

KUOMOLA Letter of Appreciation.

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MEDICAL LABORATORY Science

Critically examine the renal function of desert dwellers and the anatomical basis of their unique adaptation.

Renal functioning of a desert dweller

The ability of desert dwellers to produce a hyper-concentrated urine is attributed to their possession of extremely long loops of Henle, which is often quoted as an extreme adaptation to life in parched desert. The ability to produce concentrated urine by a desert dweller should be concentrated in the ~~size~~ size of the animal because smaller animals have kidneys which are relatively small compared with their cortex.

The thicker medulla of small desert rodents should therefore be viewed as the adaptation.

Anatomical Basis of their ~~adapted~~ ADAPTATION

Superiorly, the suprarenal (adrenal) glands sit adjacent to the upper pole of each kidney.

On the right side, the second part of the duodenum (descending portion) abuts the medial aspect of the kidney.

On the left side, the greater curvature of the stomach can drape over the superomedial aspect of the kidney and the tail of the pancreas may extend to overlie the renal hilum.

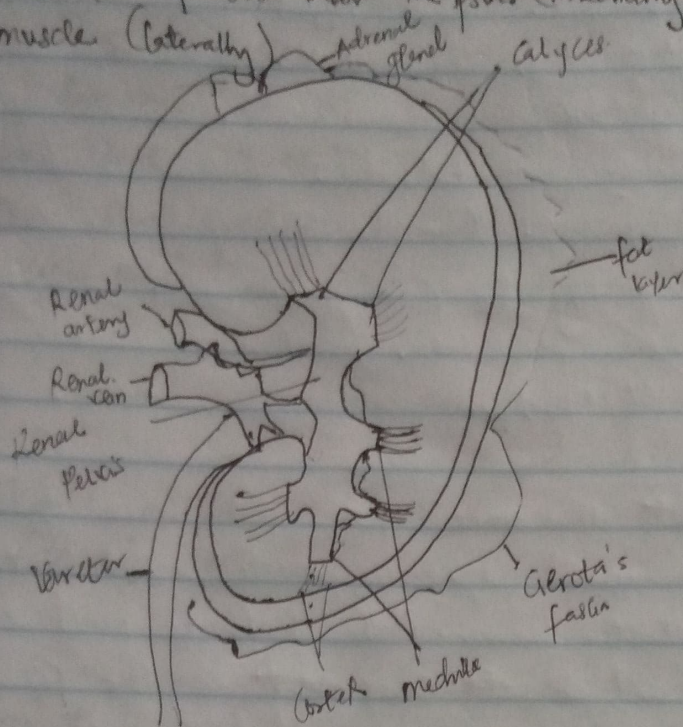
The spleen is located anterior to the upper pole and is connected by the splenorenal (lienorenal) ligaments.

Inferiorly to these organs, the colon typically rests anteriorly to the kidneys on both sides.

Posteriorly, the diaphragm covers the upper third of each kidney.

with the 12th rib most commonly crossing the upper pole

- The kidney sits over the psoas (medially) and the quadratus lumborum muscle (laterally)



Usually the kidneys are bean shaped structure and weight 150g in the male and 135g in the female

The first branch off of the renal artery is the inferior suprarenal artery. The posterior segmental artery supplies most of the posterior kidney with the exception of lower pole

Renal pelvis and superior ureteric branches also originate from the renal artery and supply the upper portion of the collecting system. Left renal vein is longer than the right as it crosses the midline to reach the inferior vena cava (IVC). Generally, the left gonadal vein drains into the left renal vein inferiorly while the left suprarenal vein drains into the superior aspect of the renal vein at approximately the same level.

Renal lymphatic - drainage parallel the venous drainage system.

Renal Nerve → Autonomic Innervation.

The kidney receives autonomic supply via both the sympathetic and parasympathetic portions of the nervous system.

The preganglionic sympathetic nervous innervation to the kidney arises from the spinal cord at the level of T8-L1. They synapse onto the celiac and aorticorenal ganglia and follow the plexus of nerves that run with the arteries.

Activation of the sympathetic system causes vasoconstriction of the renal vessels.

Parasympathetic innervation comes from the 10th cranial nerve vagus nerves and causes vasodilation when stimulated.

2. Write extensively on the clinical importance of the glomerular filtration barrier.

Glomerular filtration barrier is composed of the glomerular basement membrane, its a highly specialized blood filtration interface that displays a high conductance to small and midsize solutes in plasma but retains relative impermeability to macromolecules. Its integrity is maintained by physicochemical and signaling interplay among its three core constituent which are

- (1) Glomerular endothelial cell.
- (2) The basement membrane
- (3) Vascular epithelial cell (podocyte)

Interference with the integrity of the glomerular filtration barrier is the appearance of significant amount of protein in the urine.

These constituent are made up of a glycocalyx made up of proteoglycans and an adsorbed layer of plasma protein that is located between the endothelial cells and the fenestrated endothelial cells from the next layer. Next is the thick glomerular basement membrane (GBM) which is synthesized by podocyte and endothelial cells and has an inner layer composed of collagen type IV and laminin sandwiched between layer of heparin sulfate. Podocyte foot processes line the epithelial side of the GBM. The

The glomerular filtration barrier determines the composition of the

plasma filtrate. It restricts the filtration of molecules primarily on the basis of size.

The glomerular filtration barrier filters blood across the capillary walls of the tuft and it holds the filtrate of water and soluble substances to a cup-like sac known as Bowman's Capsule.

The filtration barrier normally acts to retain protein inside the lumen of the capillaries separate from the urinary space, however defects in the podocyte affecting the foot, tight junction and the slit diaphragm signaling, actin cytoskeleton, and cell matrix interactions have been identified in causing a breakdown of this barrier;

The Glomerular Basement Membrane filters out some proteins. This layer is a thick basement membrane that contributes importantly to the kidney filtration barrier. Both podocyte and endothelial cells synthesize and secrete components of the Glomerular Barrier membrane during glomerulogenesis and both cell types are likely important for maintaining the Glomerular Barrier membrane structure and function after glomerular maturation.