

external anatomy of kidney

External anatomy of the kidney plays a critical role in understanding its functions and significance within the human body. The kidneys are vital organs responsible for filtering blood, removing waste, and regulating fluid balance. Located in the retroperitoneal space, they exhibit a complex structure that supports their essential biological roles. This article delves into the external anatomy of the kidney, exploring its location, shape, coverings, and major blood vessels.

Location and Shape

The kidneys are situated in the posterior part of the abdominal cavity, specifically in the retroperitoneal space, which lies behind the peritoneum. Each kidney is typically located at the level of the T12 to L3 vertebrae, with the right kidney usually positioned slightly lower than the left due to the presence of the liver above it.

In terms of shape, the kidneys resemble kidney beans, which is quite fitting given their name. They are approximately 10 to 12 centimeters in length, 5 to 7 centimeters in width, and about 3 centimeters in thickness in adults. The external contour of the kidneys is smooth and convex, with a slight indentation known as the renal hilum.

External Features of the Kidney

The kidneys possess several external features that are crucial for their identification and understanding. These include:

1. Renal Hilum

The renal hilum is a significant concave notch located on the medial (inner) side of each kidney. It serves as the entry and exit point for various structures, including:

- Renal arteries
- Renal veins
- Ureters
- Nerves and lymphatics

The hilum marks the transition from the renal cortex to the renal pelvis, making it a vital anatomical landmark.

2. Renal Capsule

The renal capsule is a thin, fibrous layer that encases each kidney, providing protection and structural support. This tough outer layer serves several purposes:

- Protects the kidney from trauma and infection
- Maintains the shape of the kidney
- Acts as a barrier against the spread of infections

Inside the renal capsule lies the renal cortex and medulla, which are involved in the kidney's filtering functions.

3. Renal Cortex

The renal cortex is the outer region of the kidney, just beneath the renal capsule. It plays a crucial role in the kidney's functions, housing the renal corpuscles and the majority of the nephron structures, which are responsible for urine formation. The cortex appears granular due to the presence of numerous nephrons, which are the functional units of the kidney.

4. Renal Medulla

Situated beneath the renal cortex, the renal medulla consists of several cone-shaped regions known as renal pyramids. The medulla is responsible for urine concentration and is organized into:

- Renal pyramids: These structures contain the loops of Henle and collecting ducts.
- Renal columns: Extensions of the renal cortex that separate the pyramids.

The medulla's internal structure is essential for the kidney's ability to concentrate urine and regulate water balance.

5. Renal Pelvis

The renal pelvis is a funnel-shaped cavity located at the hilum of the kidney. It collects urine produced in the nephrons before it is transported to the ureters. The renal pelvis is divided into several major and minor calyces, which further collect urine from the renal pyramids. The efficient drainage of urine from the renal pelvis to the ureters is crucial for preventing urinary tract infections and ensuring the proper functioning of the urinary system.

Major Blood Vessels Associated with the Kidneys

The kidneys receive blood supply through a complex network of blood vessels that are essential for their function. The major blood vessels associated with the kidneys include:

1. Renal Arteries

Each kidney receives blood from a renal artery, which branches off from the abdominal aorta. The renal artery divides into smaller branches as it approaches the hilum, ensuring adequate blood supply to the renal cortex and medulla. The renal arteries are responsible for delivering oxygen-rich blood, which is essential for the kidneys' filtering processes.

2. Renal Veins

After filtering blood, each kidney drains deoxygenated blood via the renal vein, which empties into the inferior vena cava. The renal veins accompany the renal arteries and are crucial for returning blood to the systemic circulation after it has been processed by the kidneys.

3. Segmental, Interlobar, and Arcuate Arteries

The renal artery further branches into segmental arteries, which supply different regions of the kidney. These segmental arteries then divide into interlobar arteries that run between the renal pyramids and extend into the renal cortex as arcuate arteries. This branching system ensures that all parts of the kidney receive adequate blood supply.

Innervation of the Kidney

The kidneys are innervated by the autonomic nervous system, which includes both sympathetic and parasympathetic fibers. This innervation plays a critical role in regulating kidney functions, such as:

- Blood flow
- Glomerular filtration rate
- Hormonal secretion

The sympathetic innervation primarily arises from the renal plexus, which influences blood vessel constriction and renal blood flow, while the parasympathetic innervation is less understood but is believed

to play a role in stimulating renal activity.

Conclusion

Understanding the **external anatomy of the kidney** is fundamental for grasping its critical functions within the human body. The kidneys, with their unique shape, protective coverings, and complex vascular system, are essential for maintaining homeostasis. Their external features, including the renal hilum, capsule, cortex, medulla, and pelvis, work together to perform vital processes such as filtration, waste removal, and fluid regulation. By recognizing these anatomical aspects, we can appreciate the intricate design of the kidneys and their importance in overall health and well-being.

Frequently Asked Questions

What are the main external structures of the kidney?

The main external structures of the kidney include the renal capsule, renal cortex, renal medulla, renal pelvis, and renal arteries and veins.

What is the function of the renal capsule?

The renal capsule is a thin layer of fibrous connective tissue that surrounds the kidney, providing protection and maintaining its shape.

How does the size of the kidneys compare to other organs?

The kidneys are typically about the size of a fist, measuring approximately 10-12 centimeters in length, which makes them relatively small compared to other organs like the liver or lungs.

What is the significance of the renal hilum?

The renal hilum is the area where blood vessels, nerves, and the ureter enter and exit the kidney, serving as a crucial point for renal function and communication with the rest of the body.

What role do the renal arteries play in kidney function?

The renal arteries supply oxygenated blood to the kidneys, which is essential for filtering waste and regulating electrolyte balance.

What is the difference between the renal cortex and renal medulla?

The renal cortex is the outer region of the kidney, containing nephrons and blood vessels, while the renal medulla is the inner region, consisting of renal pyramids that contain collecting ducts.

How do the external features of the kidney help in identifying its function?

The external features, such as the renal capsule and hilum, facilitate protection, blood supply, and waste transport, which are essential for the kidney's role in filtration and homeostasis.

What is the anatomical significance of the renal pelvis?

The renal pelvis is the funnel-shaped structure that collects urine from the renal calyces and transports it to the ureter, playing a key role in urine drainage.

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