coloured
- Consistency: smooth with traces of lobulation





ANTERIOR VIEW OF THE RIGHT KIDNEY

C. DIMENSIONS

- **Normal kidney:**

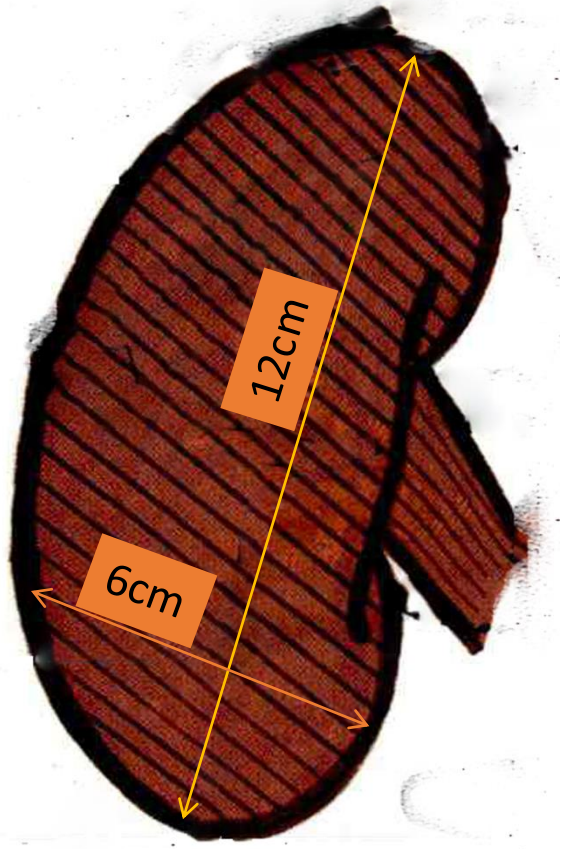
  -Length: 12 cm

  -Width: 6 cm

  -Thickness: 3 cm

  -Weigth: 130 g

- Each kidney moves in a vertical range of 2 cm during full respiratory excursion of the diaphragm



ANTERIOR VIEW OF THE RIGHT KIDNEY

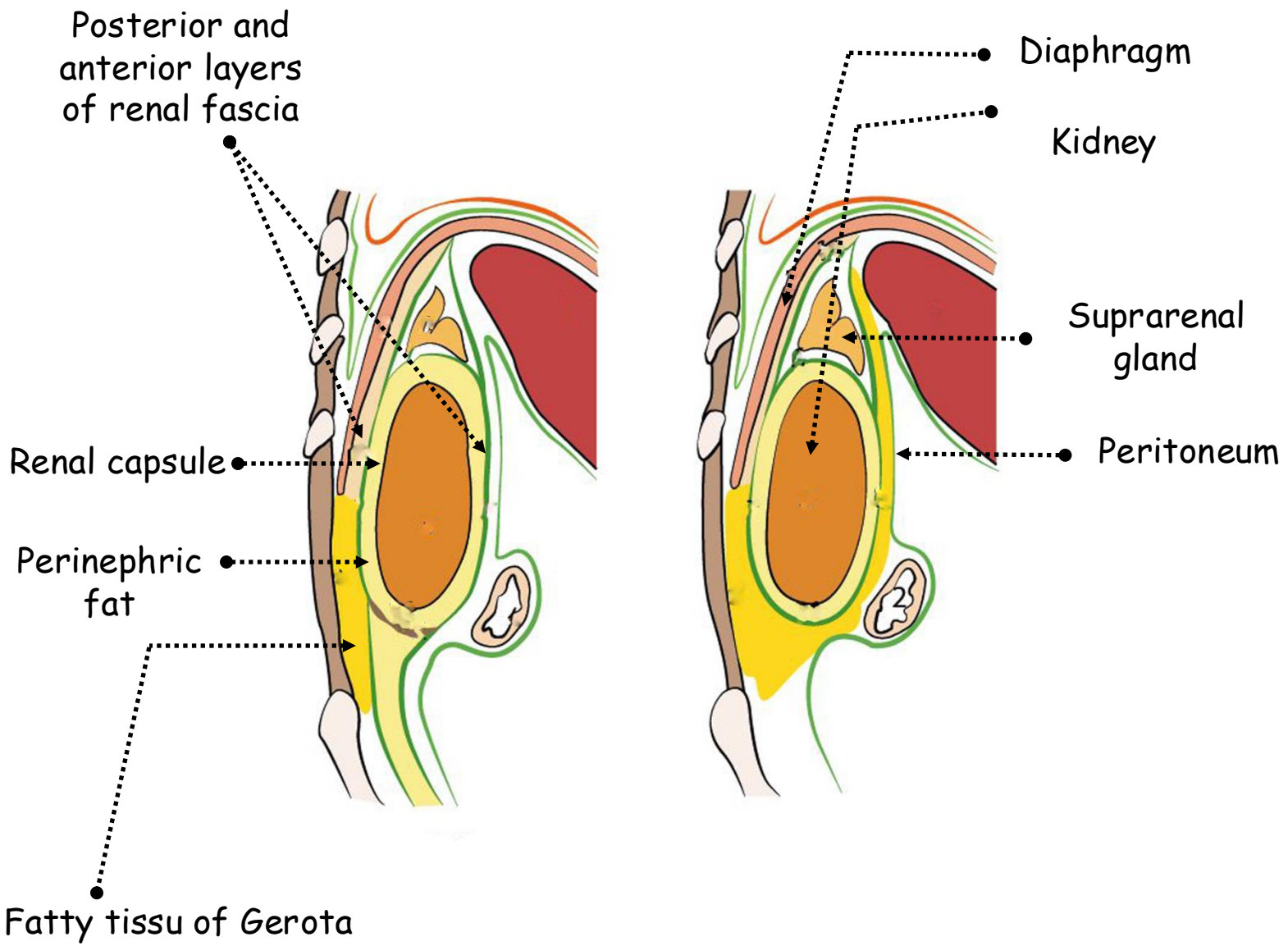
D. SUPPORTS

1. Perinephric fat:

- Lies outside the renal capsule
- More solid consistency than the general body fat
- Shape of an inverted cone
- Fills the funnel-shaped hollow of the suprailiac part of the paravertebral gutter
- Plays a part in retaining the kidney in position

2. Renal fascia of Gerota:

- Surrounds the perinephric fat and separates the kidney from the suprarenal gland
- Condensation of the areolar tissue between the parietal peritoneum and the posterior abdominal wall
- Attached to the renal vessels and the ureter at the hilum
- Ascends as a dome between the upper pole of the kidney and the suprarenal and to the diaphragmatic fascia
- Complete though weak downwards



SAGITTAL SECTION SHOWING THE RENAL COMPARTMENT

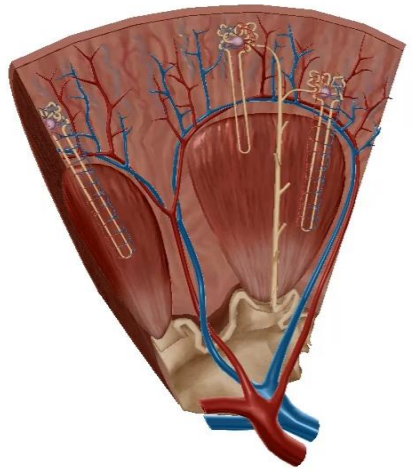
E. CALYCES

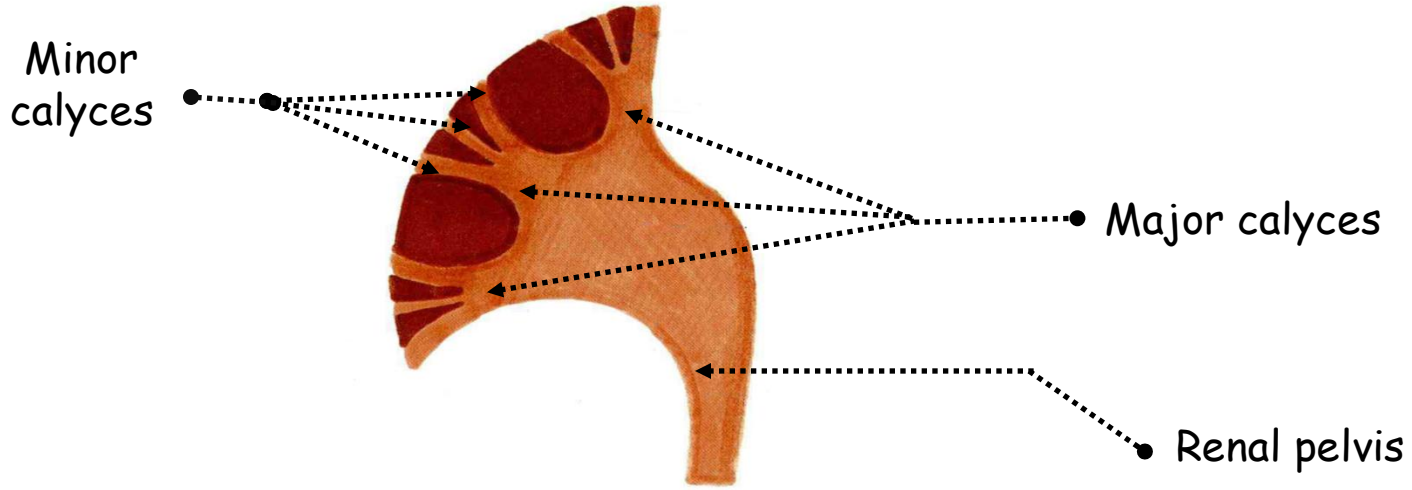
1. Minor calyces:

- 9-12 little funnels
- Projection of one renal papilla
- Commencement of major calyx

2. Major calyces:

- **3 medium funnels:** superior, middle and inferior
- 1 major calyx/renal pole
- Projection of 3-4 minor calyces
- Commencement of renal pelvis

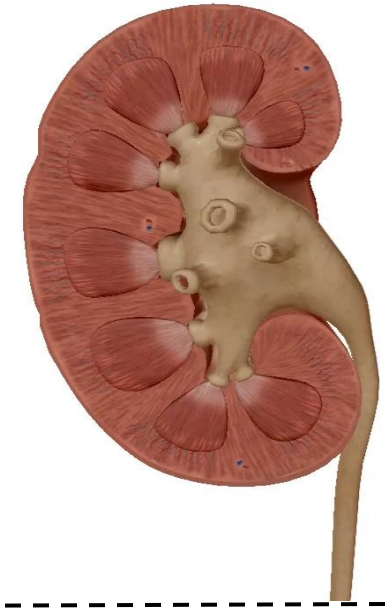


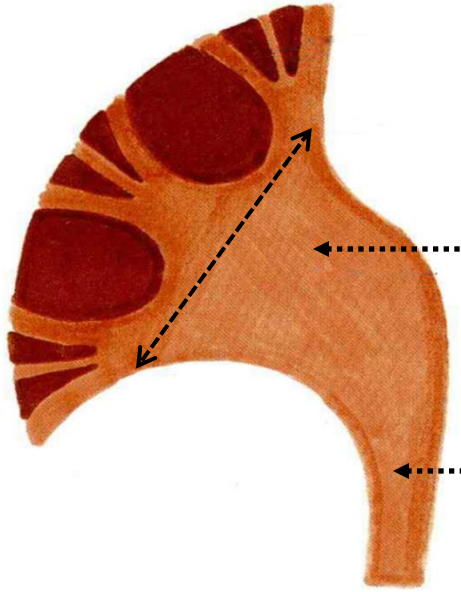


SAGITTAL SECTION OF THE KIDNEY SHOWING MINOR AND MAJOR CALYCES

F. RENAL PELVIS

- Funnel-shaped and flattened
- Muscular
- Most posterior of the three main structures in the hilum
- Its upper and lower extremities receive two or three major calyces
- Commencement of the ureter
- The capacity of the average pelvis is less than 5 ml
- Its base measures 2.5 cm





SAGITTAL SECTION OF THE KIDNEY SHOWING MINOR AND MAJOR CALYCES

III. STRUCTURE

A. RENAL CAPSULE

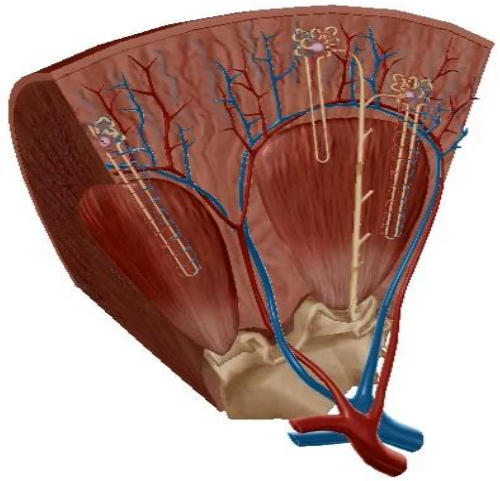
- Reflects to line the renal pelvis
- Continuous with minor calyx
- Made of smooth muscle and elastic connective tissu

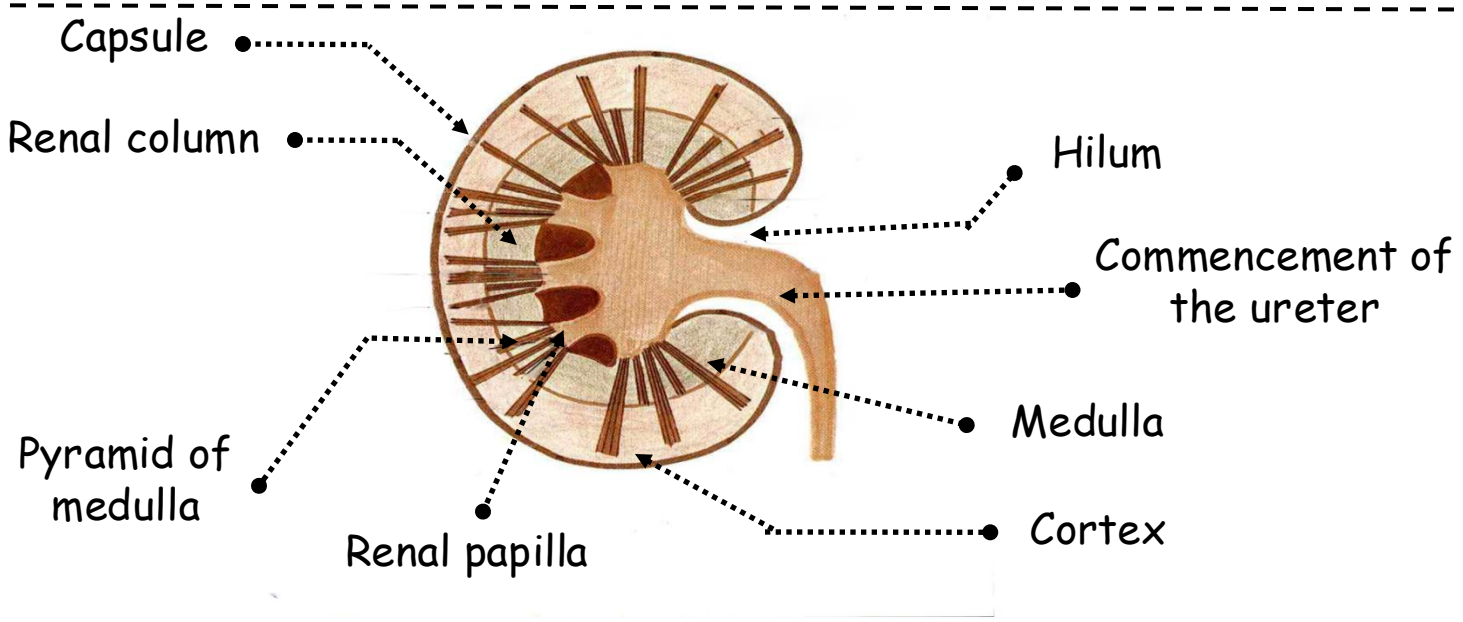
B. CORTEX

- Beneath the capsule
- Dark reddish
- Extends towards the pelvis across the medulla as the renal columns

C. MEDULLA

- Darker and triangular striated areas
- Pyramids of the medulla
- The apices of several pyramids open together into a renal papilla, each of which projects into a minor calyx





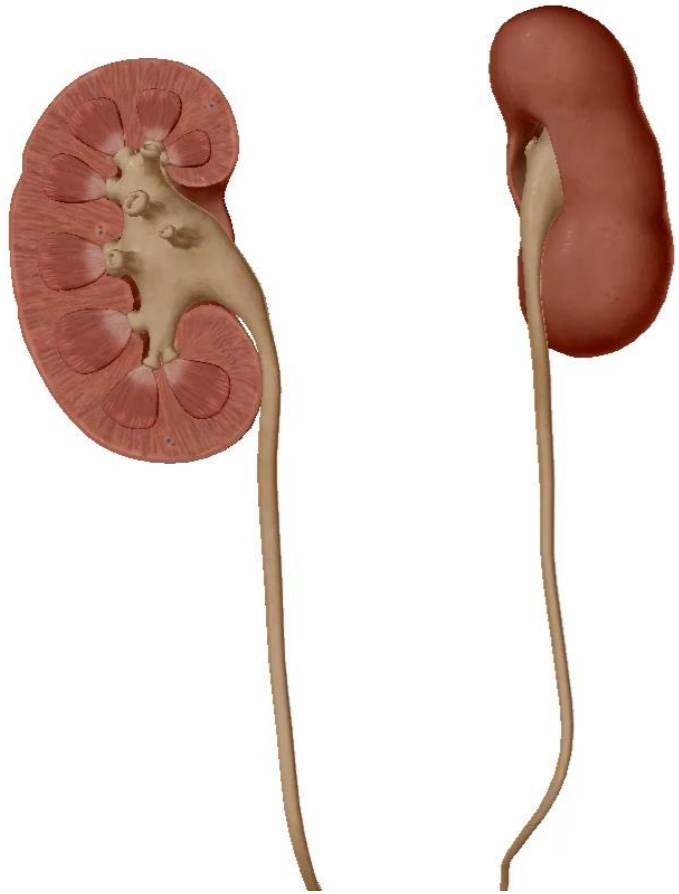
CORONAL SECTION SHOWING THE STRUCTURE OF KIDNEY

D. NEPHRON

- Histological and functional unit of the kidney
- About 1 million in each kidney
- Each nephron consists of a glomerulus and a tubule system

1. Glomerulus:

- Tuft of capillaries surrounded by very thin epithelial cells, the podocytes
- Continuous with that forming the boundary of Bowman's capsule and of the tubule system
- The whole forming a mass which projects into a rounded capsule of Bowman
- Cortex
- Supplied by an afferent arteriole, and leaving them is an efferent arteriole which breaks up into peritubular capillaries surrounding the proximal and distal convouted tubules
- Glomerular filtration

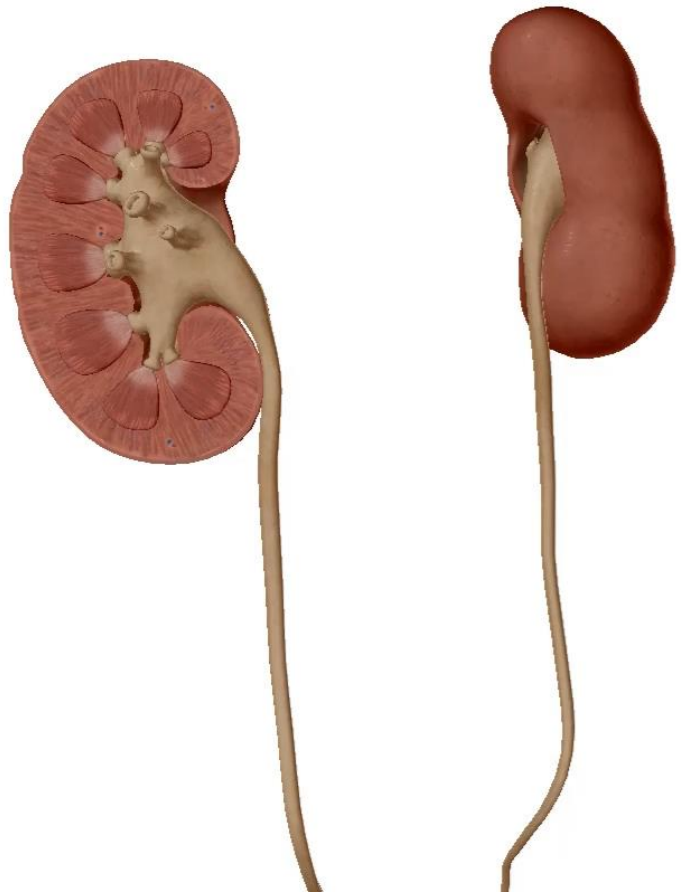


2. Tubule system:

- The part of the tubule adjacent to Bowman's capsule is the proximal convoluted tubule
- Leads into the thin walled loop of Henle and so to the distal convoluted tubule and finally to the collecting tubule and collecting duct
- Convoluted tubules: cortex
- Loop of Henle, collecting tubule and duct: medulla
- The collecting ducts unite with one another, and the largest open at the tip of a renal papilla in a minor calyx
- Modification by selective absorption and secretion

3. Juxtaglomerular apparatus

- Certain arteriolar cells and distal convoluted tubule cells constitute the juxtaglomerular (JG) apparatus
- Arteriolar JG cells of the tunica media secrete renin



IV. ANATOMICAL RELATIONS

A. POSTERIOR RELATIONS

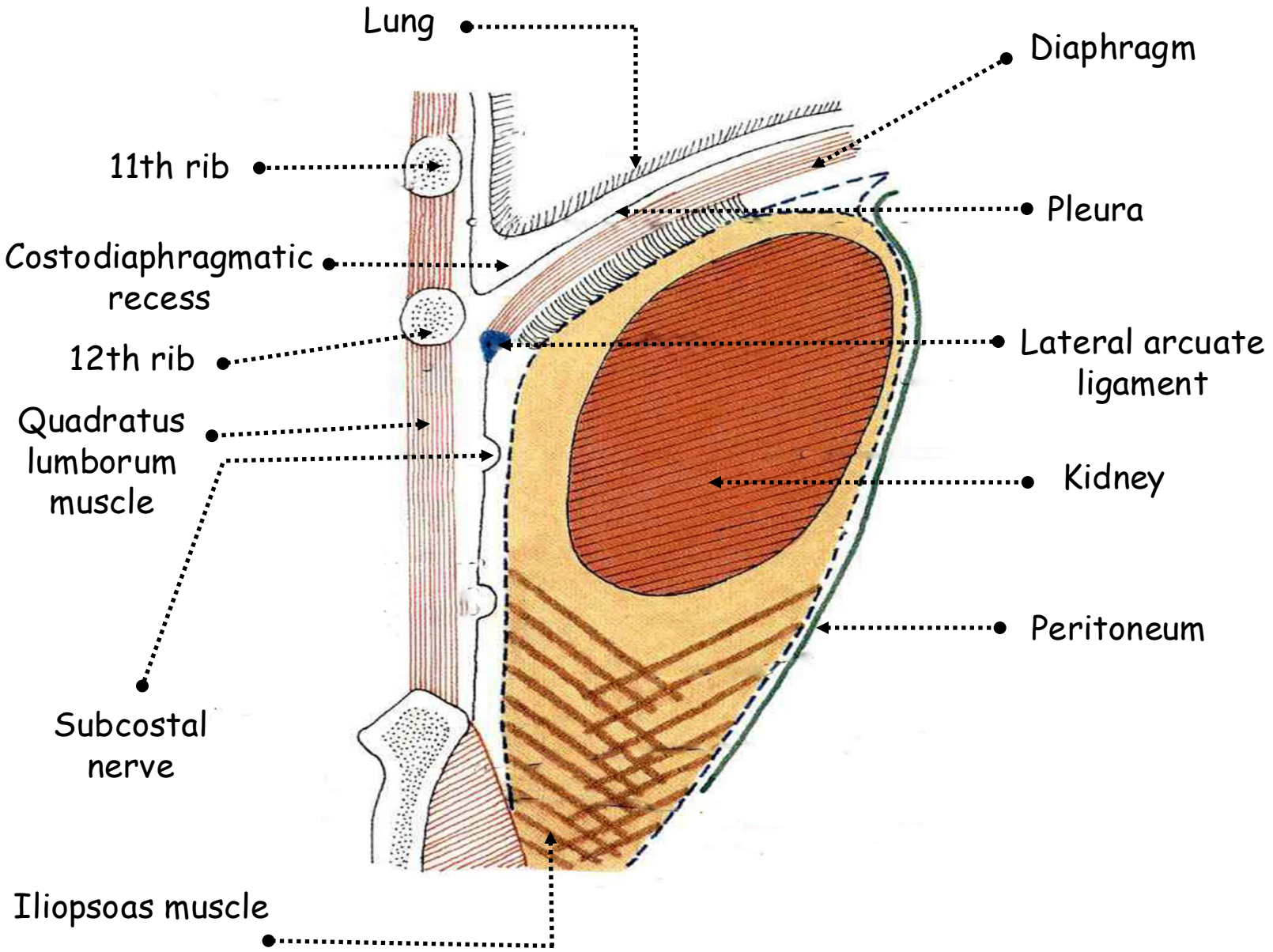
- Similar
- Arranged in two levels

1. Thoracic level:

- Fibres of the diaphragm which arise from the lateral and medial arcuate ligaments
- Costodiaphragmatic recess of the pleura
- 11th and 12th ribs
- The subcostal vein, artery and nerve beneath the lateral arcuate ligament

2. Lumbar level:

- Psoas major muscle and the iliohypogastric and ilioinguinal nerves as they emerge from its lateral border
- Quadratus lumborum muscle and the upper lumbar arteries and veins behind
- Transversus abdominis muscle



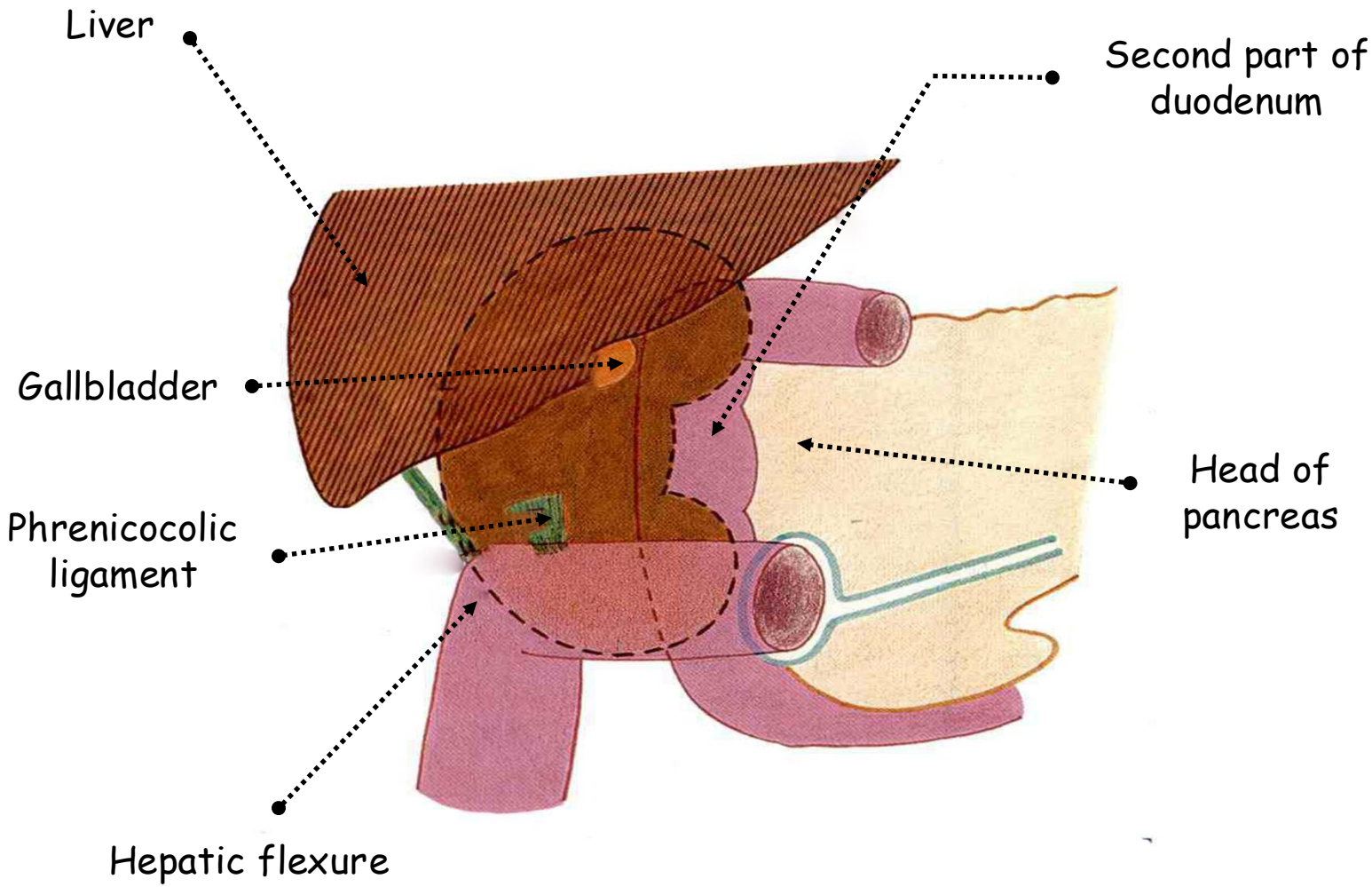
SAGITTAL SECTION SHOWING THE POSTERIOR ANATOMICAL RELATIONS OF KIDNEY

B. ANTERIOR RELATIONS

- More symmetrical than appears at first sight
- Through the peritoneum of the posterior abdominal wall

1. Right kidney:

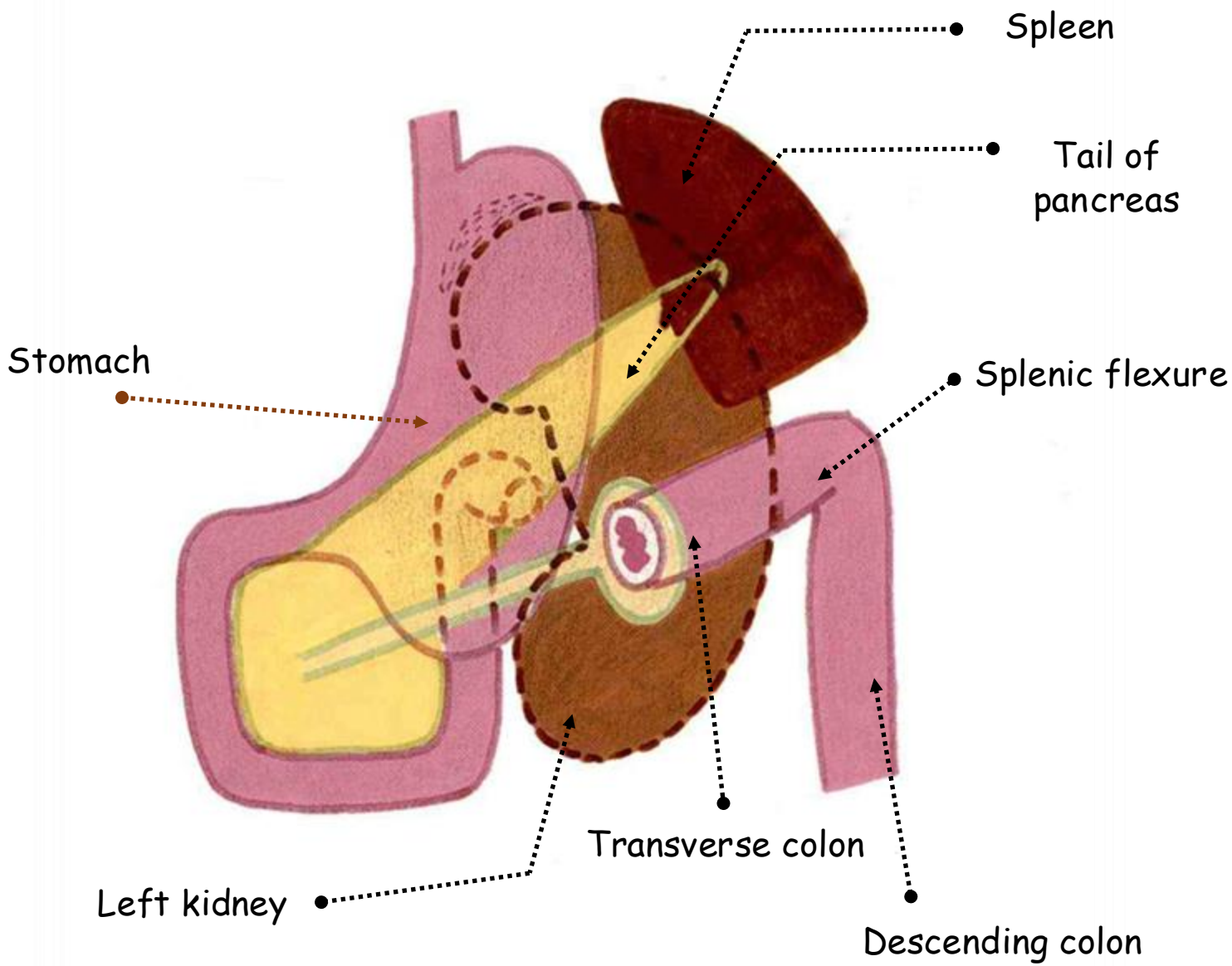
- Under surface of the liver and the hepatorenal pouch
- The second part of the duodenum
- Hepatic flexure and phrenicocolic ligament
- Jejunal coils
- Ascending branch of right colic artery



ANTERIOR VIEW OF THE RIGHT HYPOCHONDRIUM SHOWING THE ANTERIOR ANATOMICAL RELATIONS OF THE RIGHT KIDNEY

2. Left kidney:

- The tail of the pancreas
- Splenic flexure
- Jejunal coils
- Ascending branch of left colic artery
- Spleen
- Lesser sac and lienorenal ligament
- Stomach



ANTERIOR VIEW OF THE LEFT HYPOCHONDRIUM SHOWING THE ANTERIOR ANATOMICAL RELATIONS OF THE LEFT KIDNEY

C. HILUM

- Lies over psoas
- Right: inferior vena cava
- Left: left suprarenal gland and the peritoneum of the posterior wall of the lesser sac

D. LATERAL BORDER

- Aponeurosis of origin of transversus abdominis

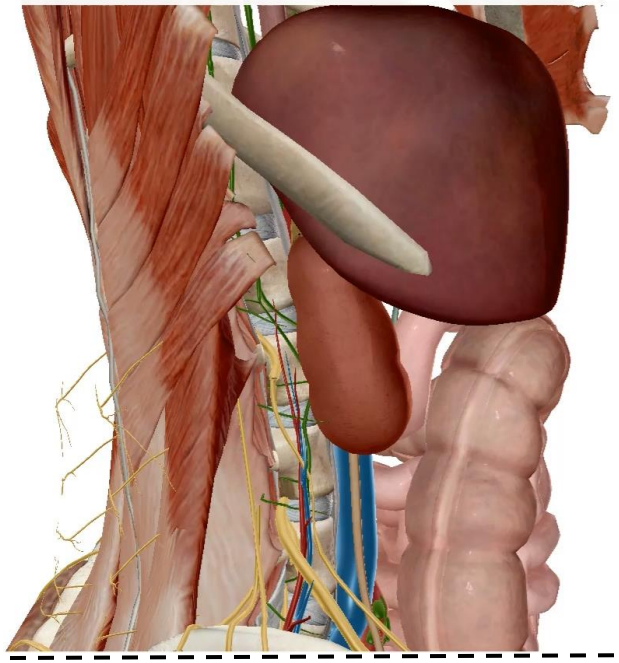
E. UPPER POLE

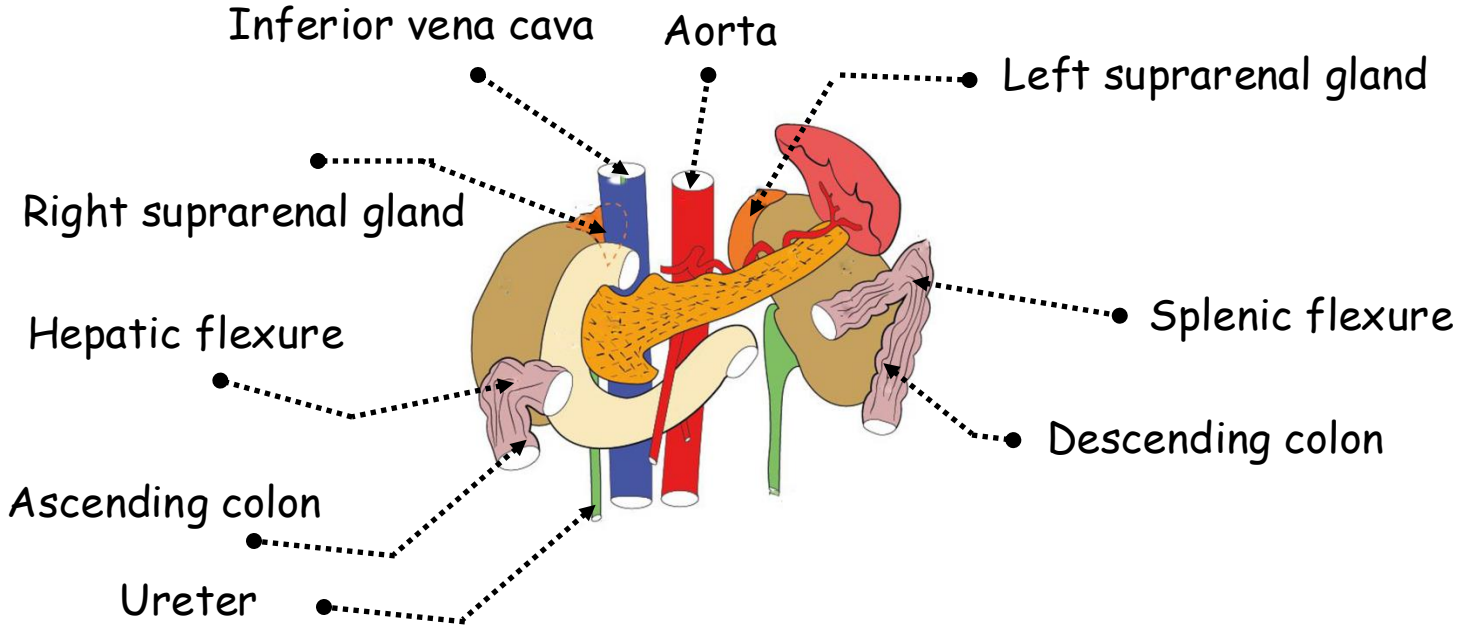
- **Right:** right suprarenal gland, inferior vena cava and the bare area of the liver forwards

F. LOWER POLE

- Iliac crest

G. RENAL PELVIS



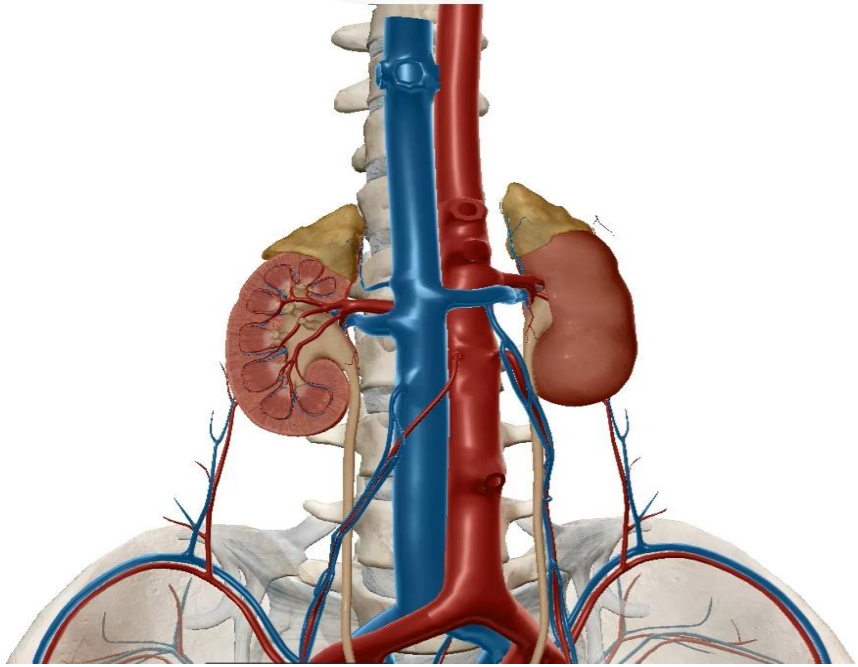


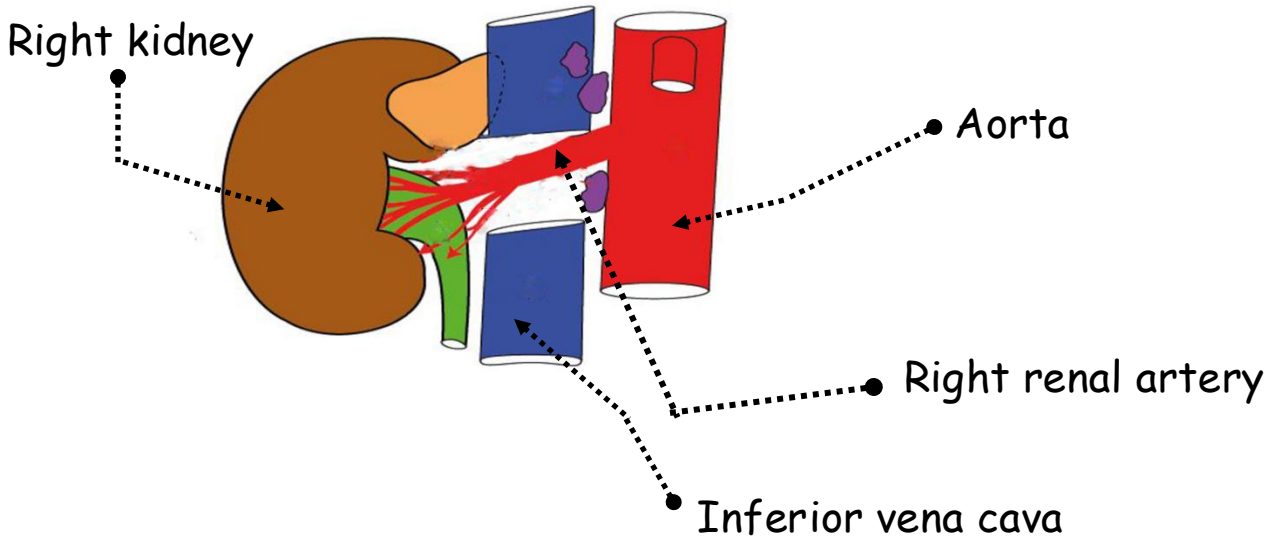
ANTERIOR VIEW SHOWING THE ANATOMICAL RELATIONS OF KIDNEYS

V. BLOOD SUPPLY; LYMPH DRAINAGE AND NERVE SUPPLY

A. ARTERIES

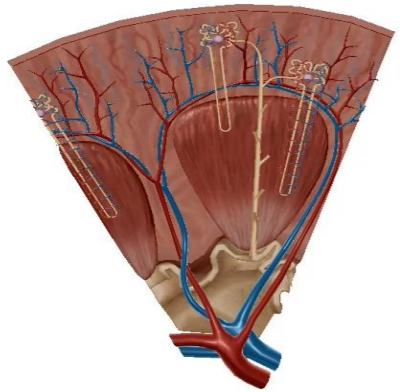
- Renal arteries
- Large vessels arising at right angles from the aorta at the level of L2 vertebra
- **Left artery:**
  - -Shorter than the right
  - -Crosses the left crus of diaphragm and psoas
  - -Behind and above the left renal vein
  - -Covered by the tail of the pancreas and the splenic vessels
- **Right artery:**
  - -Longer
  - -Crosses the right crus and psoas behind the inferior vena cava, the short right renal vein, the head of pancreas, bile duct and the second part of the duodenum

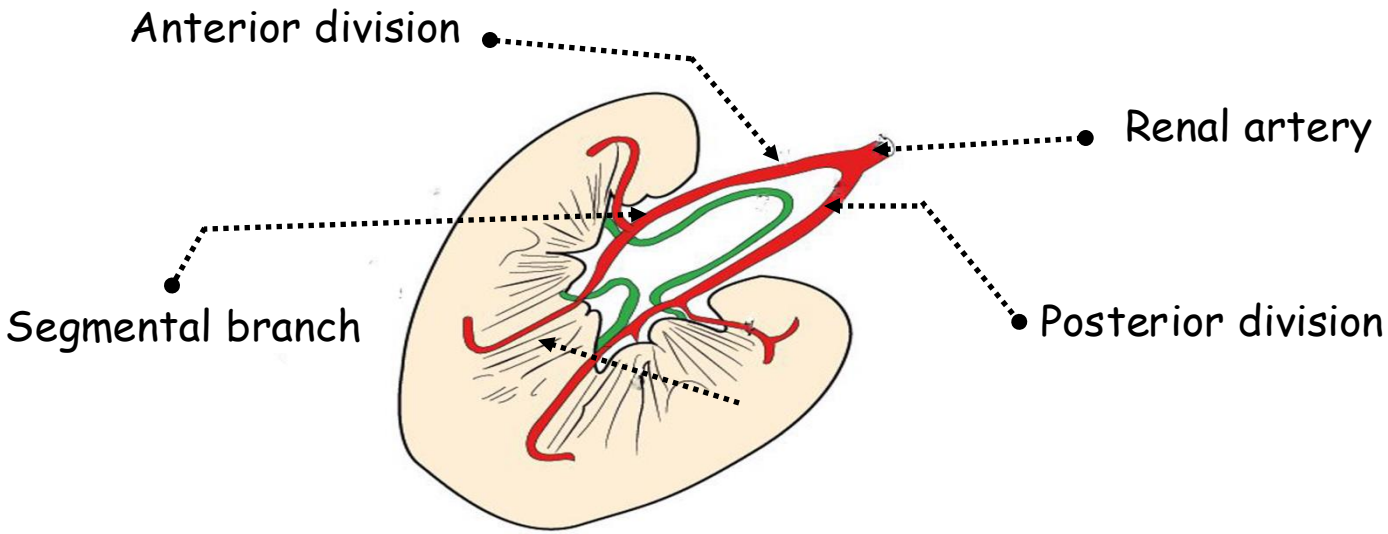




ANTERIOR VIEW SHOWING THE RIGHT RENAL ARTERY

- In the region of the hilum the artery typically gives rise to an anterior and a posterior division
- The posterior division supplies the posterior segment
- The anterior division gives branches that supply the apical, upper, middle and lower segments
- Based on its blood supply, each kidney possesses five segments
- The standard pattern is frequently modified by the way the vessels branch
- There are always five segments with no collateral circulation between them

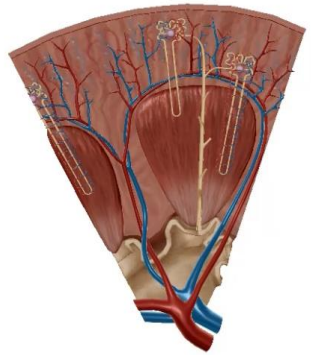


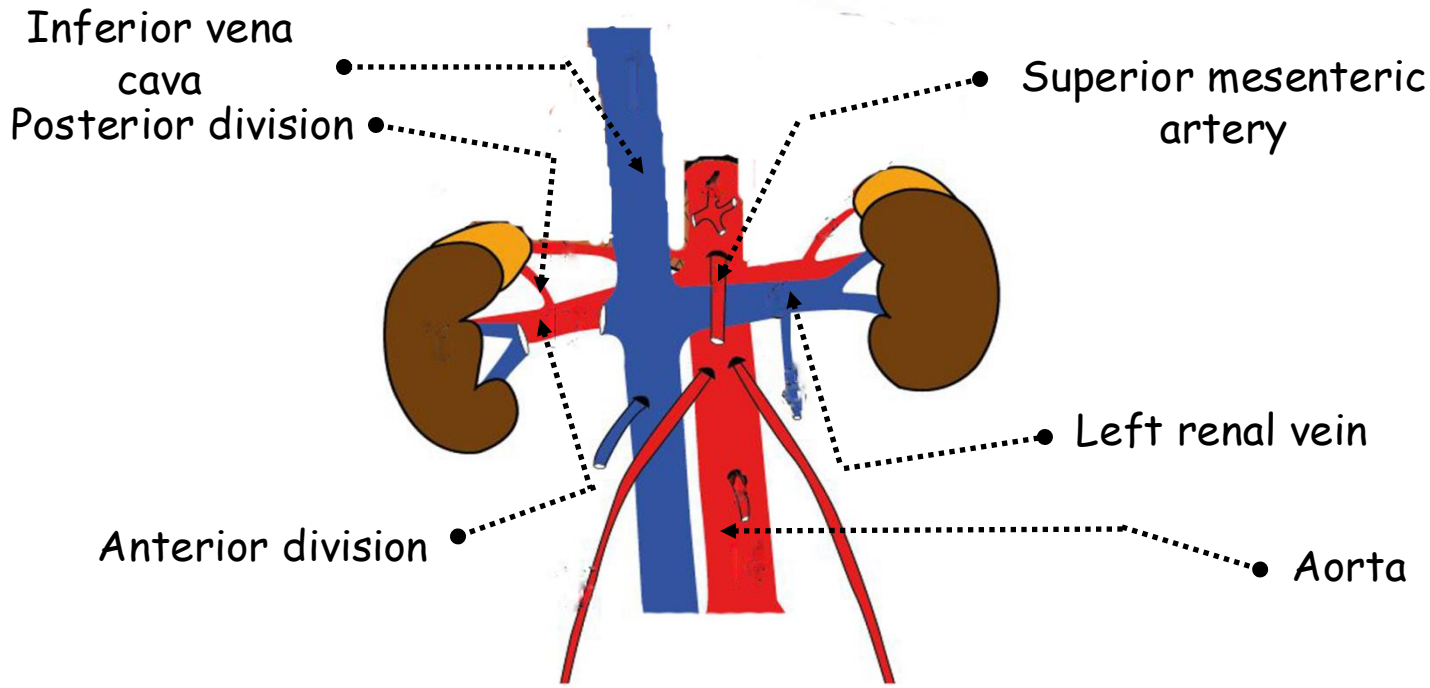


HORIZONTAL SECTION OF THE KIDNEY SHOWING THE HILUM

B. VEINS

- Veins from the renal segments communicate with one another profusely
- Form five or six vessels that unite at the hilum to form the single renal vein
- Lie in front of the renal arteries and behind the pancreas
- In length and in territory drained the two veins are very different
- **Left vein:**
  - -Three times as long as the right
  - -7.5 cm long
  - -Crosses in front of the aorta
  - -Receives the left suprarenal vein, left gonadal vein, left inferior phrenic vein and is connected with left ascending lumbar and lumbar azygos veins and hence with azygos and vertebral systems





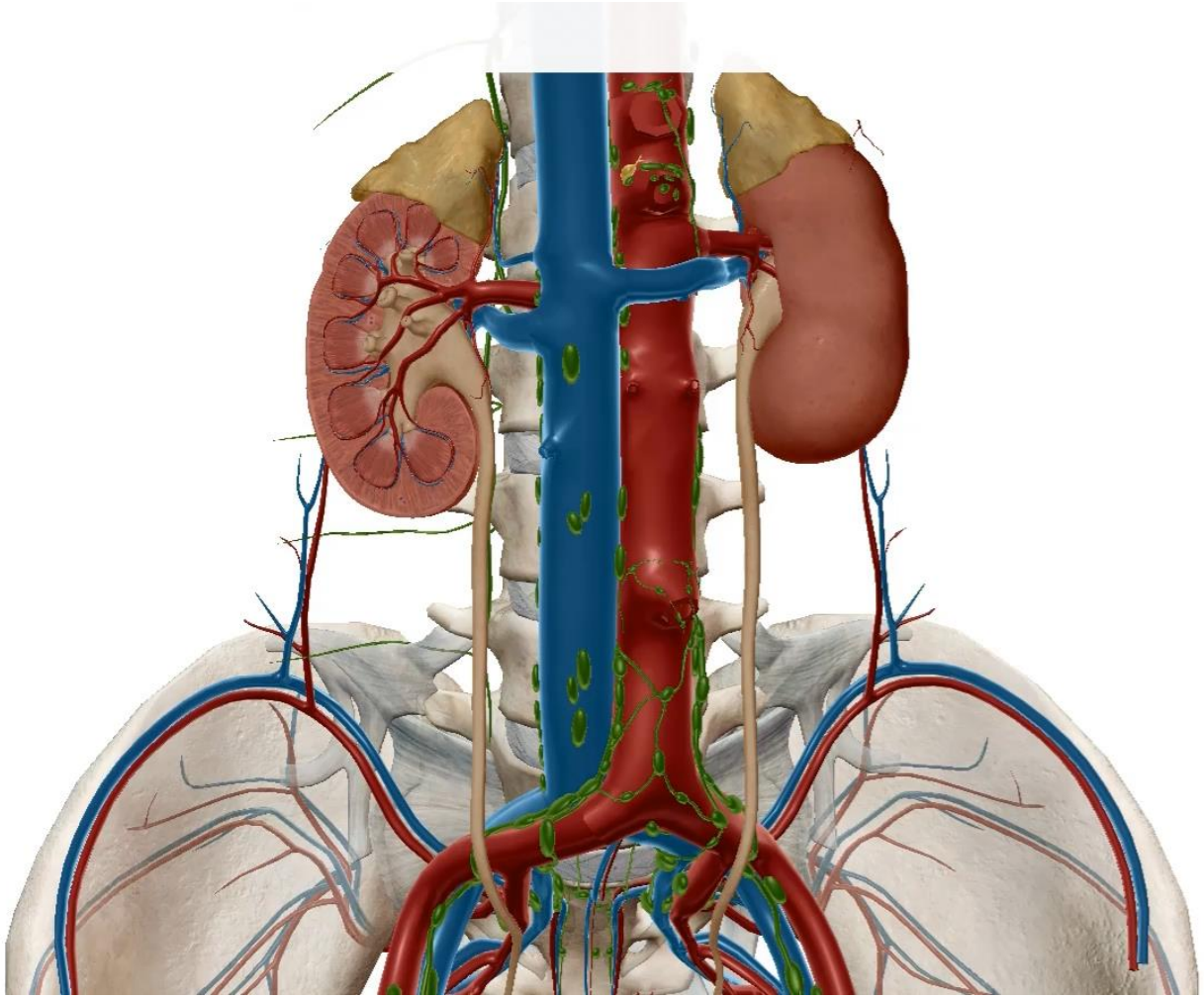
ANTERIOR VIEW SHOWING ARTERIES AND VEINS OF KIDNEYS

- **Right vein:**

  -Drains only its own kidney

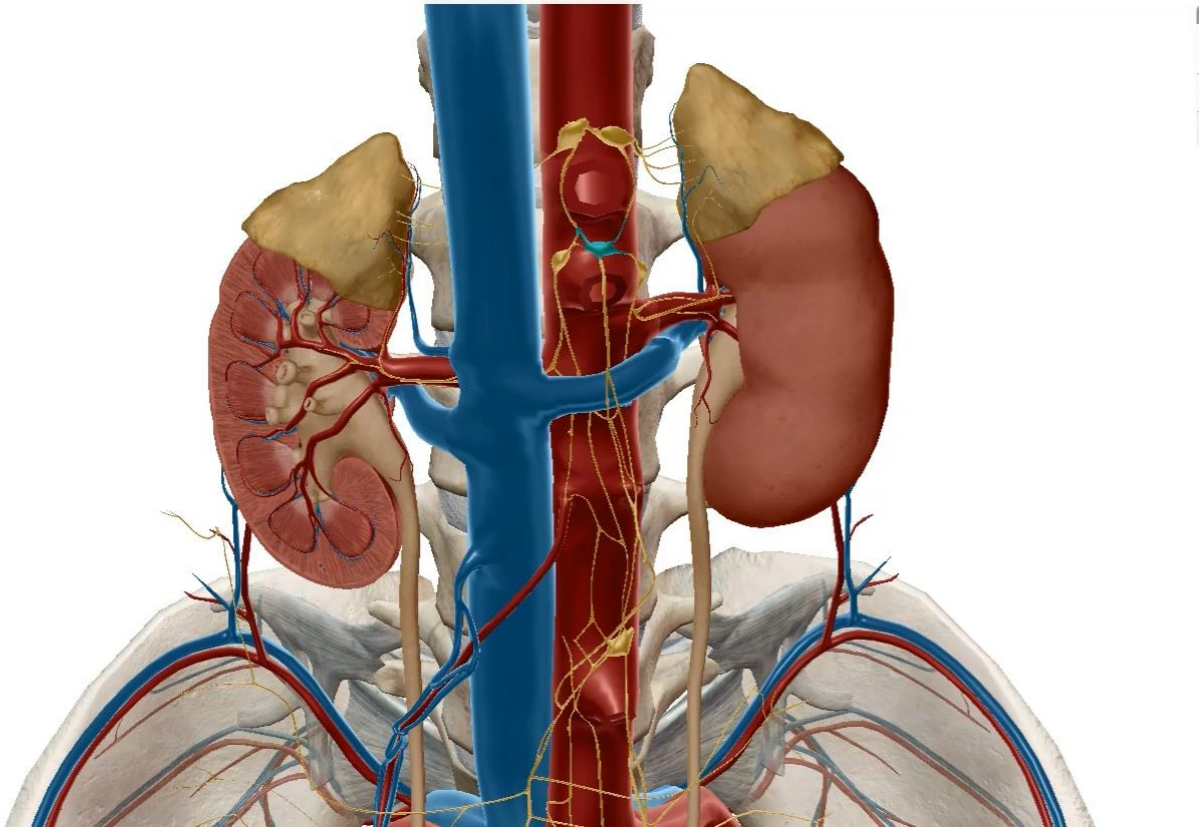
C. LYMPH DRAINAGE

- Para-aortic nodes at the level of origin of the renal arteries
- The surface of the upper pole may drain through the diaphragm into nodes in the posterior mediastinum



D. NERVES

- **Sympathetic:**
  - -Preganglionic cells lie in the spinal cord from T12 to L1 segments and they send preganglionic fibres to the thoracic and lumbar splanchnic nerves
  - - Postganglionic cells are in the coeliac, renal and superior hypogastric plexuses and, for the least splanchnic nerve, in the renal ganglion in the hilum of the kidney
  - -Vasomotor function
- **Parasypathetic:**
  - -Vagus

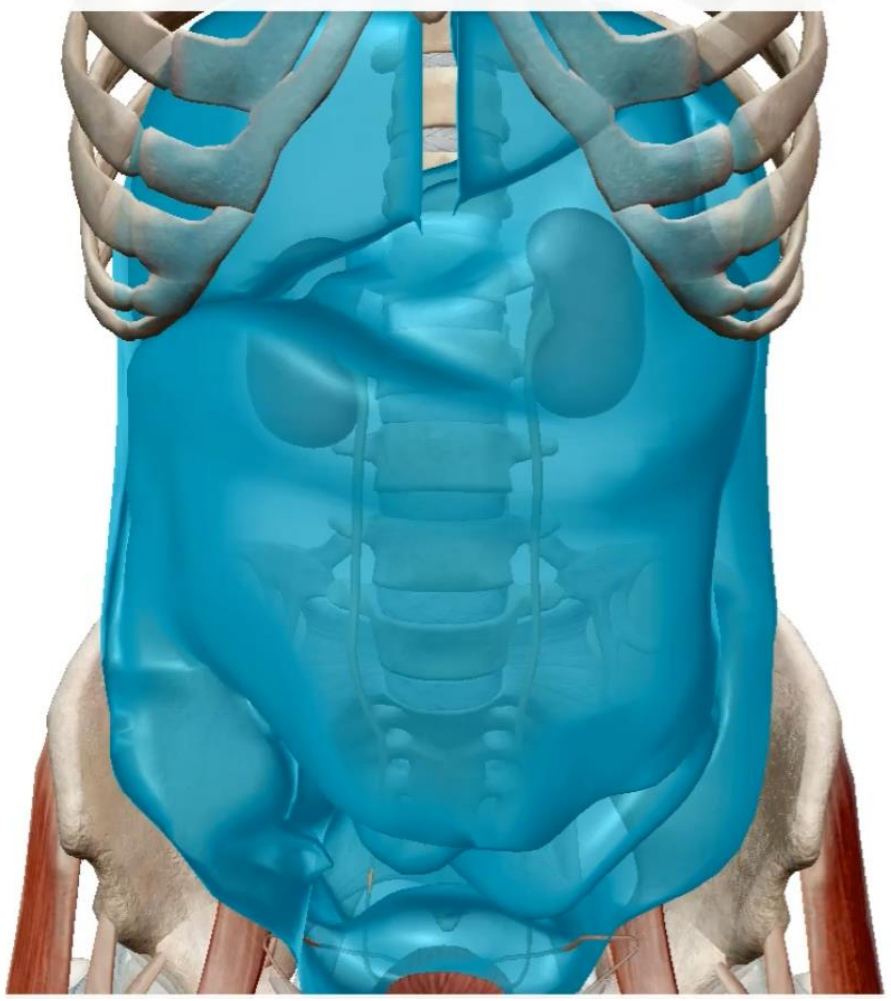


VI. SURGICAL APPROACH

- **Nephrectomy or nephrolithotomy:**
  - -Removal of kidney or removal of stones
  - -Lumbar approach
- **Percutaneous renal biopsy:**
  - -2.5 cm below the twelfth rib and at a distance from the midline determined radiologically
  - -Holding the breath so that the kidney is not torn by respiratory movement
- **Transplantation:**
  - -Iliac approach

VII. CONCLUSION

- Paired heterocrine glands
- Retroperitoneal and paravertebral
- Important to life
- Cortex and medulla
- Secrete different hormones
- Several anatomical relations
- Rich terminal blood supply
- Nerves mainly provided from the splanchnic nerves
- Lymph drainage is ensured by the para-aortic nodes

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