THE KIDNEYS

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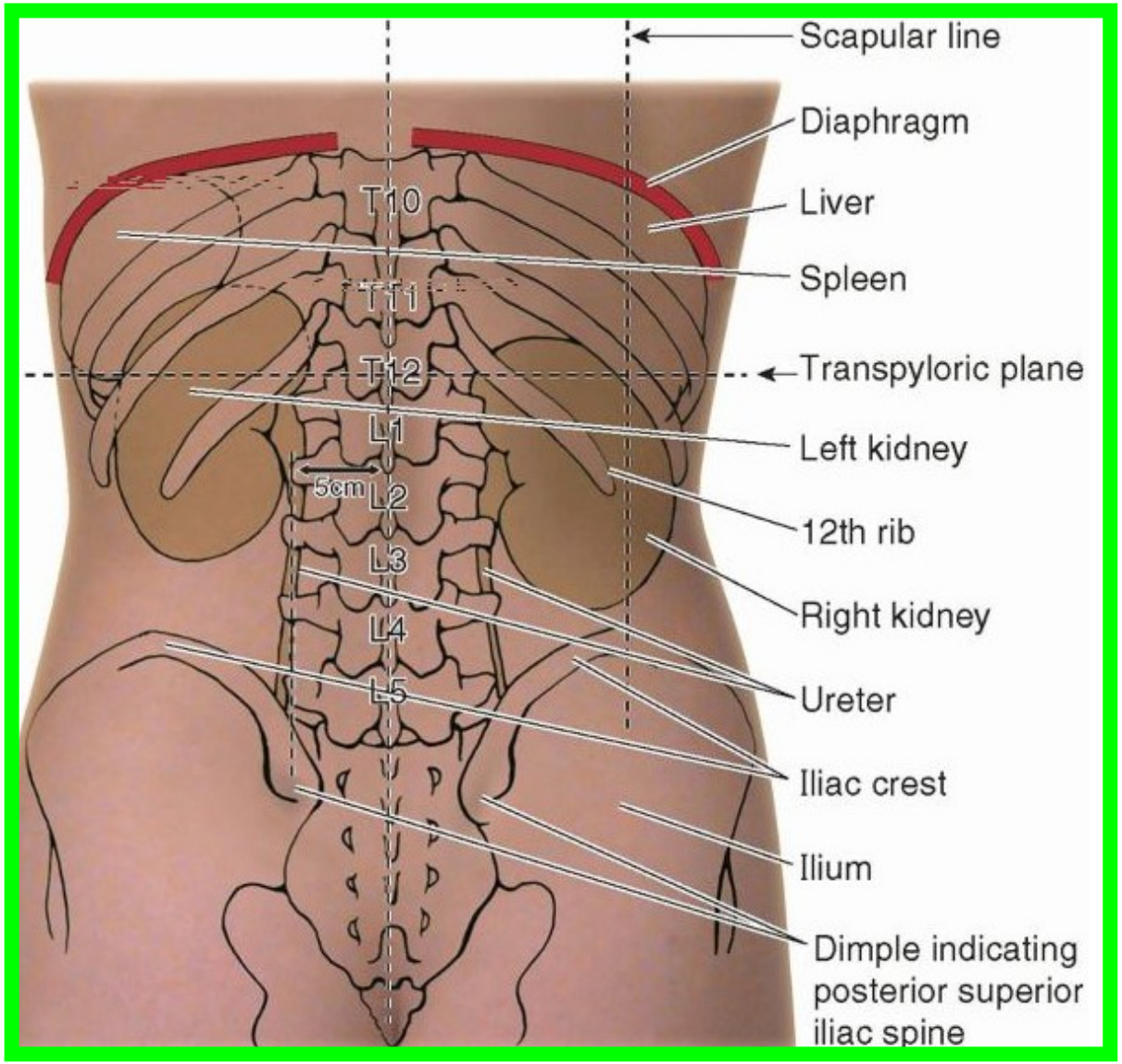
2024-2025

Monday 28 April 2025

KIDNEYS

The ovoid kidneys remove excess water, salts, and wastes of protein metabolism from the blood while returning nutrients and chemicals to the blood.

❖They lie retroperitoneally on the posterior abdominal wall, one on each side of the vertebral column at the level of the T11-L3 vertebrae



❖They are largely under cover of the costal margin

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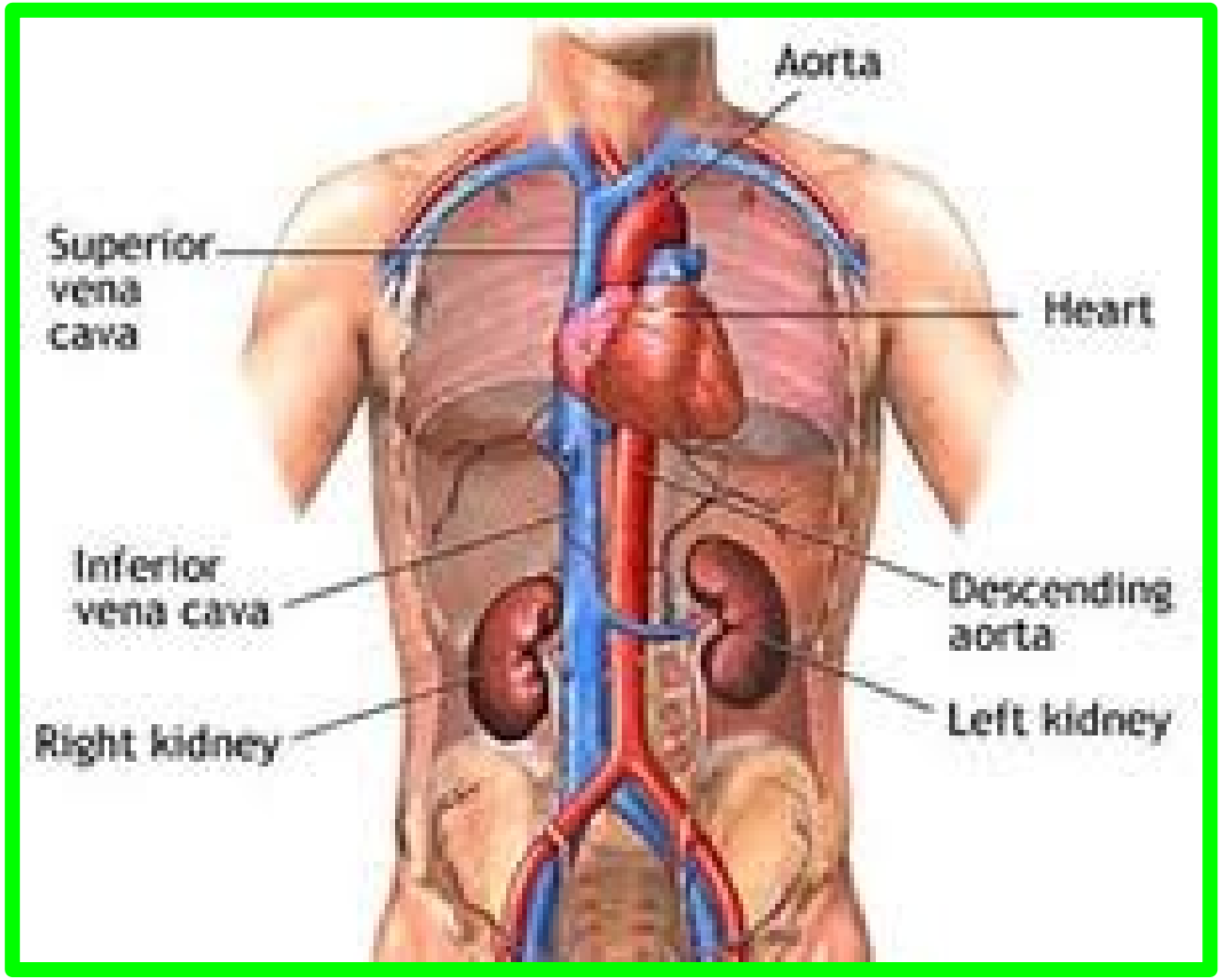
✓The right kidney lies slightly lower than the left kidney because of the large size of the right lobe of the liver.

✓With contraction of the diaphragm during respiration, both kidneys move downward in a vertical direction by as much as 1 in. (2.5 cm).



✓On the medial concave border of each kidney is a vertical slit that is bounded by thick lips of renal substance and is called the hilum

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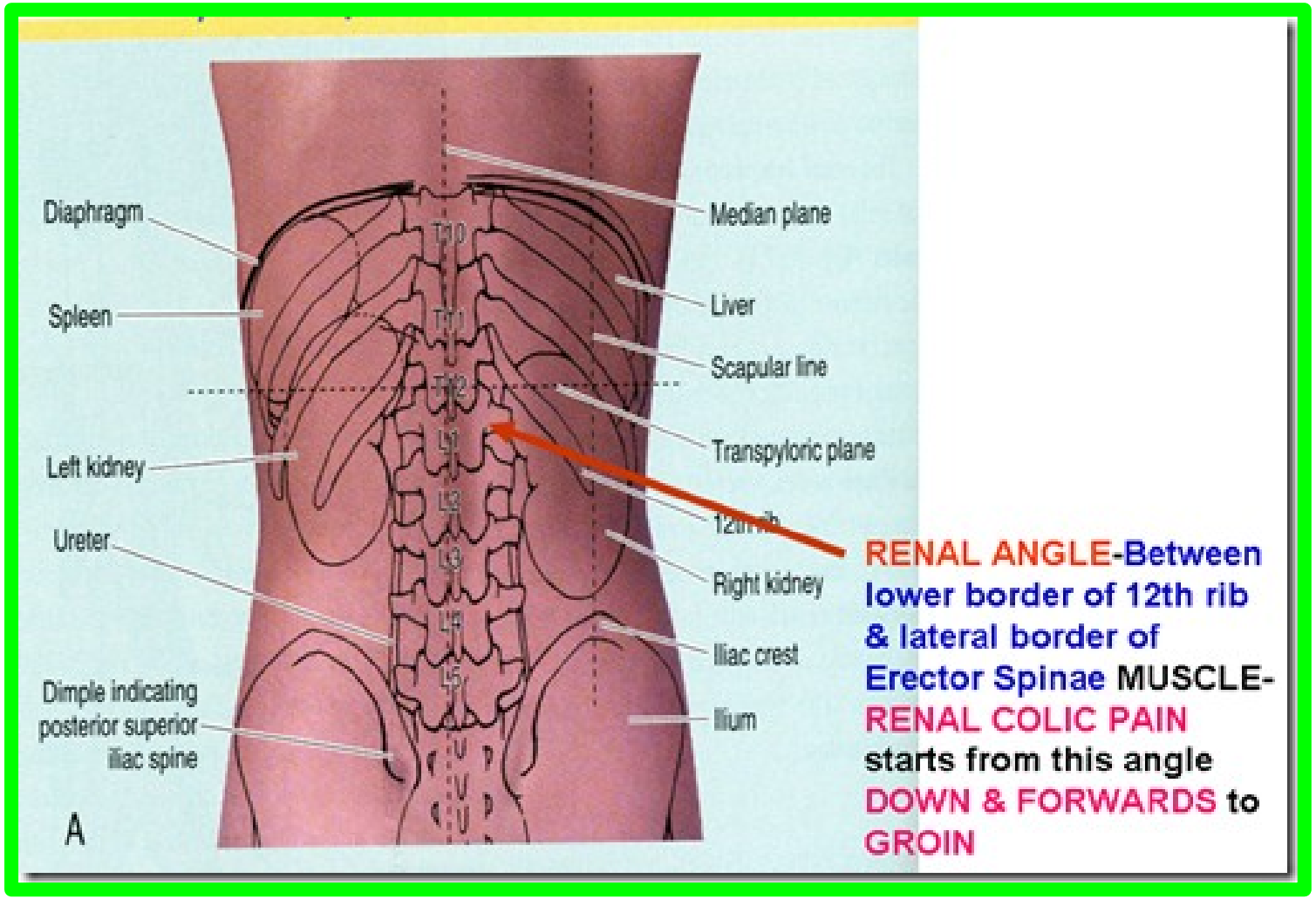
❖The hilum of the left kidney lies near the transpyloric plane, approximately 5 cm from the median plane

❖The transpyloric plane passes through the superior pole of the right kidney

❖During life, the kidneys are reddish brown and measure approximately 12cm in length, 6cm in width, and 3cm in thickness.



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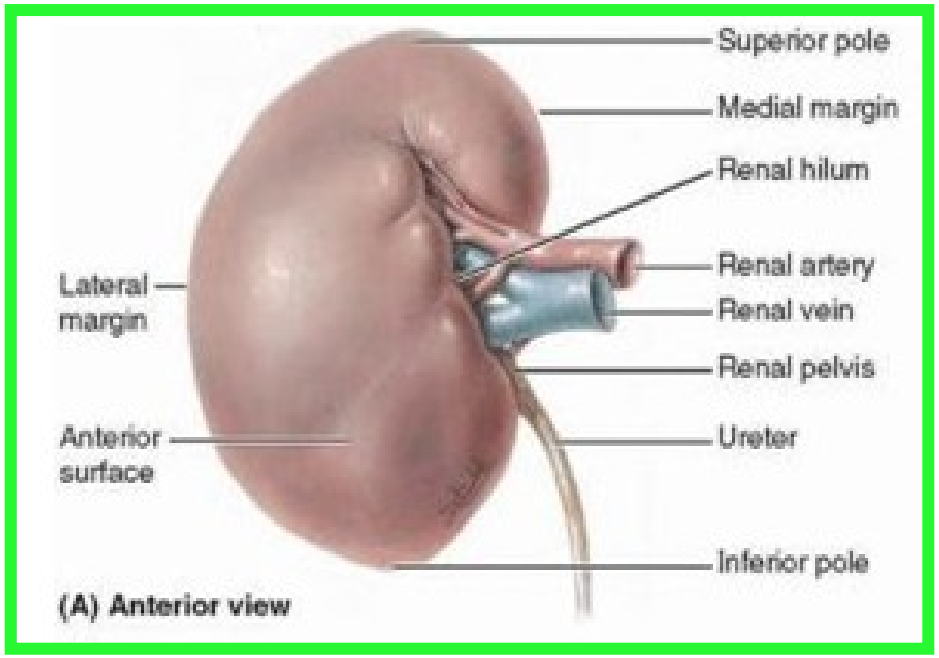
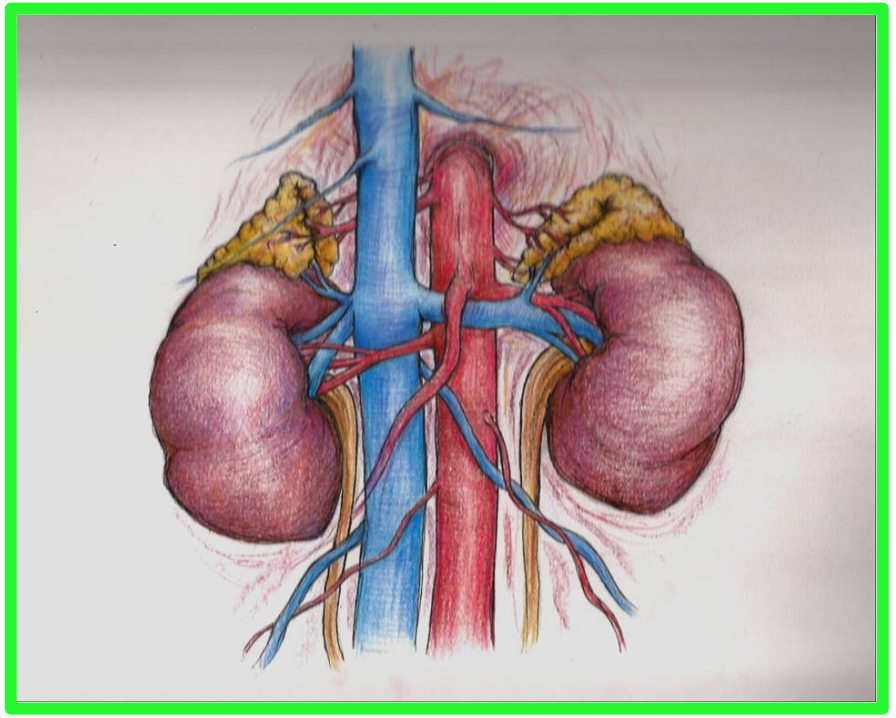
✓The hilum extends into a large cavity called the renal sinus.

✓The hilum transmits, from the front backward :

- The renal vein
- Two branches of the renal artery,
- The ureter
- Third branch of the renal artery (VAUA).
- Lymph vessels and sympathetic fibers also pass through the hilum.

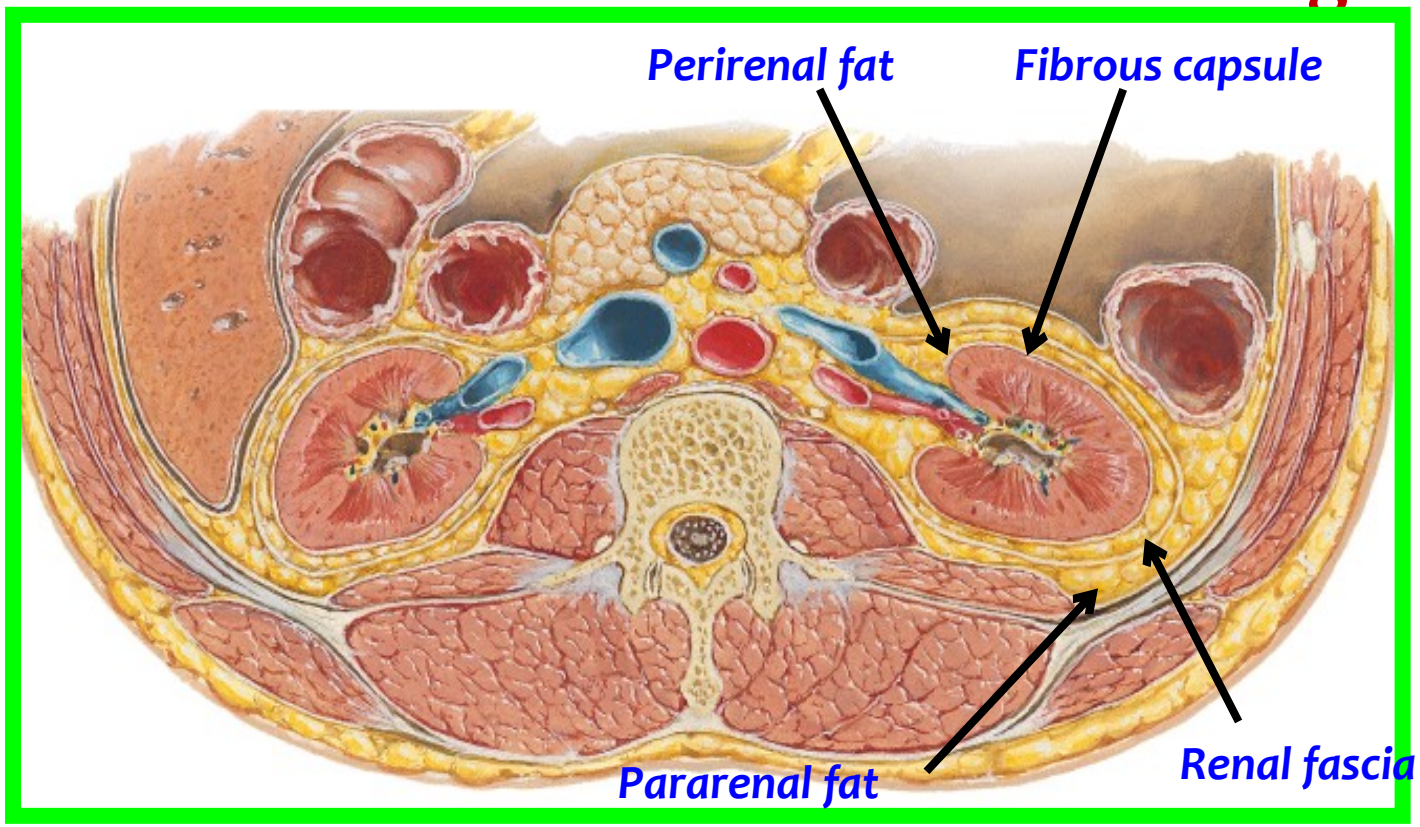




Kidneys

❖The kidneys have the following coverings:

- **Fibrous capsule :** This is closely applied to its outer surface.
- **Perirenal fat:** This is fat that covers the fibrous capsule
- **Renal fascia:** This is a condensation of areolar tissue outside the perirenal fat. It encloses the kidneys and the suprarenal glands.
- **Pararenal fat:** This is external to the renal fascia and is often large in amount



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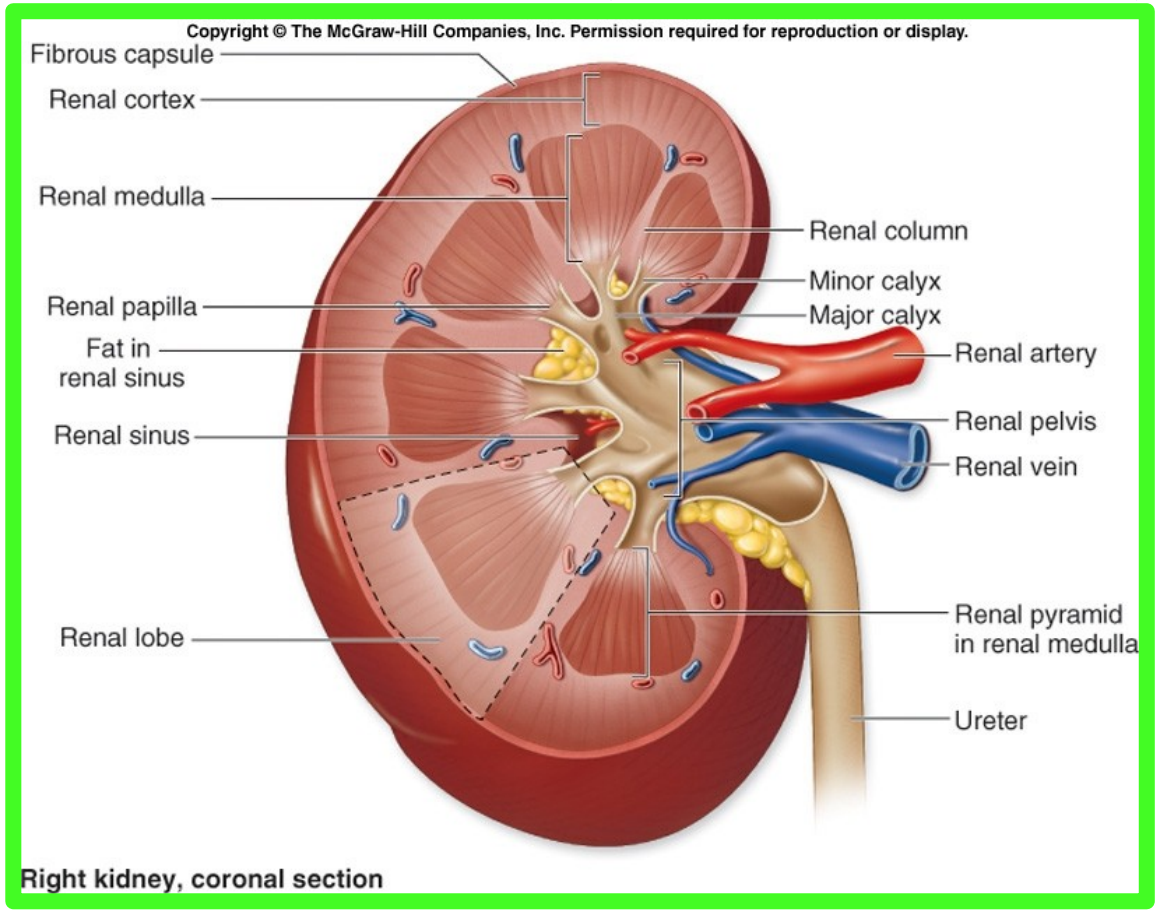
Renal Structure

❖Each kidney has a dark brown outer cortex and a light brown inner medulla.

❖The medulla is composed of about a dozen renal pyramids, each having its base oriented toward the cortex and its apex, (the renal papilla), projecting medially.



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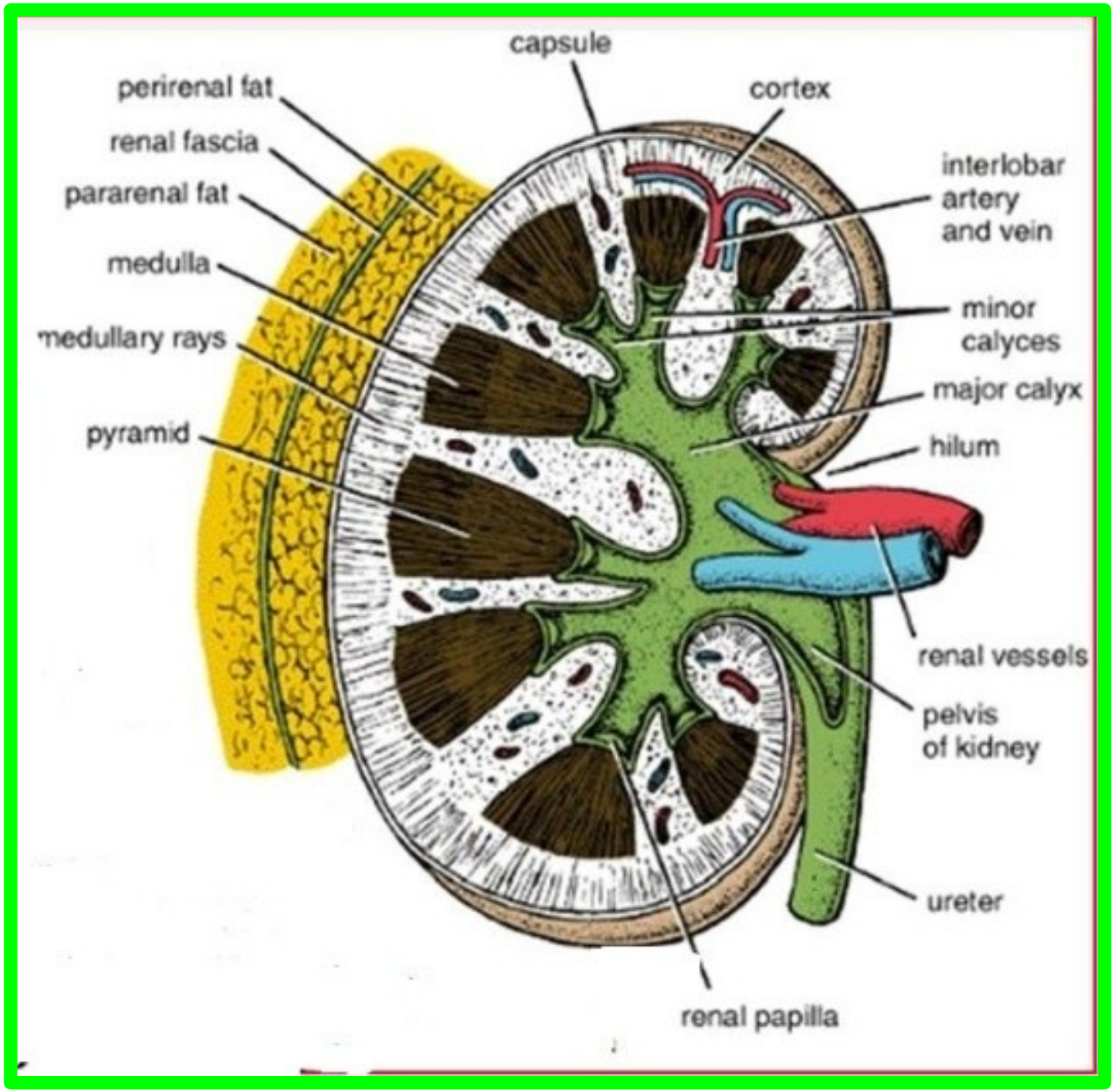
❖**The cortex :**

❖**Extends into the medulla between adjacent pyramids as the renal columns.**

❖**Extending from the bases of the renal pyramids into the cortex are striations known as medullary rays**



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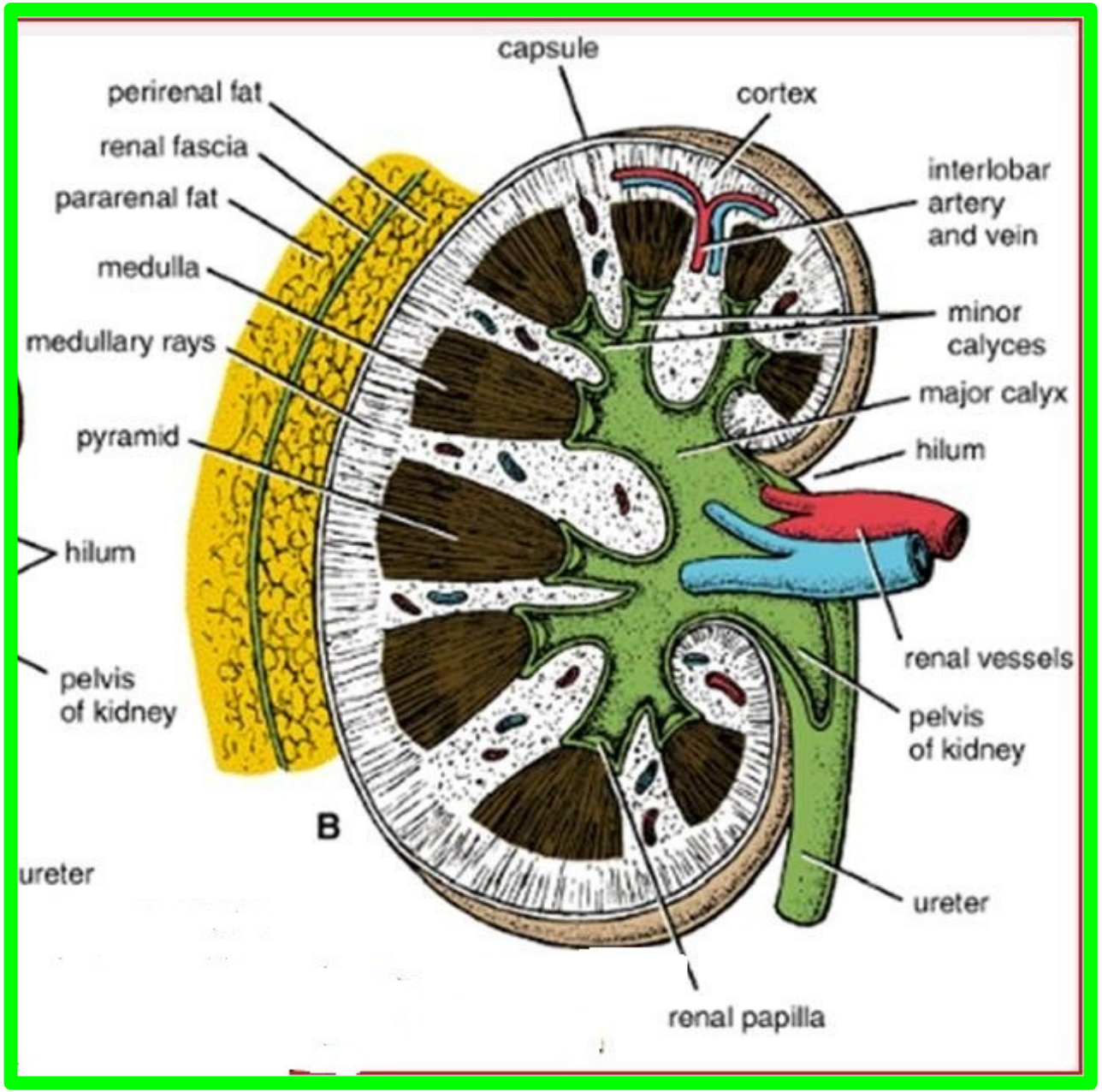
❖The renal sinus, which is the space within the hilum, contains the upper expanded end of the ureter, the renal pelvis.

❖This divides into two or three major calyces, each of which divides into two or three minor calyces

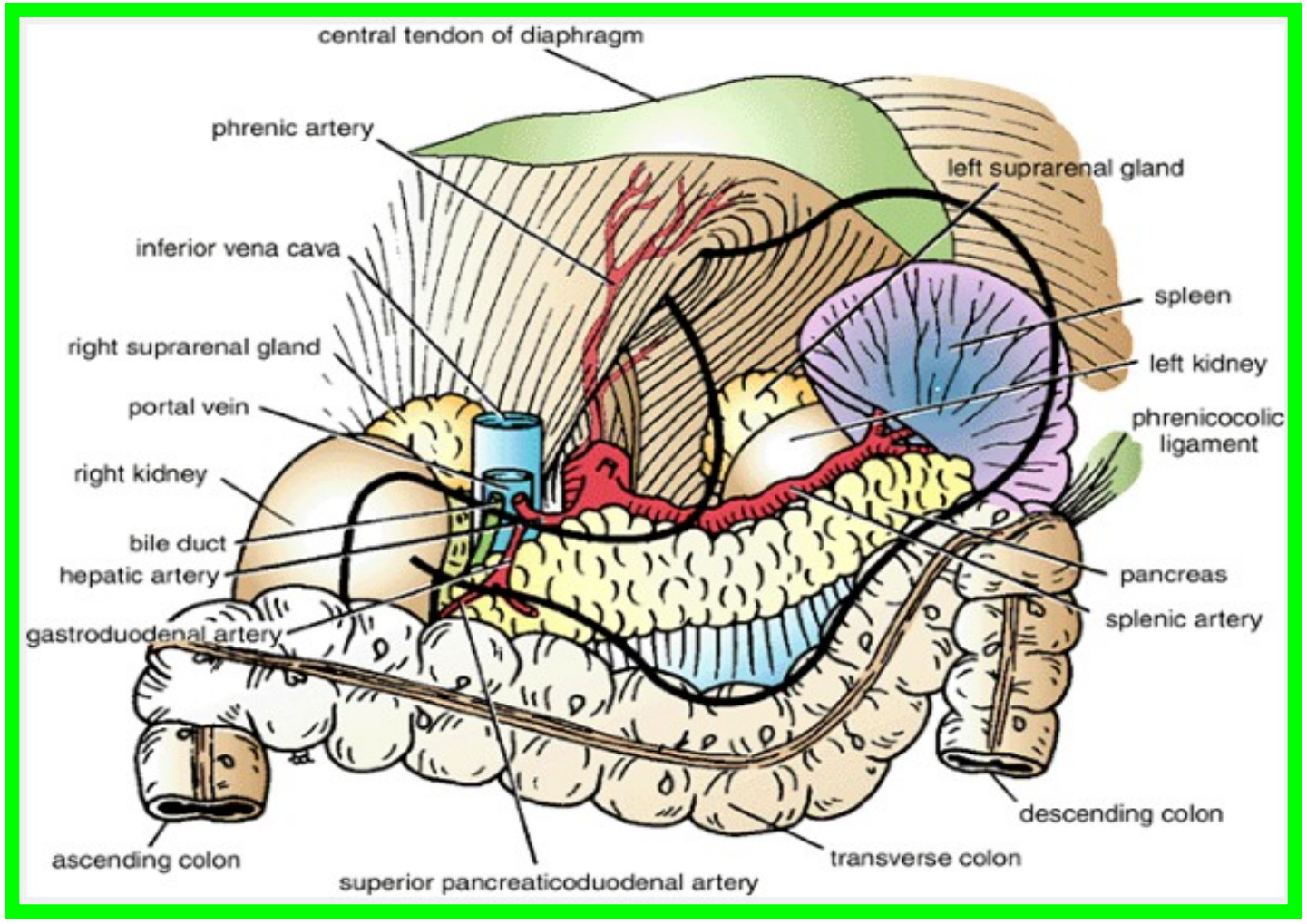
❖Each minor calyx is indented by the apex of the renal pyramid, the renal papilla.



KIDNEYS

Important Relations, Right Kidney:

Anteriorly: The suprarenal gland, the liver, the second part of the duodenum, and the right colic flexure



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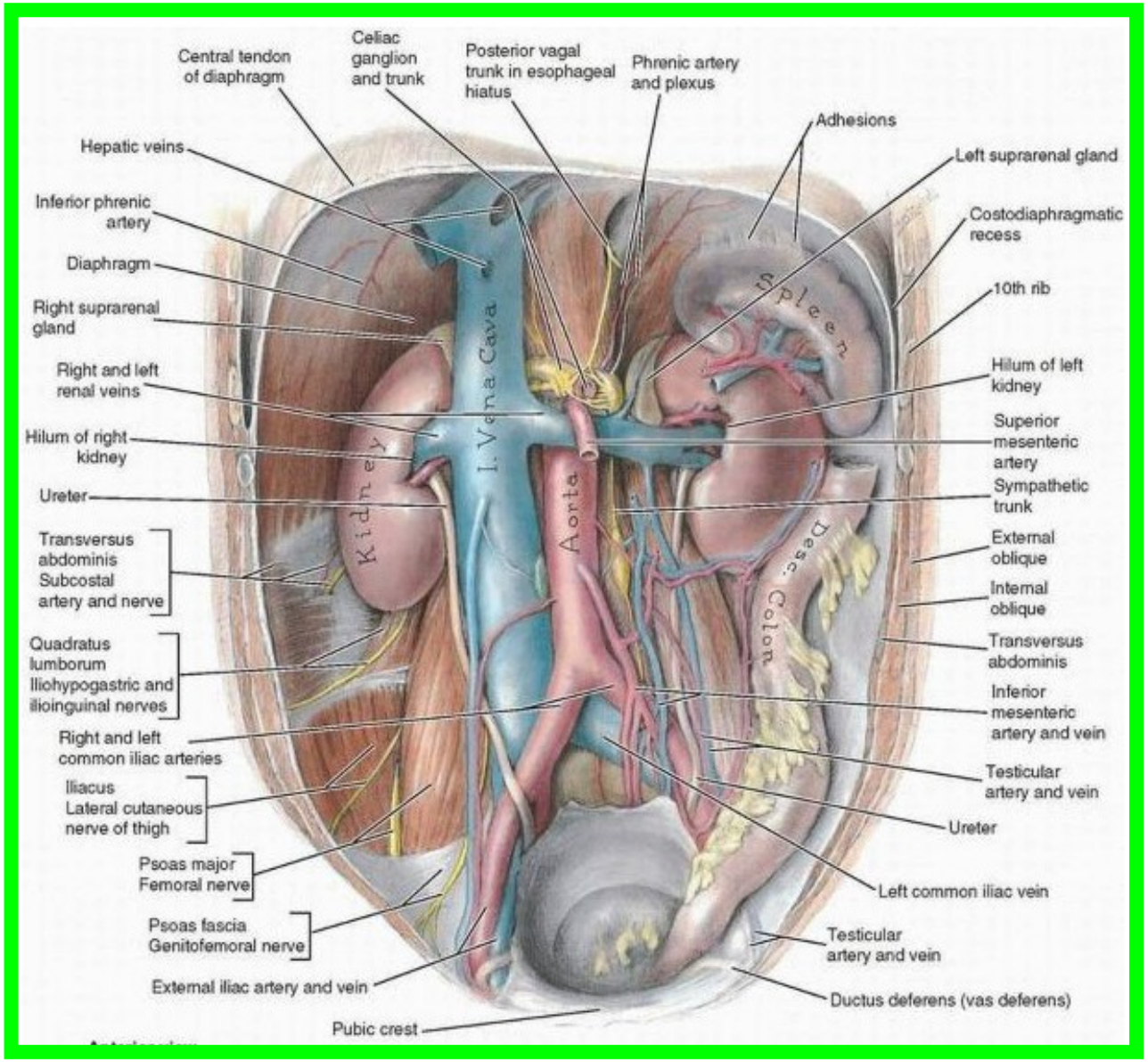
KIDNEYS

Posteriorly

- The diaphragm;
- The costodiaphragmatic recess of the pleura
- The 12th rib
- The psoas
- Quadratus lumborum
- Transversus abdominis muscles.
- The subcostal (T12), iliohypogastric, and ilioinguinal nerves (L1) run downward and laterally



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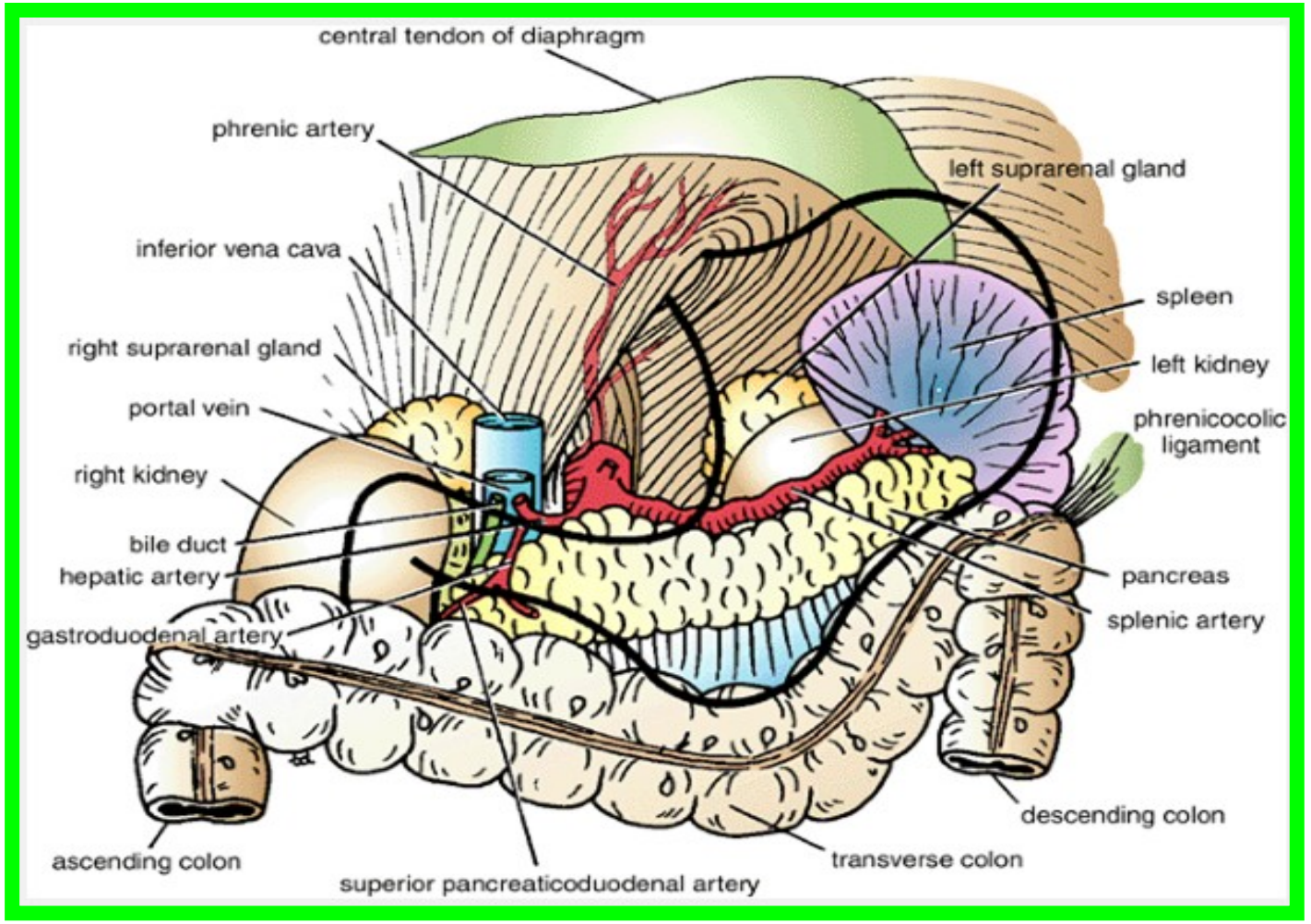
Important Relations, Left Kidney

Anteriorly: The **suprarenal gland**, the **spleen**, the **stomach**, the **pancreas,** the **left colic flexure**, and **coils of jejunum**



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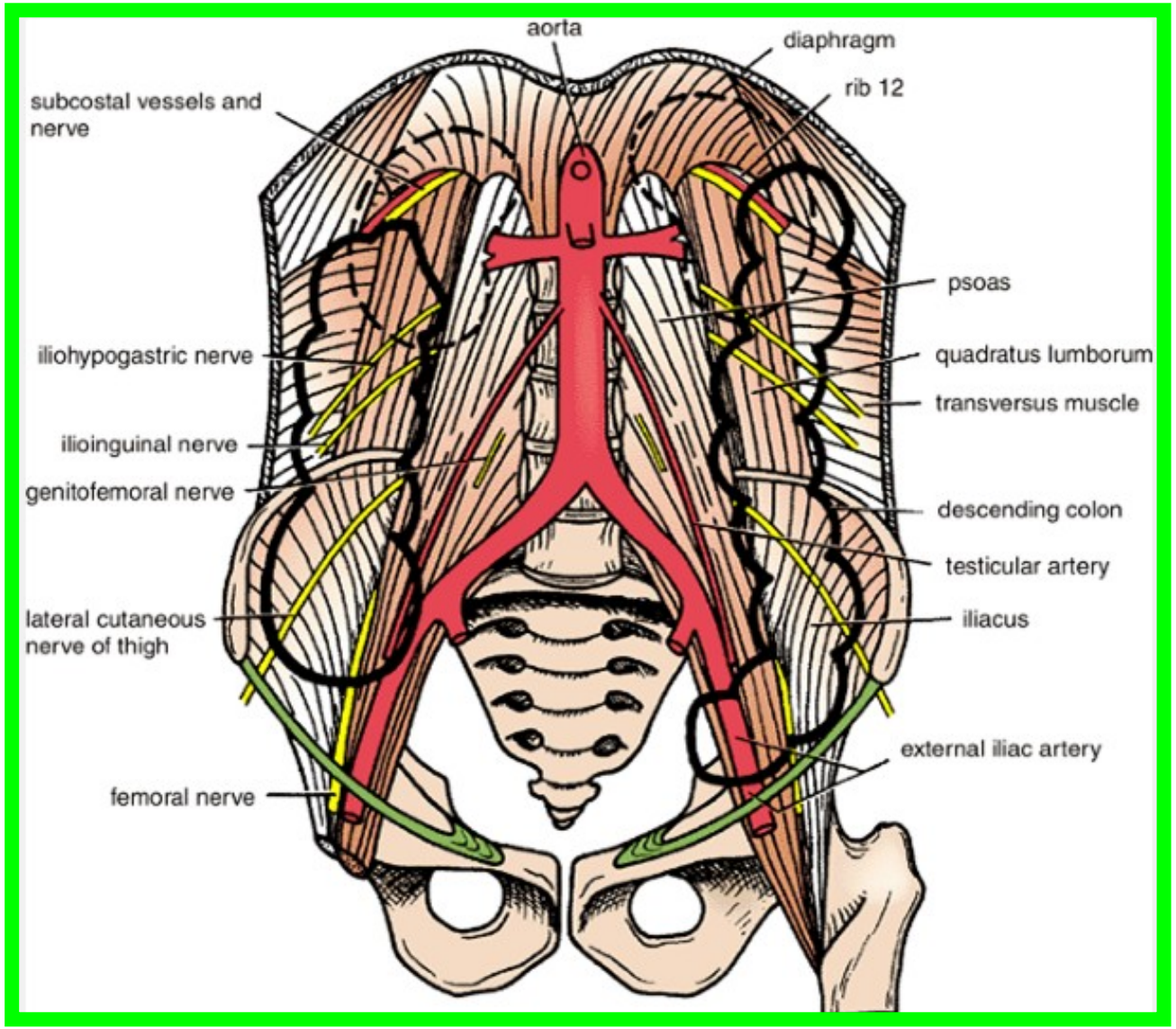
Posteriorly:

- The diaphragm
- The costodiaphragmatic recess of the pleura
- The 11th (the left kidney is higher) and 12th rib
- The psoas,
- Quadratus lumborum
- Transversus abdominis muscles.
- The subcostal (T12), iliohypogastric, and ilioinguinal nerves (L1) run downward and laterally



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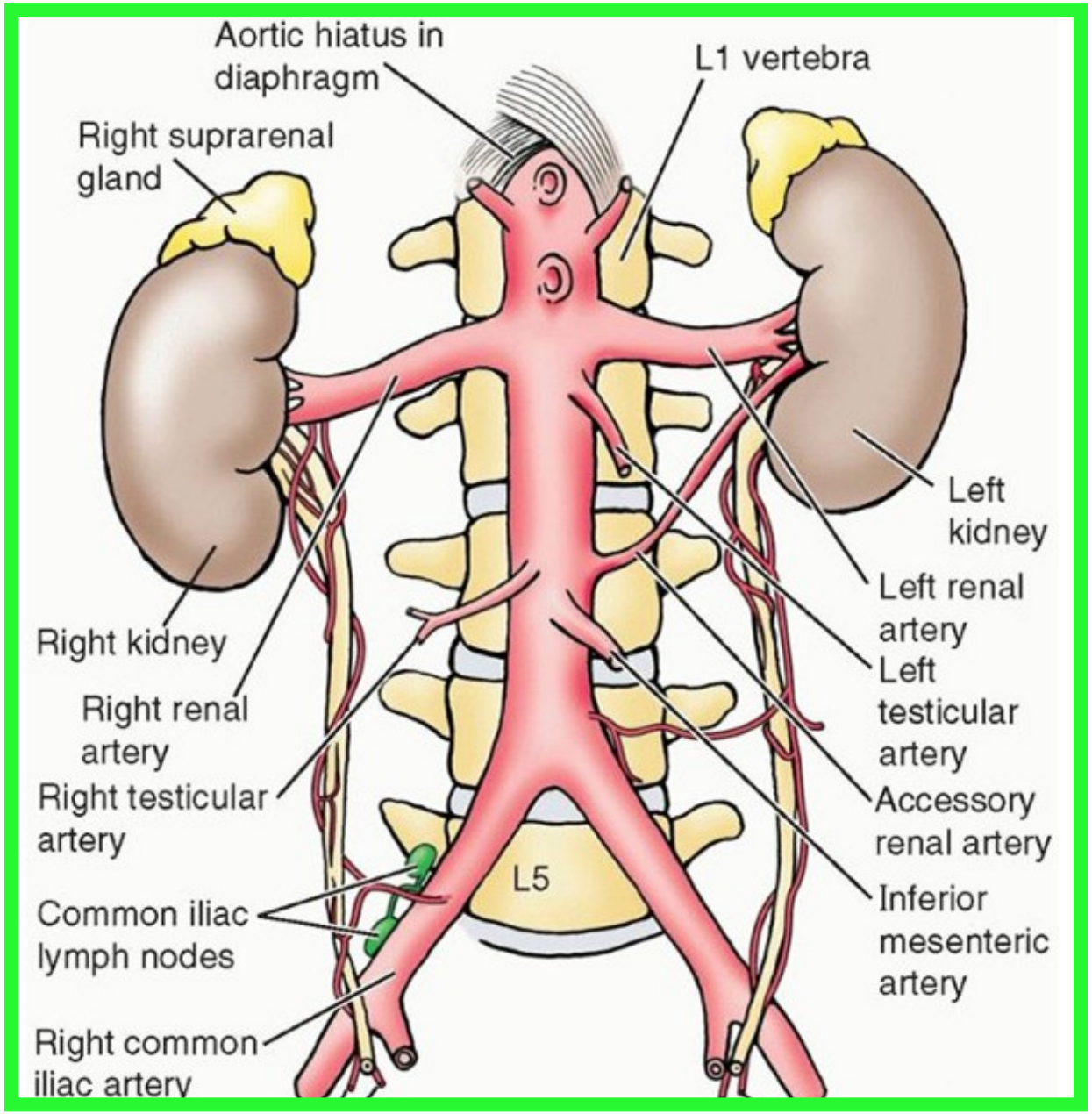
Blood Supply

Arteries

❖**The renal arteries** arise at the level of the IV disc between the **L1 and L2 vertebrae**

✓The longer right renal artery passes posterior to the **IVC.**

✓Typically, each artery divides close to **the hilum** into **five segmental arteries** that are end arteries



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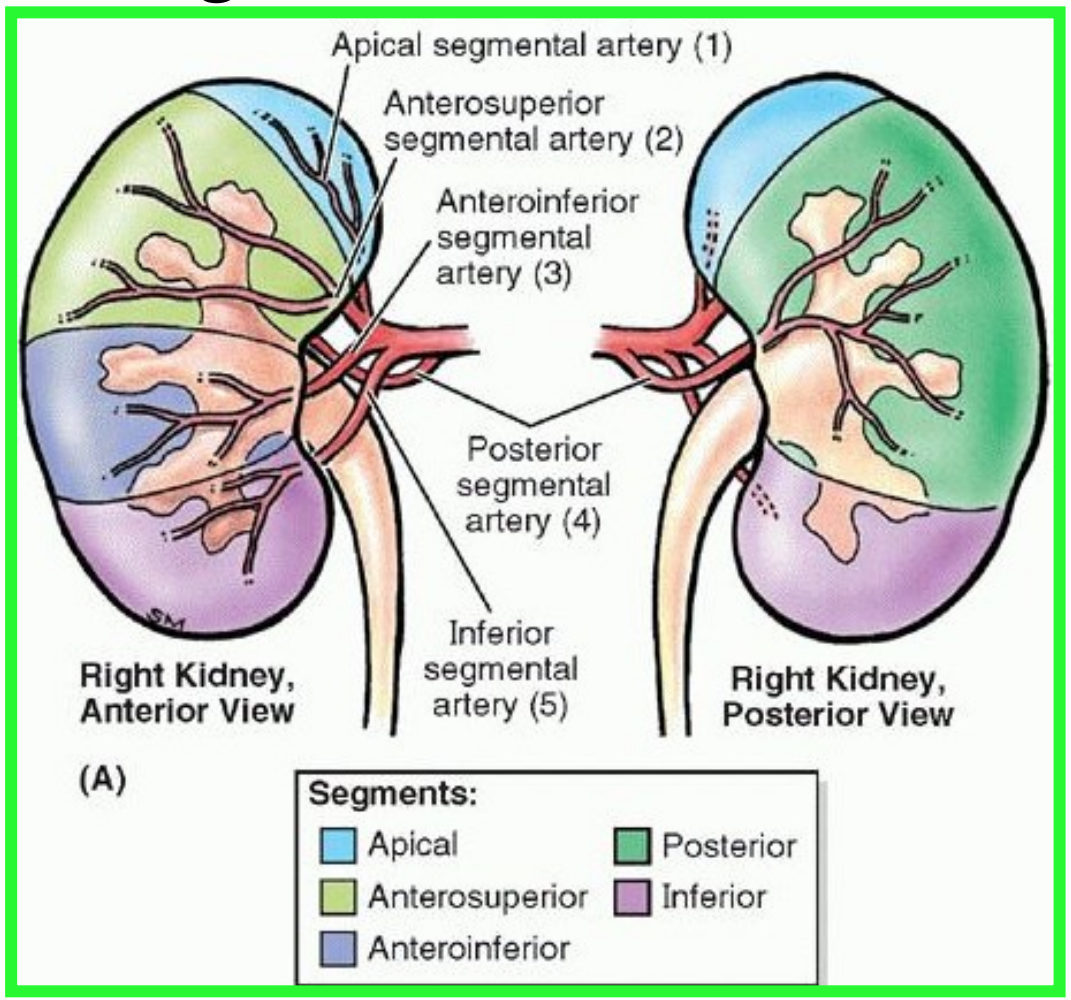
- Each renal artery usually divides into five segmental arteries that enter the hilum of the kidney.
- They are distributed to different segments or areas of the kidney.



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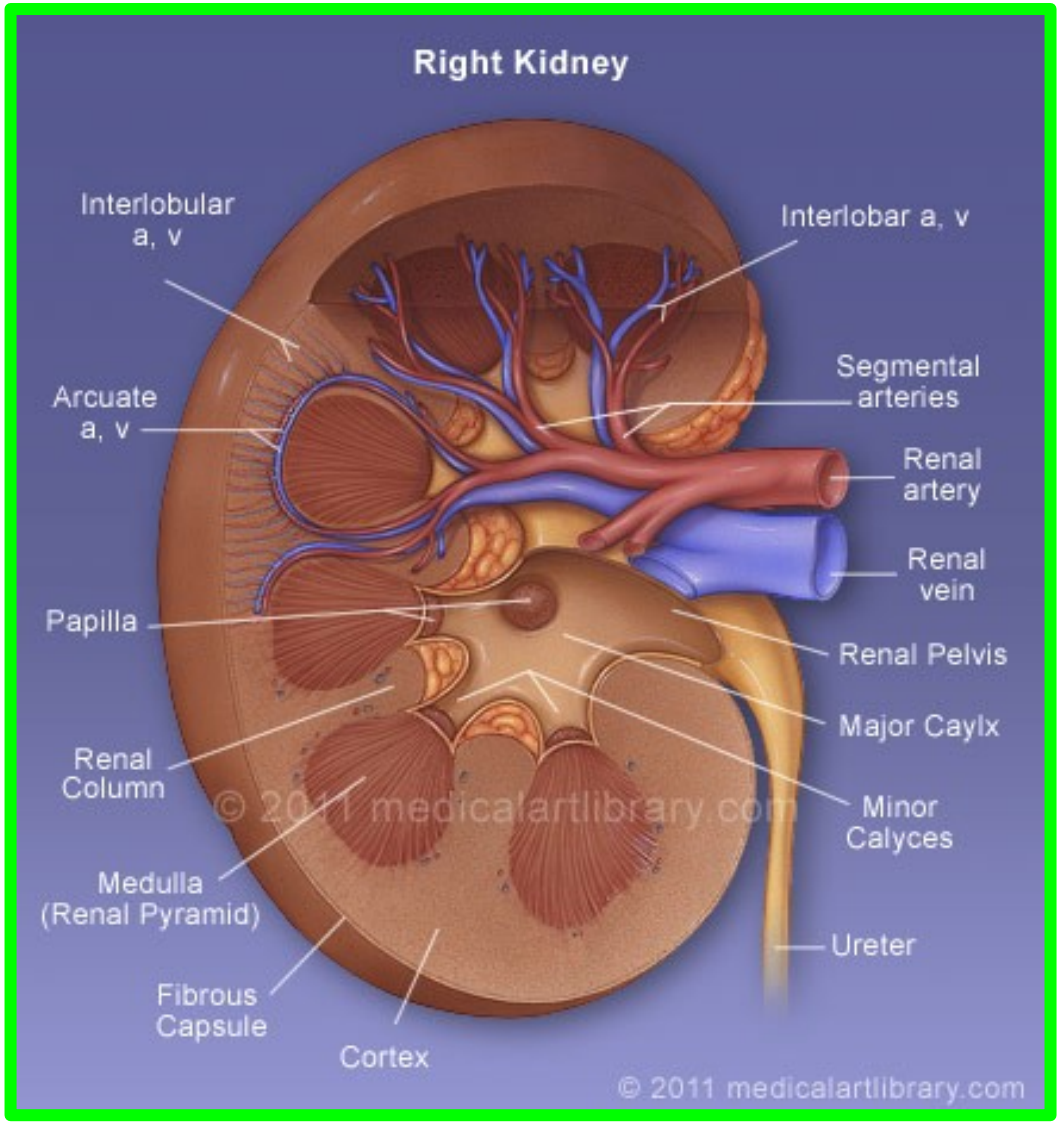
❖**Lobar arteries** arise from each segmental artery, one for each renal pyramid.

❖Before entering the renal substance, each lobar artery gives off **two or three interlobar arteries**



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

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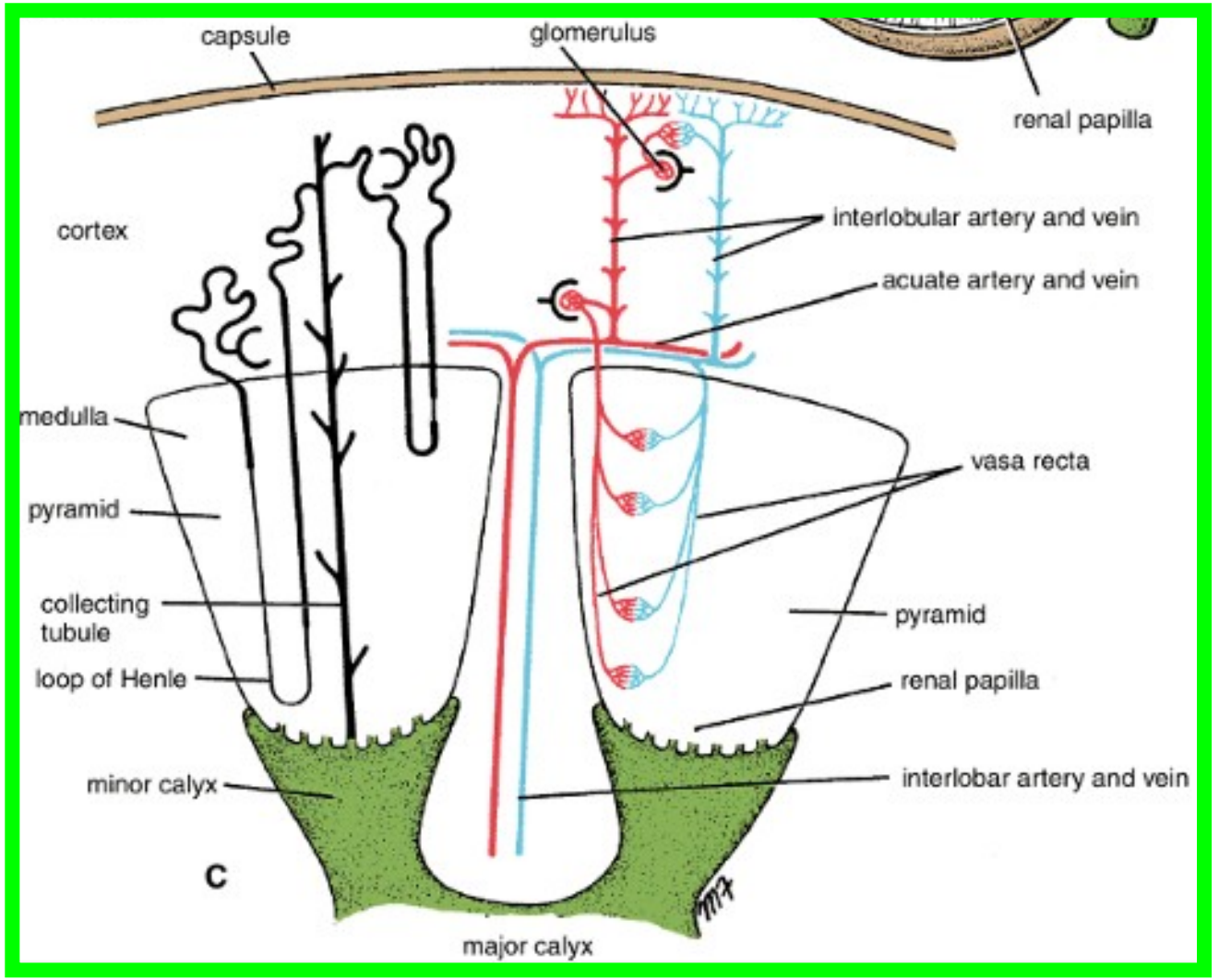
- At the junction of the cortex and the medulla, the interlobar arteries give off the arcuate arteries, which arch over the bases of the pyramids

- The arcuate arteries give off several interlobular arteries that ascend in the cortex.



- The afferent glomerular arterioles arise as branches of the interlobular arteries

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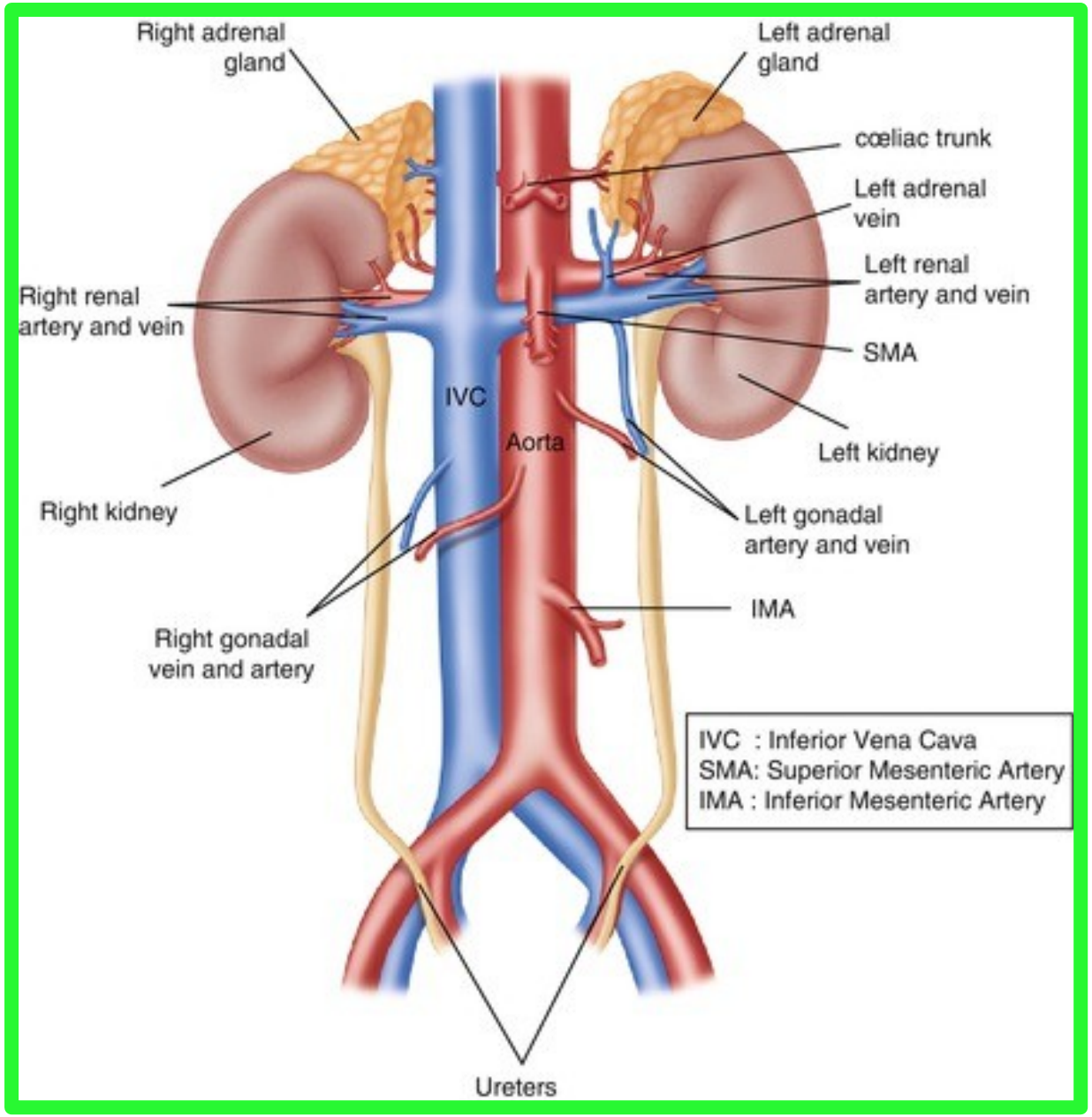
Veins

The renal vein emerges from the hilum in front of the renal artery and drains into the inferior vena cava.

Nerve Supply

The nerve supply is the renal sympathetic plexus.

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



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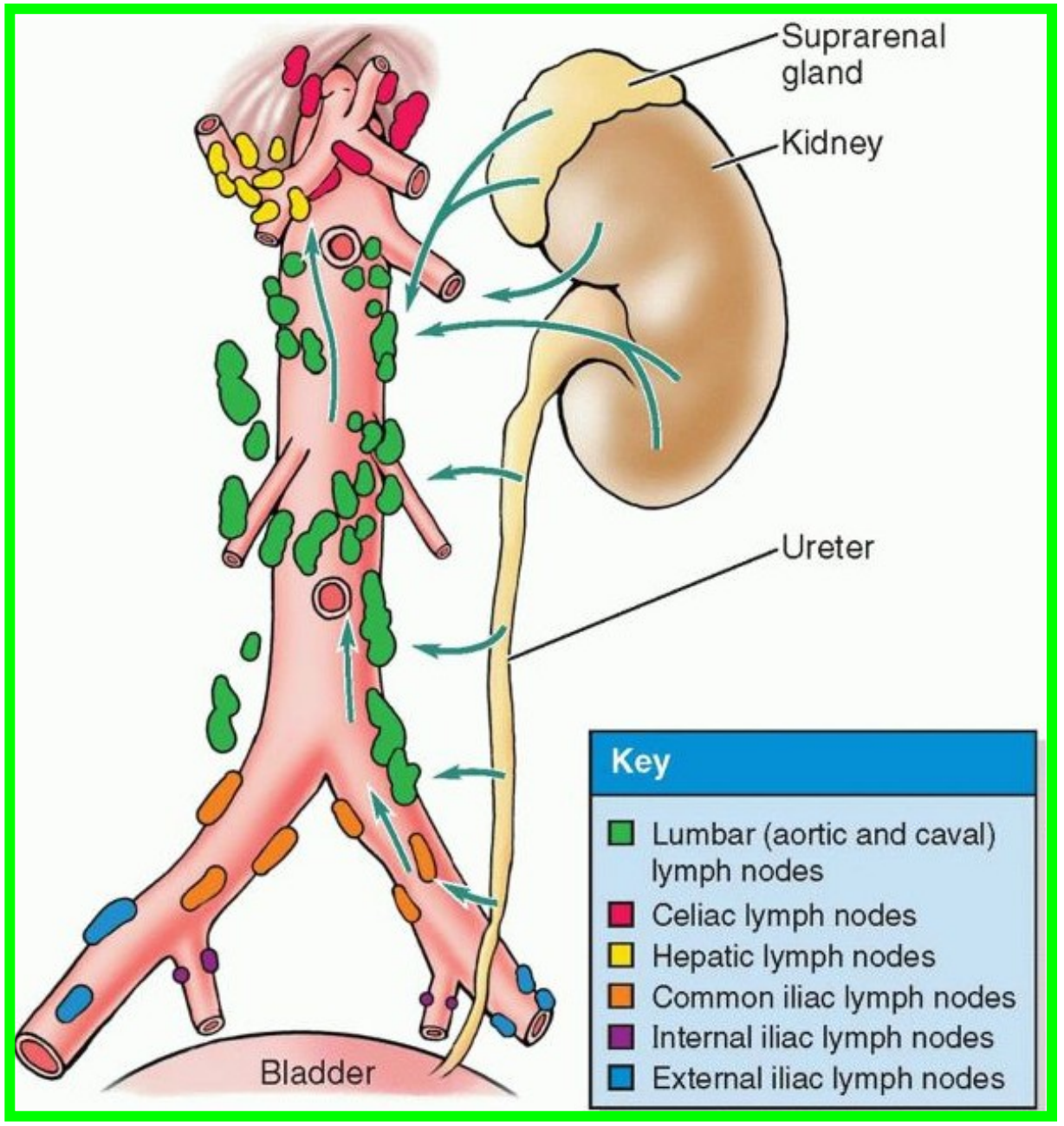
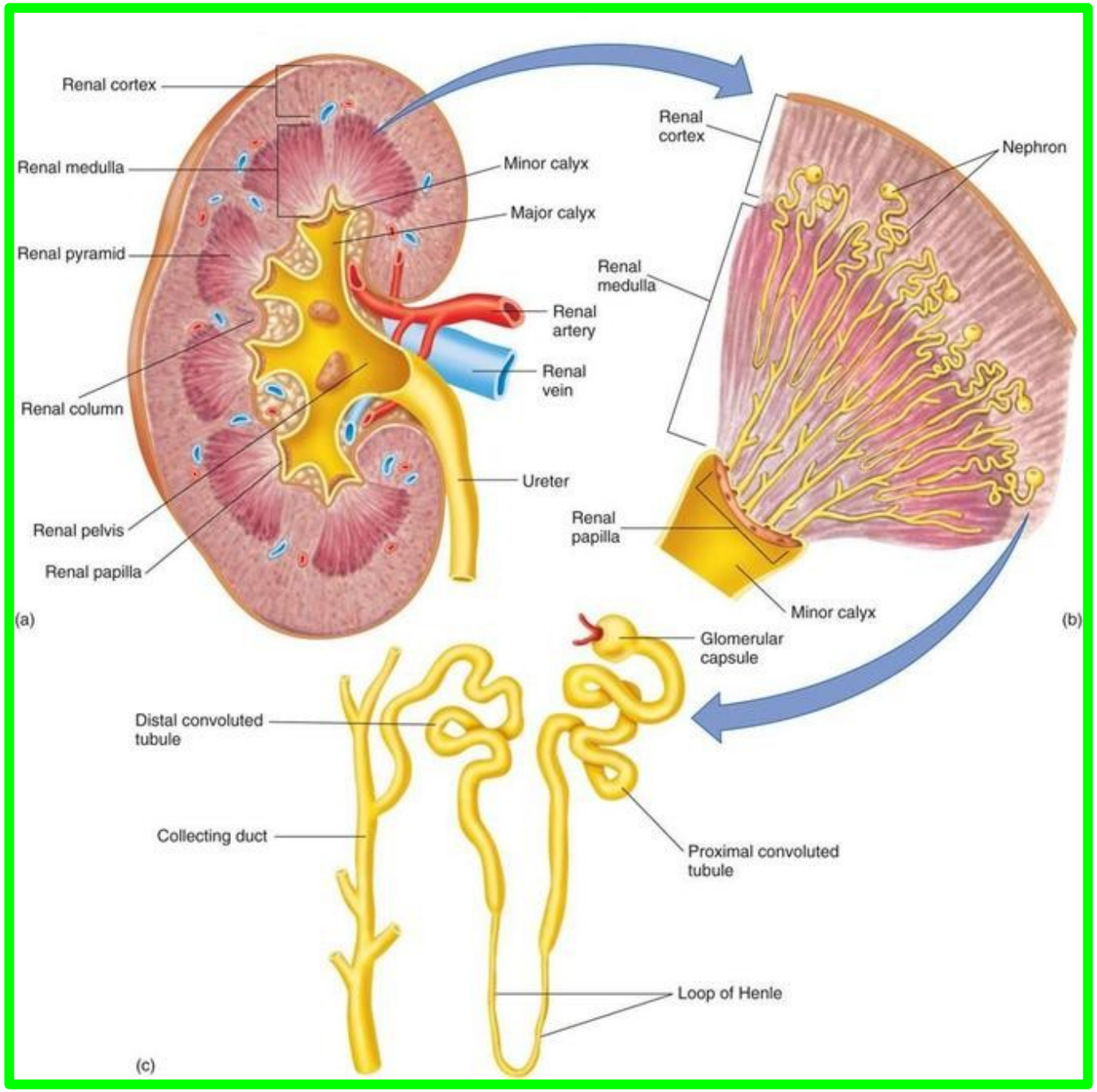
Lymph Drainage

Lymph drains to the lateral aortic lymph nodes around the origin of the renal artery & Lumbar (aoratic and caval) lymph node




Renal cortex
Renal medulla
Renal pyramid
Renal column
Renal pelvis
Renal papilla
Minor calyx
Major calyx
Renal artery
Renal vein
Ureter
(a)
Renal cortex
Renal medulla
Renal papilla
Minor calyx
Nephron
(b)
Glomerular capsule
Distal convoluted tubule
Collecting duct
Proximal convoluted tubule
Loop of Henle
(c)

Renal Cysts

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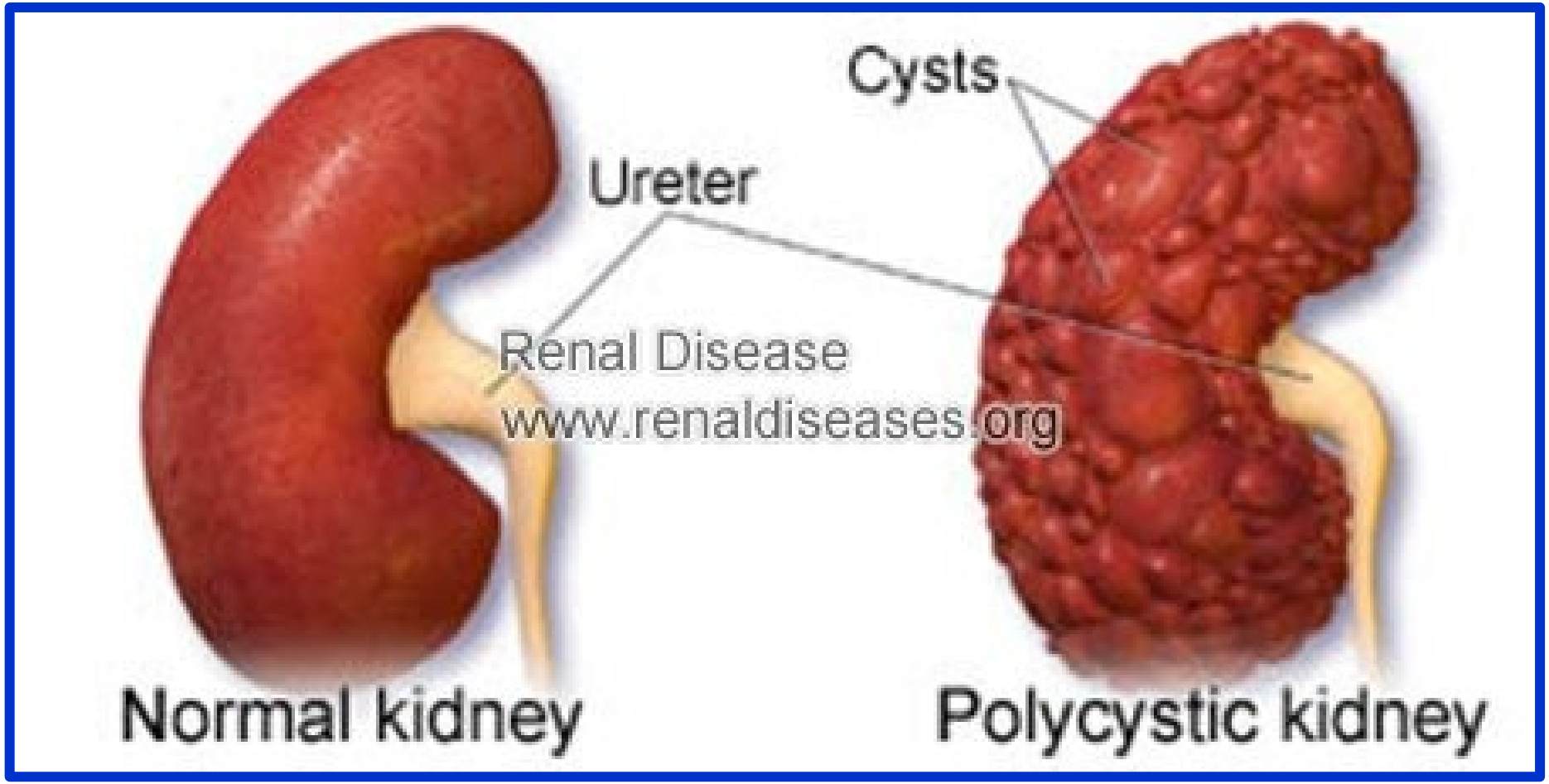
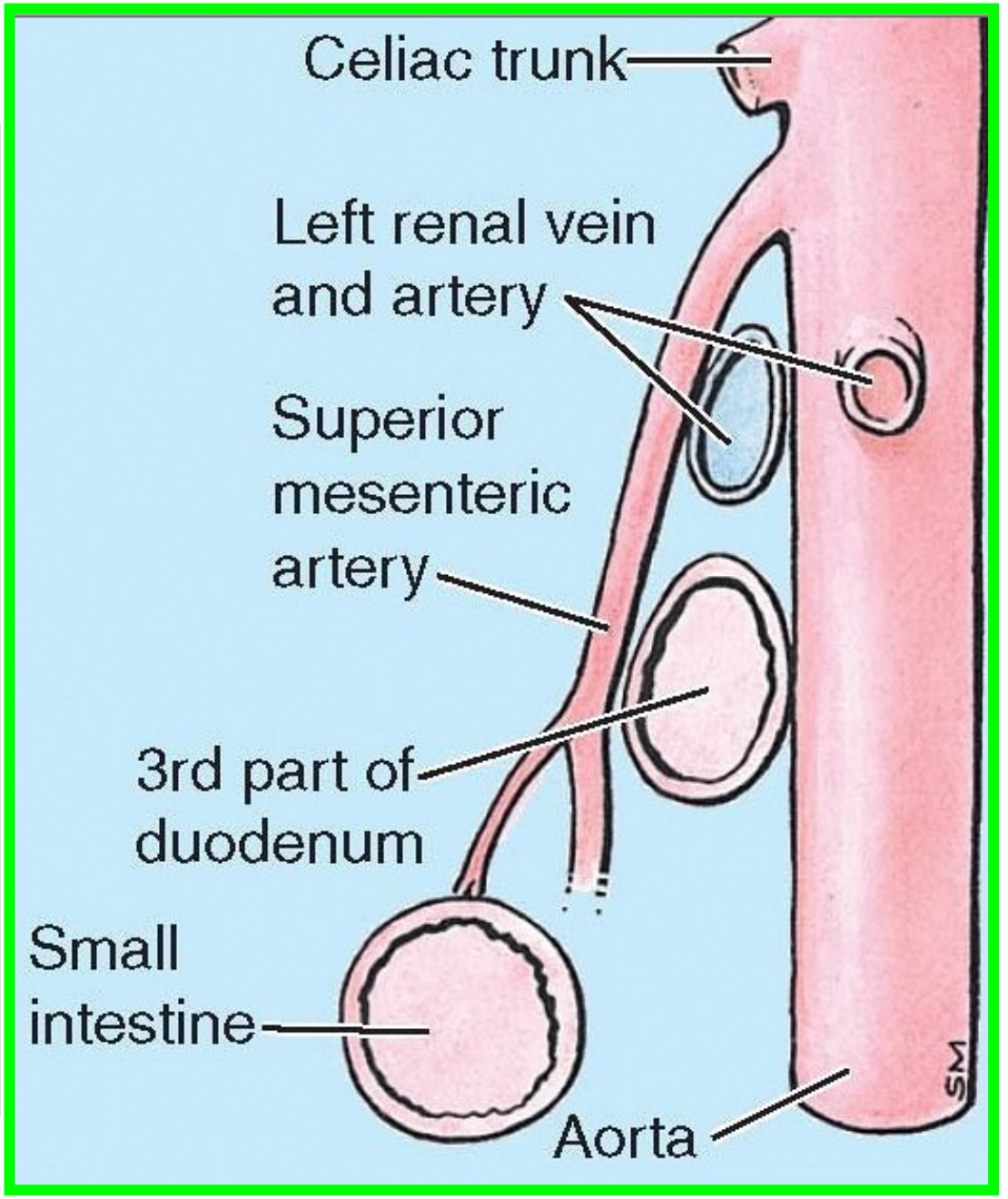
Cysts in the kidney, multiple or solitary, are common findings during ultrasound examinations and dissection of cadavers. Adult polycystic disease of the kidneys is an important cause of renal failure;



Renal Vein Entrapment Syndrome

In crossing the midline to reach the IVC, the longer left renal vein traverses an acute angle between the SMA anteriorly and the abdominal aorta posteriorly (and perhaps the third part of the duodenum) resulting in a renal vein entrapment syndrome also known as "nutcracker syndrome".

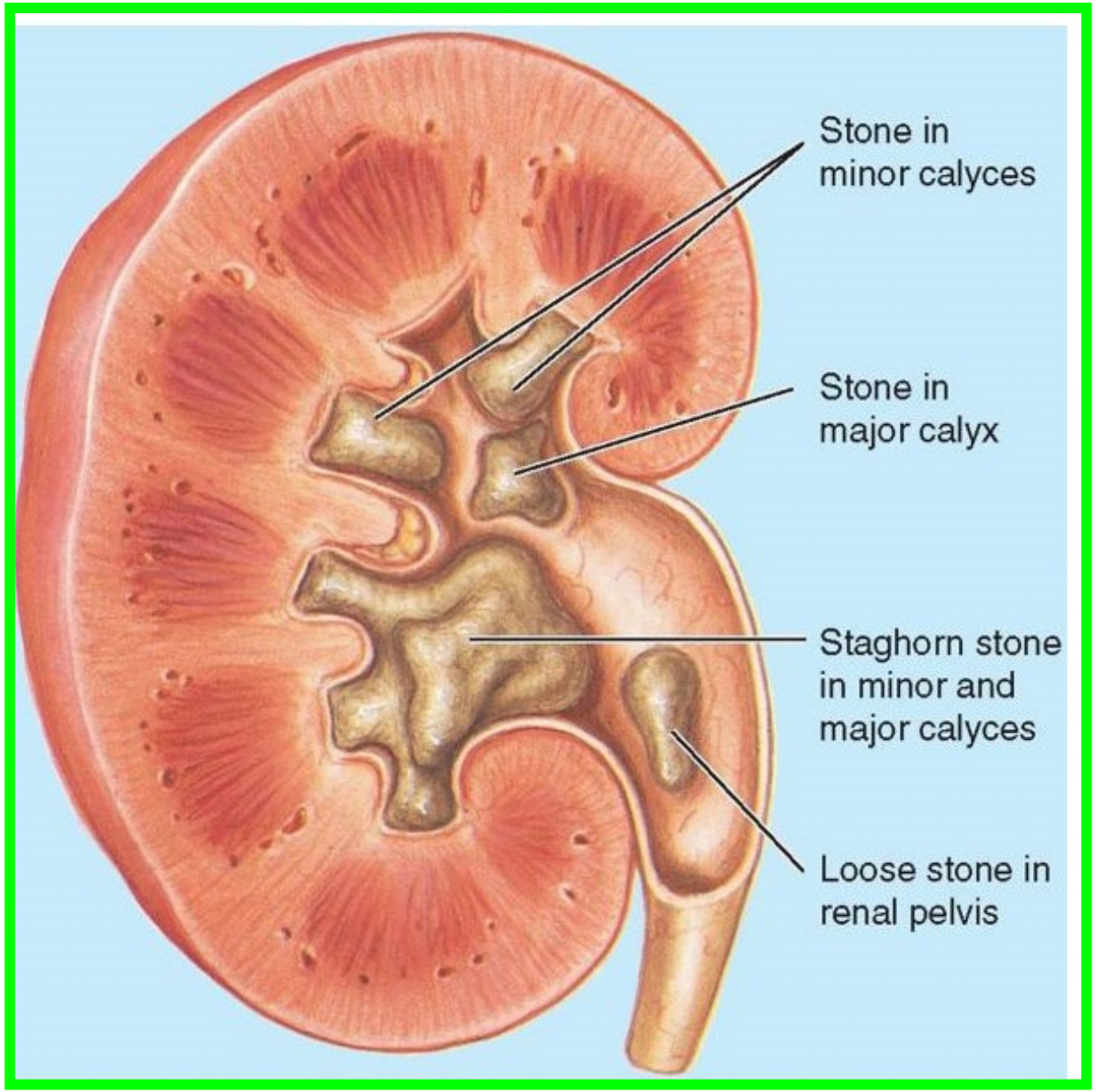
✓ left testicular pain in men (related to the left testicular vein draining into the left renal vein proximal to the compression).



Renal and Ureteric Calculi

Calculi are composed of salts of inorganic or organic acids or of other materials. They may form and become located in the calices of the kidneys, ureters, or urinary bladder

A renal calculus (kidney stone) may pass from the kidney into the renal pelvis and then into the ureter.



Congenital Anomalies of Kidneys

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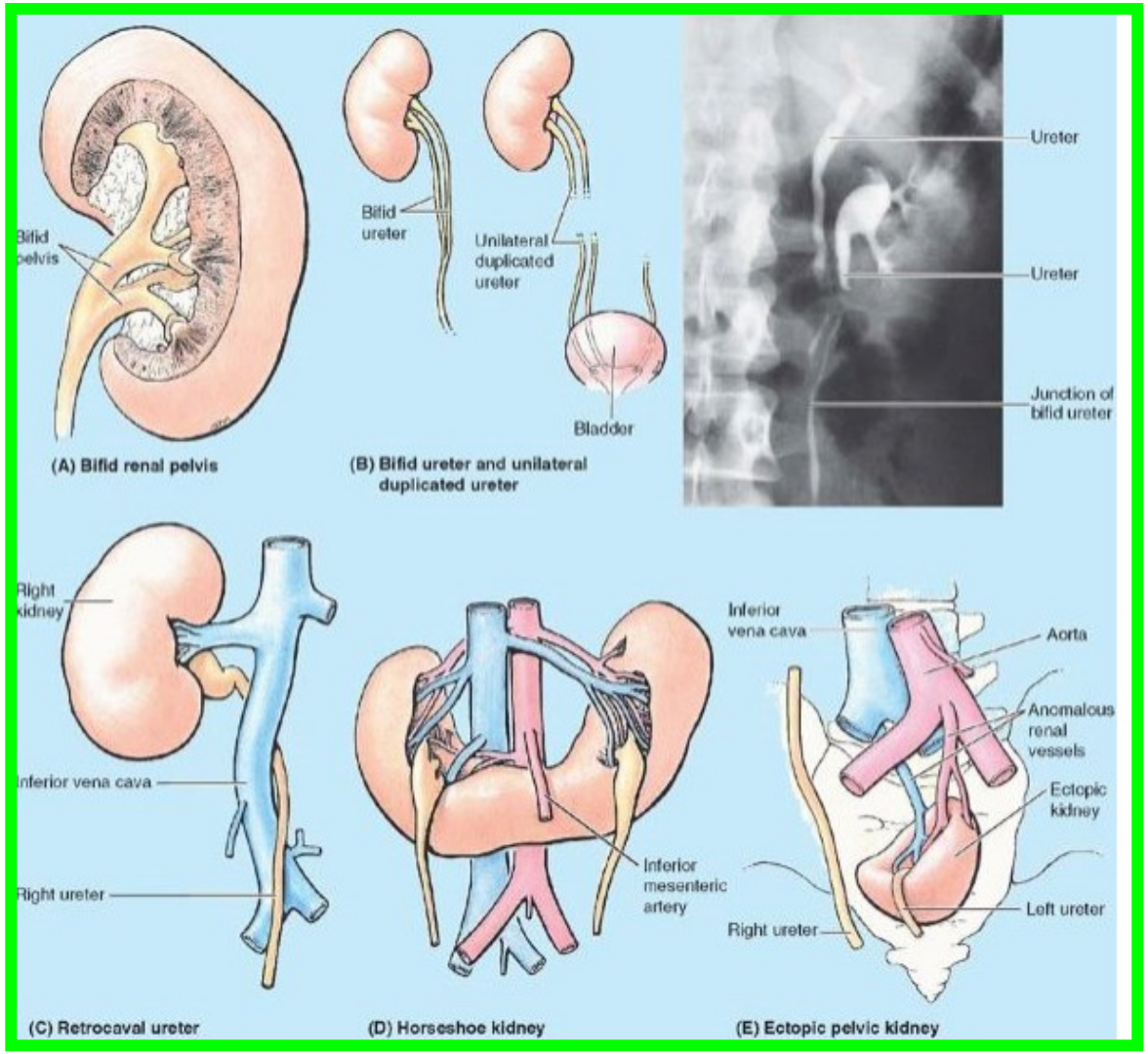
Bifid renal pelvis and ureter are fairly common. The bifid renal pelvis and/or ureter may be unilateral or bilateral; however, **separate openings into the bladder** are uncommon.

An uncommon anomaly is a **retrocaval ureter** , which leaves the kidney and passes posterior to the **IVC**.

The kidneys are close together in the embryonic pelvis. the inferior poles (rarely, the superior poles) of the kidneys fuse to **form a horseshoe kidney**

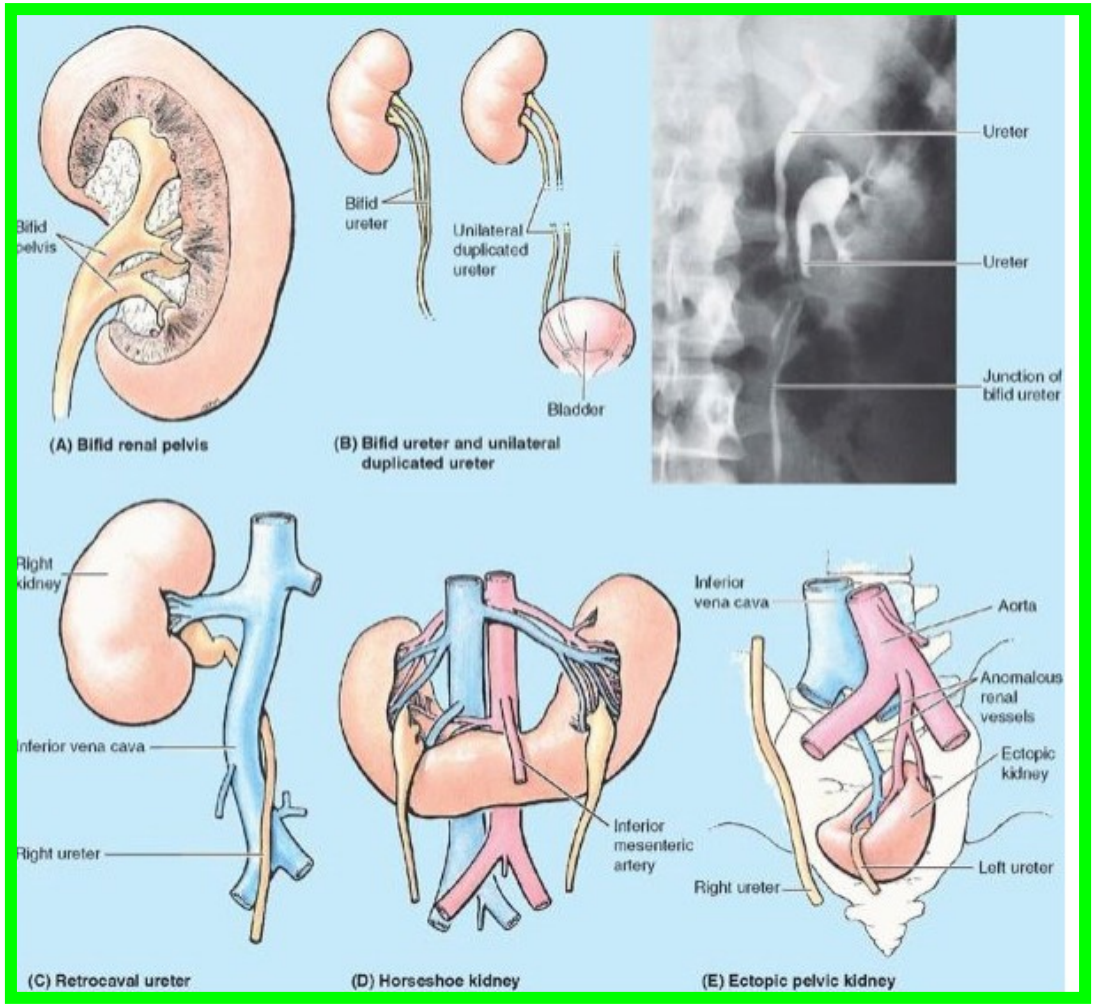


Congenital Anomalies of Kidneys

This U-shaped kidney usually lies at the level of L3-L5 vertebrae because the root of the inferior mesenteric artery prevented normal relocation of the kidneys.

Horseshoe kidney usually produces no symptoms; however, associated abnormalities of the kidney and renal pelvis may be present, obstructing the ureter.

Awareness of the possibility of an ectopic pelvic kidney should prevent it from being mistaken for a pelvic tumor and removed.



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