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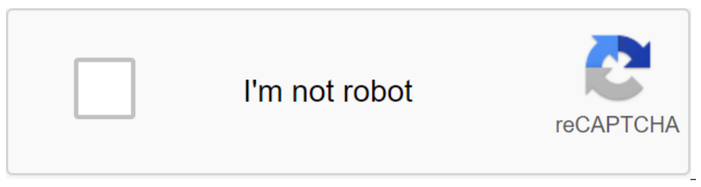

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Morphology, Biochemistry, PhysiologyPostegrad Orthopedics Series This chapter focuses on three levels of kidney morphology: embryonic development, gross anatomical structures, and histological features. The first section illustrates the progression of kidney development from the original rudimentary pronephroi to the metanephroi or permanent kidneys living in the posterior abdominal wall. The second section discusses the rough features of the kidneys, as well as its connection with other structures, vascular perfusion, lymphatic drainage and inertia of the nervous system. The final section explores the microanatomous structures that allow the kidneys to function as an integral component of the urinary system. Development of Kidney Anatomy Kidney Histology This is a preview of the contents of the subscription, log in to check access. The urogenital system. In: Moore KL, Persaud TVN, editors. Developing person: clinically oriented embryology. 9th o.p. Philadelphia: Saunders; 2013. page 245-53.Google ScholarAbdomen. In: Drake RL, Vogl AW, Mitchell AWM, editors. Grey's Anatomy for students. 3rd Ed. Philadelphia: Churchill Livingston; 2015. page 373-97.Google ScholarStructure and kidney function. In: Koeppen BM, Stanton BA, editors. Renal physiology. 4th o.p. Philadelphia: Mosby; 2007. page 19-30.Google ScholarUrinary system. In: Ross MH, Pawlina W, editors. Text and atlas histology: with correlated cells and molecular biology. 6th o.p. Philadelphia: Lippincott Williams and Wilkins; 2011. page 698-739.Google Scholar© Springer Science-Business Media New York 2016Jennifer M. McBrideEmail author1. Cleveland ClinicLerner College of Medicine Case West Reserve UniversityClevelandUSA Kidneys paired retroperitonea urinary system organs. Their function is to filter the blood and produce urine. Each kidney consists of the cerebral cortex, medulla and calices. Nephrons are the main functional units of the kidneys responsible for the removal of metabolic waste and excess water from the blood. In this article, we will study the microanatomy of nephron and find out how their function is related to their histological features. Studying kidney histology should not be as painful as kidney stones! We've come up with a simple step-by-step guide to help you master this complex but fascinating organ. If you need to start the jump a bit, why not refresh your memory with our introduction to histology and gross kidney anatomy. The kidney is a bean-shaped organ, with a pumping side surface, a concave medial surface and superb and lower poles. The medial surface has a kidney handle, which is a passage for renal vessels and a ureter. The capsule of connective tissue (kidney capsule) and a layer of perineum (perirenal) fat protect and soften the kidneys. The capsule contains a layer of contracting cell called myofibroblasts, make the capsule able to adapt to constant changes in the pressure in the kidneys. Suprarenal (adrenal) gland is located on the upper pole of the kidney, separated from it by perine fat. Both the kidney and the dredum gland are covered with a layer of renal fascia. The paranchem of the kidneys consists of two layers; outer bark and internal medulla. They make up about one million nephrons producing urine. Urine is collected into the kidney system, which is a number of distinctive chambers in the kidneys. Kaliki gradually increase in size, starting with small kalica, which open into larger potassiums, which are emptied into the renal pelvis. From the renal pelvis urine gets into the ureter. Part of the kidney, which contains potassium, renal pelvis, ureter and renal vessels, is called the renal sinus. The structure of the kidney starter pack awaits you here: Review the kidneys Explore the research unit Now let's take a closer look at the layers of parenchem. Renal cortex is an outer layer of renal tissue. It is darker than its main renal medulla because it receives more than 90% of the blood supply to the kidneys. The bark has a grainy appearance, as it mainly contains ovoid and spiral parts of nephrons (kidney calves and tangled trumpet-murders). Renal medulla looks striped because it contains vertical jade structures (pipes that collect ducts). It consists of renal (medullary) pyramids, separated by projections of the renal cortex (kidney columns). Apiki pyramids project to the renal pelvis and open in minor colic through perforated plates on their surfaces (area cribrosa). Each renal pyramid, with its surrounding cortical tissues, forms a renal lobe. Renal lobes are further divided into renal lobes. Each lobula consists of a group of nephrons emptying into one collecting duct. These structures can be observed in the coronal part of the kidney. Learn more about kidney cord and medulla with our training materials. Kidney Structure Explore the Nephron Study Unit of the Kidney. It produces concentrated urine, creating ultrafilter from the blood. Nefront consists of two main parts: the renal calf and the associated renal tubular system. Renal calves are located in the renal cortex, while their tubular systems extend to the medulla. Depending on their distribution and morphology, there are two main types of nephrons in the kidneys; cortical and juxtamedullary. Cortical nephrons have their calves close to the kidney capsule. Their pipe-killing are very short, extending only to the upper medulla. The juxtamedullary thrron hulls are located near the border of corticomedulllars. Their tubular systems are much longer, extending deep into the medulla. Each nefront is surrounded by a network of capillaries. Kidney branches arteries enter nephron as an afferent arteriole, form a capillary beam (glomerulus) and then emerge from the nephron-like efferent arteriole. The capillary network then continues to surround the nephrons of the renal tubular system as peritubular capillaries, forming a vasa recta around the nefront loop. Did you know that these peritububic capillaries are secretary erythropoietin (EPO)? A hormone that regulates the production of red blood cells. The renal calf is a nephron filtration apparatus. Each corpuscle consists of two main elements; glomerul and glomerular capsule (Bowman's). Glomerul is a network of capillaries formed by branches of the renal artery (afferent and efferent arterial). A glomerular capsule surrounds glomerul. It consists of two layers (temporal and visceral) that involve a cavity called a glomerular capsule space (Bowman's/urinary space). The inner visceral layer consists of special cells called podocytes. Subocytes cover the walls of glomerular capillaries, intertwining with each other and forming narrow gaps between their projections. The outer dark layer consists of a simple squamous cell epithelium and continuous with nephron tubes. Afferent and efferent arterials enter the renal calf at the vascular pole, while the place where the glomerular capsule narrows and continues as a proximal thick segment of the nefron is called the urinary poles. Renal calf is the starting point of urine formation. Systemic blood passes through the glomerular capillary system and is filtered to form primary urine (ultrafilter). It does this through a special filtration barrier that selectively filters the water and dissolves from the blood passing through the glomerular capillaries. Glomerular ultrafiltration is collected by glomerular space and passes into the kidney tube. The kidney filtration machine is formed by three layers of tissue; endothelial glomerular capillaries, the glomerular cellar membrane (GBM) and subocytes (visceral layer of the renal capsule). Glomerular capillaries are composed of phenestenated endothelials. Fenstresses function like pores. GBM is more complex than other epithelial basal membranes. It consists of three layers; thick central lamina densa and two thin layers (lamina rara interna and lamina rara externa). Here at Kenhub we realize that studying histology can be difficult! That's why we've come up with different training methods to remember the structure of these tissues a little easier. Why not try our histological slide quizzes? Subocytes cover the walls of glomerular capillaries. Their finger, as projections (pedicures) interdigitize, with narrow filtration slits (filtering the slit of the diaphragm) formed between the projections. Together, these three layers function as a selective filter, allowing only molecules below charge to get out of the blood and enter the renal tubular system. For example, blood cells, platelets, some proteins and some anions cannot leave the glomerular capillaries, while water and solutions pass through. The remaining unfiltered blood is carried from the glomerula by the efferent arterial and transferred back to the venous system. The tubular system is part of the nephron that processes glomerular ultrafiltration into the urine by reabsorping the necessary molecules and secreting unnecessary and waste. It has three parts; Proximal pipe-killing; tangled proximal tube-murders and a straight proximal nephron tuber; the descending and ascending limbs of the Dishal Trumpeting; The straight-diffal trumpeting and tangled castal pipe-killing Proximal Tube-murders of the Proximal Tube is the first part of the tubular system. It consists of confusing and direct segments. Proximal tangled tube-murder is found in the renal cortex and is continuous with capsule space. A direct proximal tube (or a thick descending limb) extends down into the medulla. Both parts consist of a simple cuboid epithelium rich in mitochondria and microvilles (the edge of the brush). This morphology is adapted to the proximal tubular function of absorption and secretion. More than half of the previously filtered water and molecules are returned to the bloodstream (reabsorbing) by proximal tubes. The Nefron Loop Loop of the Nephron is a U-shaped bend of the nephron that extends through the medulla kidneys. Histo logic, it consists of two parts; thin descending and thin ascending limbs. Both limbs consist of a simple squamous cell epithelium. Cells have several organelles, virtually no microvilles and low secretion abilities. Two limbs work in parallel, with the surrounding vasa recta capillaries, to regulate the filtration salt (e.g. sodium, chloride, potassium) and water level. More precisely, the descending limb is very permeable to water, less permeable for solutions, while the ascending limb is the opposite. Some authors believe that the nefron loop is synonymous with the Henle loop, while other authors include proximal straight pipes, nefront loops and distal direct trumpeting in this term. The dishecule pipe-killing Dishal pipe-killing also consists of straight and confusing segments. The direct distal tube (thick ascending limb) continues from the thin ascending limb of the non-front loop at the level between the inner and outer medulla. Intricate ditch pipe-killing projects in the bark. Both parts of the distulale consist of a simple cuboid epithelium, similar in morphology to proximal trumpets. The key difference between them is that the epithelial distal tubular umbia has less developed microvilles. Here there is reabsorbion and secretion, albeit to a lesser extent than in proximal Having lots of mitochondria mitochondria diffal tube-murders can reabsorb any useful substances (electrolytes) and emit any remaining waste by active transport. Particularly noteworthy is the absorption of sodium, under the regulation of aldosterone. The kidney collection system represents 10 tubes that move urine from the nephrons to the small potassium. Several distal tangled tubes from neighboring nephrons flow into the collection channel through connecting/collecting pipe-murders. Collecting ducts then travel through the kidneys of the medulla converging on top of each renal pyramid. Here, several ducts merge to form a single large papillary duct (Bellini), which opens into a minor calix through the creprose region. The collection of ducts is called cortical or medullary, depending on which part of the kidneys is parenchim, that part of the duct is located. They are made of epithelial cells that get taller as the ducts become larger. Cortical collectible ducts - simple cuboid epithelial medullary channels - simple pillar epithelial papillary ducts - a simple column of epithelium Two additional cell types are visible in these ducts. The main cells that pale color and play a role in the transport of ions. Dark colorings of intercalated cells are scattered among the main cells and are responsible for acid-basic balance. Collecting ducts is the last place to chance for water and electrolyte reabsorption from the filter of further urine concentration, especially under the influence of the antideuretic hormone (ADH). No more reabsorption occurs past the medullary collection of ducts. Located in the vascular pole of the nefron is a set of cells called the juxtaglomerular apparatus (JGA). It is formed by three types of cells; dens, juxtaglomecular granular (JG) cells and extra-glomer mezangal (Lacis) cells. Makula dens are located in the wall of the distal tube, at the point where the trumpet killer comes into contact with glomerulus. Here the usual cuboid epithelium of the distal tubular crowd together and become colonnaded in shape. Juxtaglomerular granular (JG) cells altered by smooth muscle cells found around the efferent, and sometimes effervescent, arteriole. The third type of JGA cells are extralomeric mezangal (Lacis) cells. They are located in a triangular space between afferent and efferent arterial. The Juxtaglomerular apparatus has two key functions; regulates glomerular blood flow and the rate of filtration regulates systemic blood pressure Glomerular blood flow is regulated by a feedback mechanism in which the dens macula responds to high levels of sodium chloride into the filter by releasing vasoconsquer-healing chemicals. These chemicals cause afferent arteriole to shrink, thereby reducing the glomerular pressure and, in turn, the rate of filtration. This system basically constant pressure pressure nephrons. Systemic blood pressure is regulated through the renin-angiotensin-aldosterone system. Low systemic blood pressure, recognized by baroreceptors, causes juxtaglomerular granular cells to secrete an enzyme called renin. Renin, in turn, activates the renin-angiotensin-aldosterone system, raising systemic blood pressure through the actions of angiotensin and aldosterone. The function of nephron is to maintain the body's fluid homeostasis, by secreting unwanted foods in the urine. Nephron anatomy specializes in creating urine from the blood through 4 key activities; filtration, reabsorption, secretion and selection. Nefron secretion and reabsorbion (figure) filtering occurs in the renal calf of nefron, and is described above. Reabsorbtion and secretion are activities that occur in the renal tubular system of nephrons. These processes fine-tune what substances are released and what is stored in the body. Reabsorbation is the process by which water and molecules lost from blood during filtration are reabsorbed back into the capillaries surrounding the nefront. Secretion is where water and molecules leave peritubular capillaries and introduce (or re-enter) urine filter. The remaining product, urine, is then excreted from the kidney through the ureters. Reabsorbation and secretion are finely controlled processes in which the epithelial cells of each segment of the tubular system are reabsorbized and secretees different substances to achieve maximum control over urine concentration. Regulating these processes includes; passive (opposite metabolic metabolic system), nervous (sympathetic nervous system) and hormonal (angiotensin, aldosterone and antidiuretic hormone) mechanisms. The result of this process is urine, a liquid highly concentrated with metabolic substances in the body and excess substances. In healthy people urine usually contains ions, urea, creatinine and variable amounts of water. Healthy urine does not contain microorganisms, glucose, blood cells and blood proteins. Now that you've mastered kidney histology, why not challenge yourself with our non-frontural quiz: quiz: convert multiple jpg to pdf ipad

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