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Modern Principles on Normal Morphological Indications of Kidneys

Nuriddinov Asliddin Mekhriddinovich
Bukhara State Medical Institute

Abstract: The kidney is one of the organs subjected to intense functional stress during human life and is a complex organ that performs the function of filtering waste from the blood through the production of urine, and is increasingly important in modern research. This article presents a review of the literature on the modern concepts of the normal morphological indicators of the kidneys.

Keywords: kidney, morphology, rat, nephron, tubules.

The kidney is one of the organs subjected to intense functional stress during human life and is a complex organ that performs the function of filtering waste from the blood through the production of urine, and is increasingly important in modern research. The kidneys also perform other vital functions, including maintenance of homeostasis, maintenance of blood pressure, osmotic pressure, and acid-base balance. Considering their results, it is undoubtedly important to develop ideas about the kidney and its importance for science [7].

In a person, 170 liters of glomerular filtrate is formed from 1700 liters of blood passing through the glomerular capillaries of both kidneys in 24 hours, of which 168 liters of liquid are reabsorbed and approximately 1.5-2 liters are separated into the urinary tract, making up the daily urine volume [8].

The human kidney is multilobed and contains 8 to 18 lobes. From the outside, the kidney is covered with a connective tissue capsule, and from the front with a serous membrane.

Kidneys of rats are bean-shaped solid organs, covered with a smooth and shiny thick fibrous capsule, no visible pathological changes are observed, and a well-defined gate can be seen on the medial surface. The fibrous layer of the kidney, consisting of dense collagen fibers, is easily separated from the kidney tissue.

In the kidneys, the outer cortex-cortical and the inner medulla are distinguished. The radial straight tubules of the medulla are located in the renal pyramids, and two or three pyramids can unite to form a renal tubule. Among the pyramids are columns of shell material - Bertini columns. The most characteristic structures of the cortex are kidney bodies (consisting of capillary balls and a ball capsule) and convoluted tubules [7].

The renal pyramid, divided by the renal columns, and the cortical substance located at its base form the kidney lobe [2].

A nephron is a structural and functional unit of the kidney, there are 1.3 million nephrons in each kidney, the length of the tubules of all the nephrons of the kidney is 120 km (the length of the tubules of 1 nephron is 50-55 mm). The nephron includes the following: ball capsule, proximal convoluted tubules, loop of Henle and distal convoluted tubules [11].

The capsule of the nephron (diameter 150-250 μm) is formed by two sheets. The outer sheet (parietal) is made of flat epithelium, the inner - (visceral) sheet is made of special podocyte cells. These cells have a nuclear part of the cytoplasm, from which large outgrowths - cytotrabeculae - are separated. Small outgrowths - cytopodia - grew out of cytotrabeculae. Between the cytopodia lie the filtration spaces. Between the sheets of the capsule there is Bowman's space, where the renal filtrate is separated. The leading artery enters the capsule, divides into capillaries and forms the kidney capsule. The diameter of the outgoing artery is two times smaller than the diameter of the incoming artery, which increases the pressure in the capillaries to 70 - 90 mm/sm and ensures the release of blood plasma into Bowman's capsule [1,5].

The proximal tubule of the nephron is a tube with a diameter of 60 μm and a length of about 14 mm. The tube is covered with a single-layer cylindrical epithelium, and on the apical surface of the cells, microvilli form a brush-like part. In the basal part of the cells, between the basal folds of the plasmolemma, many basal lines are visible, formed by the orderly arrangement of mitochondria. 85% of water, Na, Ca, glucose, amino acids, phosphates are absorbed in proximal convoluted tubules. The absorption process takes place with active energy consumption. Protein molecules are absorbed by pinocytosis. The same cells serve to separate dye and penicillin from urine [15].

The loop of Henley of the nephron consists of ascending and descending parts. The diameter of the descending part is 15 μm, the tube is composed of a single layer of squamous epithelium, without microvilli, and there are solitary outgrowths. The ascending part of the gyrus is covered with cuboidal epithelium, 35 μm in diameter and 9 mm in length. There is no brush part, but the basal line is well developed. Water, Na +, Ca- ions are absorbed due to the difference in osmotic pressure (Na-Ca pump) in the tubes of Henle's loop. The length of the distal tubules is 4.6 - 5.2 mm and the diameter is 20 - 50 μm. The structure of the epithelial part is similar to the ascending part of the loop of Genli. In this area, water is absorbed under the influence of ADG, which is synthesized in the hypothalamus (large cell supraoptic nucleus) [9].

A supraglomerular complex consisting of two parts is formed at the intersection of the glomerular artery with distal tubules. In the distal tubules, there is a dense stain, the nuclei of these epithelial cells lie in a row, because the epithelial cells are very thin. In the middle membrane of the leading artery, smooth muscle cells are replaced by pre-balloon cells - it consists of polygonal cells containing many granules. Pre-ball cells are in close contact with the inner layer of the artery and the epithelial cells of the dense spot. A mesangial island is located between the incoming and outgoing arteries [16].

A decrease in the volume of blood or tissue fluid is received by afferent arterioles, which act as baroreceptors, and changes in the concentration of Na + ions are recorded by a dense spot. At the same time, pre-globuler cells synthesize renin, under its influence, angiotensinogen in the blood plasma changes to angiotensin II, which in the lungs turns into angiotensin III, which is the most powerful vasoconstrictor (hypertensive) hormone. [6,8,11].

The kidneys play a major role in accelerating the removal of foreign substances from the body, it is an excellent passive filter that cleans the blood of toxins and decay products. They produce urine to accelerate the elimination of toxins from the body, regulate the fluid content in the body, maintain the acid-alkaline balance of the blood, which affects the sensitivity to radiation. Factors that overload the kidneys are stress, increased meat content in the diet, slags, etc. In any case, kidney dysfunction increases the strain on other organs. If slags, decomposition products, radionuclides are not excreted with urine, they are excreted with sweat through the pores of the skin. Normal functioning of the kidney helps to remove toxins from the body [21].

Substances that improve kidney function include magnesium, calcium, and vitamin C [14].

The kidney performs many functions. It participates in almost all types of metabolism and maintains body homeostasis. Thus, the kidney is an important link in the formation of adaptive responses to various external influences or diseases originating from other organs and systems [3].

The kidney and its structures have been studied by scientists for centuries. To date, many issues have been studied, such as the development of organ layers, development of vessels, innervation apparatus, topography, histogenesis, and morpho-biological and morpho-biochemical changes of this organ [13].

According to scientists, the kidney is not only a member of the urinary system, but also an active component of the endocrine system. Researchers have proven that many endocrine hormones are produced by the kidneys. In the kidneys, receptors are located in certain areas, and their excitability affects the regulation and control of the body [22].

In mammals, the kidney is a bean-shaped organ, covered with a smooth, shiny capsule, with a distinct gate on its medial surface, and no other pathological or altered macroscopic abnormalities are visible to the eye [14].

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