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TOPOGRAPHIC ANATOMY OF KIDNEYS AND CHANGES IN THE SIZE AND POSITION OF A SINGLE KIDNEY

SCIENTIFIC RESEARCH GROUP:

Pivtorak Volodymyr
MD, PhD, DSc, Professor,
Head of the Department of Clinical Anatomy and Operative Surgery
National M. I. Pirogov Memorial Medical University, Vinnytsia, Ukraine

Monastyrskiy Volodymyr
MD, PhD, DSc, Professor,
Department Surgery Faculty of Postgraduate Education
National M. I. Pirogov Memorial Medical University, Vinnytsia, Ukraine

Pivtorak Kateryna
MD, PhD, DSc, Professor, Department of Clinical Pharmacy and Clinical Pharmacology
National M. I. Pirogov Memorial Medical University, Vinnytsia, Ukraine

Bulko Iryna
MD, PhD, Associate Professor, Department of Human anatomy
National M. I. Pirogov Memorial Medical University, Vinnytsia, Ukraine

Summary. *The article examines the influence of macroscopic and microscopic changes in the kidney on function and the development of pathological processes. Kidney volume has been shown to be the optimal parameter for predicting kidney function. It has been established that weight gain often leads to nephroptosis. The variability of the renal vessels in terms of number, sources of departure from the main vessels, method of branching, spatial relationships of the branches was noted.*

Keywords: *single kidney, topographic anatomy, kidney sizes, structural changes, renal artery reconstruction*

Adaptation processes in a single kidney after nephrectomy are manifested in the early stages by compensatory hypertrophy of the kidney [1]. A number of studies have found that body weight and body mass index are independent predictors of the development of chronic kidney disease after nephrectomy. It has been established that the greater the weight of the kidney, the greater the predictability of survival after nephrectomy in the elderly [2]. Normal renal aging is characterized by progressive nephrosclerosis with loss of functional glomeruli and decline in

overall kidney function as determined by GFR. To some extent, the decrease in the volume of the kidney cortex due to nephrosclerosis is compensated by nephron hypertrophy. However, when the age of patients exceeds 50 years, this compensation becomes less adequate, and the total volume of the kidneys begins to decrease [3]. In healthy adults under the age of 65, renal parenchymal volume is determined by body size and gender and is closely related to glomerular filtration rate. This indicates that the volume of renal parenchyma varies depending on metabolism and is closely related to kidney function.

The conducted histological studies showed that on the 7th day after experimental nephrectomy in the kidneys of young and sexually mature animals, against the background of vascular reorganization, there are changes in all components of nephrons. In the cortical substance, most of the renal corpuscles are hypertrophied, blood filling of the hemocapillaries of vascular glomeruli is noted in them. The lumens of the capsules are also increased, compared to the renal corpuscles of animals of the intact group [4].

Patients with a single kidney, after nephrectomy, are in the risk group, as the risk of developing kidney stones increases [5]. This may be due to compensatory hypertrophy, structural and physiological changes that lead to stone formation [6]. Weight gain often leads to nephroptosis. What position the kidney will take in this case is important to know in order to assess the mechanisms of the development of complications. A detailed study of the anatomy of the kidney is necessary to optimize preoperative planning and select a specific surgical technique [7].

Assessment of renal measurements, such as length, width, and thickness, is important in the diagnosis and treatment of many kidney disorders, as there is a close relationship between kidney size and kidney function [8]. According to researchers, after nephrectomy, the renal function of the contralateral kidney decreases in patients regardless of the choice of access (open, laparoscopic) and depends on the volume of renal parenchyma loss. Kidney volume is considered the most accurate measure of kidney size. Modern studies have shown that kidney volume is the optimal parameter for predicting kidney function. Changes in the size of the kidneys from one examination to another can be an important indicator of the presence or progression of the disease. An increase in kidney volume was observed to a greater extent after nephrectomy than after nephrectomy.

The height of the location of the right and left kidneys is different. The left kidney is normally located at the level from Th11 to L2-L3. The right kidney is located at the level of Th12 - L3. According to literature data, based on computer tomography studies, the syntopy of the kidneys is as follows. The right kidney is located approximately 1-2 cm below the left kidney due to the location of the liver. The diaphragm behind covers the upper third of the kidneys, where there is also a close connection with the pleura, which extends to the level of the 12th rib. From the front, the right kidney is limited by the liver and the curve of the right colon. The average distance between the upper pole of the right kidney and the liver is 7.5 ± 1.5 mm. The descending part of the duodenum with the head of the pancreas covers the right renal cavity. The left kidney is limited in front by the left curve of the large intestine. According to computer tomography, the distance between the left kidney and the spleen ranges from 1 to 15 mm, with an average of 7.3 ± 1.4 mm. The right kidney from the head of the gland is at a distance of 22 to 41 mm, the average values

are 36.5 ± 5.9 mm. The left kidney is much closer to the tail of the gland, the distance was in the range of 3 - 32 mm, the average value was 18.7 ± 2.6 mm. The upper poles of both kidneys are adjacent to the adrenal glands, which can occlude the kidney, especially on the left. The back surface of the kidney is adjacent to the lumbar muscle [9].

Renal vessels, in particular, arteries, according to morphologists [10], are characterized by variability in sources of departure from main vessels, topography, method of branching, spatial relationships of branches, syntopy with other anatomical structures, in number and morphometric characteristics. Duplication of the renal arteries is more common on the right side. Duplicate arteries are often similar in caliber, with the exception of accessory renal arteries, which occur in approximately 25% of patients. Accessory arteries to the upper pole are usually smaller in diameter than to the lower pole. The study of the sexual characteristics of the structure of the renal arteries showed that additional arteries are found in men in 53% of cases, and in women - in 47% of observations. The presence of additional renal arteries is a risk factor for the development of post-transplantation complications. The right renal artery passes behind the inferior vena cava and is usually posterior and superior to the left and right renal veins. In approximately 30% of cases, the renal artery is located in front of the renal vein. Knowledge of renal artery variations is becoming increasingly important due to the increase in the number of kidney transplants, vascular reconstructions, and various surgical, urological, and radiological methods performed in recent years.

Improvements in ultrasound, computer and magnetic resonance imaging enable morphologists to reliably assess the individual variability of the kidney and other organs of the retroperitoneal space in normal conditions and after surgical interventions. However, according to the literature, where the intravital topographic anatomy of the kidneys is highlighted, only visualization of the kidneys in tumors, inflammations, cysts and other pathological processes is considered [11]. There are isolated publications covering the topographical anatomy of the kidney in normal conditions, as well as the size and mobility of the kidney. Increased mobility and nephroptosis detected by ultrasound in patients with a single kidney aged 14-17 years. Urologists detect multiple rotations of a single kidney and its nephroptosis [12].

The peritoneum, its folds and mesentery take part in fixing the kidney. On the right, the folds of the peritoneum, moving to the front surface of the kidney from the liver, duodenum, and colon, form a series of ligaments: duodenal-renal (lig. duodenorenal) and hepatic-renal (lig. hepatorenal), which fix the kidney. The left kidney is fixed by the pancreatico-renal ligament (lig. pancreaticorenal) and the splenic-renal ligament (lig. lienorenale). Some role in fixation of the kidney to the posterior abdominal wall is assigned to the root of the mesentery of the ascending and descending colon. The anterior abdominal wall is involved in fixing the kidney as the main link that provides intra-abdominal pressure. Perirenal adipose tissue (capsula adipose renis) plays an important role in preserving the physiological state of the kidney, the reduction of which volume contributes to the occurrence of nephroptosis. The kidney with adipose tissue is enclosed in the perirenal fascia, which is attached to the front side of the body of the lumbar vertebrae and above to the diaphragm. In addition, the kidney is fixed by connective tissue cords passing

through the fatty tissue between the fibrous capsule and the fascia of the kidney. Laterally, the kidney is supported by its own blood vessels. The renal vascular pedicle interferes with the displacement of the kidney down and laterally, but the vessels can stretch and lengthen by 1.5-2 times.

Determining the topography of the kidneys is of great importance for carrying out diagnostic manipulations (kidney biopsy) and surgical interventions on the kidneys, urinary tract and renal vessels. Monitoring the size of the kidneys and their comparison can be the main criterion for detecting kidney damage. Increased kidney size is the main symptom of pyelonephritis and renal ischemia [13]

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