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D. Shuba
Operative surgery and topographical anatomy department
(head – prof. V.G. Dudenko) Kharkiv National Medical University

MORPHOMETRIC CHARACTERISTICS OF INFERIOR EXTREMITY RENAL PYRAMIDS OF A HUMAN KIDNEY, CONSISTING OF THREE EXCRETORY SECTORS

МОРФОМЕТРИЧНІ ХАРАКТЕРИСТИКИ НИРКОВИХ ПІРАМІД НИЖНЬОГО КІНЦЯ НИРКИ ЛЮДИНИ, ЩО СКЛАДАЄТЬСЯ З ТРЬОХ ЕКСКРЕТОРНИХ СЕКТОРІВ

Резюме. На топографічних зрізах 89 нирок людини вивчені морфологічні характеристики ниркових пірамід нижнього кінця нирки. Отримані дані можуть бути використані в оперативній нефрології для розробки нових методик органозберігаючих втручань на нирці.

Ключові слова: нирка, ниркові піраміди, індивідуальна анатомічна мінливість.

The work is done in accordance with the scientific theme: "Anatomy of human kidney applied to minimally invasive surgical interventions"; state registration number: 0104U002234.

Currently available information about the structure of human kidneys reflects different aspects of their morphology at macro and micro structural level [1-4]. However, many important questions, devoted to anatomy of renal parenchyma and individual human renal pyramids, are still not completely reflected in scientific literature devoted to nephrology surgical practice [5-7]. An inferior extremity of a kidney is of particular interest in surgical nephrourology, as it requires some surgical intervention most of all. This study aims to contribute on creation of anatomical basis for development of modern organ operations techniques on kidney.

The aim was to study the features of individual anatomical variability on renal pyramids sections of the kidney inferior extremity at mature people and at elderly.

As a research material were used obtained with a macrotom topographical sections of 89 human kidneys inferior extremities, divided by age groups, in each of which we studied a number of renal pyramids, their topography and morphometric characteristics.

In the inferior extremity, which renal excretory channel is represented by three excretory sectors, we identified some features of morphometric characteristics of medullary substance pyramids, which are reflected in the table.

Table

The amount and morphometric characteristics of inferior extremity renal pyramids of a three-sector kidney

Pyramid	N	Base diameter (mm)			Height (mm)			Volume (mm³)		
		average	min	max	average	min	max	average	min	max
PR i	33	14,4	3,2	24,1	14,11	4	25	1710,32	17	5305,5
PR ipl	31	16,78	6,0	36,5	15,86	6	37	2177,56	156	9685,0
PR ips	8	9,66	5,1	14,7	10,83	5,1	18	674,79	48	2590,0
PR ipm	32	10,62	4	24,6	10,36	5	24	630,4	39,6	1732,4
PR ial	33	13,7	4,6	33,4	13,39	4,6	33,4	1360,45	39,4	4381,6
PR ias	7	13,01	4,6	21,2	13,66	5	21,2	1066,59	150	2356,7
PR iam	36	12,31	4,6	20,8	12,26	3	19,3	1179,52	101,4	4188
onli	**180**	**13,33**	**3,2**	**36,5**	**13,08**	**3**	**37**	**1357,44**	**17**	**9685,0**

The above table shows that the smallest average base diameter of the pyramid is defined in the lower posterior median pyramid (PRips) and is 9,66 mm. The lower posterolateral pyramid (PRipl), located on the same rear surface, holds the largest average value of the base diameter of 16.78 mm. The average diameters of pyramids, lying on the front surface of an inferior extremity of the kidney, differ little from each other, from 12.31 mm in the lower anteromedial pyramid (PRiam) to 13.7 mm in the lower anterolateral pyramid (PRial). Considering minimum and maximum values of the inferior extremity renal pyramids of a three-sector kidney, we noted the following. The minimum values of renal pyramids diameters, located on the front surface of the organ, are identical and average 4.6 mm. The minimum values of the renal pyramids diameters belonging to the rear surface of the inferior extremity of kidneys are little distinguishable from 4.0 mm in the lower posterior-medial pyramid (PRipm) to 6.0 mm in the lower posterolateral pyramid (PRipl).

The smallest minimum value diameter revealed by us in the lower renal pyramid (PRi) is 3,2 mm. Maximum diameters magnitudes of inferior extremity renal pyramids of the kidney differ more than 2.5 times. Thus, the smallest maximum diameter we have defined in the lower posterior medial pyramid (PRips), it is 14.7 mm. At the same rear surface of the inferior extremity of the kidney is a pyramid with the largest maximum diameter (36.5 mm), it is the lower posterolateral pyramid (PRipl).

Maximum values of the renal pyramids diameters, lying on the front surface of the inferior extremity of the organ differ quite sharply from 20.8 mm in the lower anteromedial pyramid (PRiam) to 33.4 mm in the lower anterolateral pyramid (PRial) (Fig. 1).

Assessing the height of inferior extremity renal pyramids of the kidney (Fig. 2), we noticed a rather equal average height of all the pyramids on both the front and the rear surfaces: from 10.36 mm in the lower posterior-medial pyramid (PRipm) to 15.86 mm in the lower posterior-lateral pyramid (PRipl). Average height of renal pyramids, located on the front surface of the inferior extremity of the kidney, are even less distinguishable from 12.26 mm in the lower anteromedial pyramid (PRiam) to 13.66 mm in the lower antero-median renal pyramid (PRias).

We consider it necessary to note that the three-sector kidneys, unlike the two-and four-sector, the average height of the lower anterior-median renal pyramids (PRias) and lower posterior-median pyramid (PRips) are sufficiently large (13.66 mm and 10.83 mm respectively).

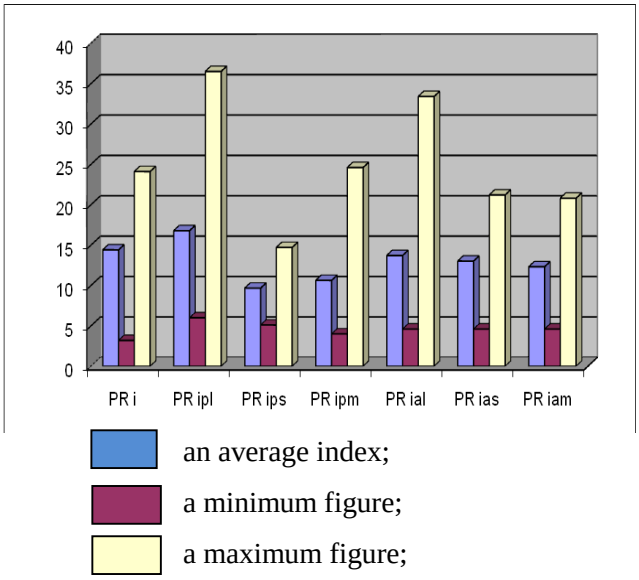

Fig. 1. Histograms: renal pyramids base diameters in the kidney inferior extremity, including three excretory sectors

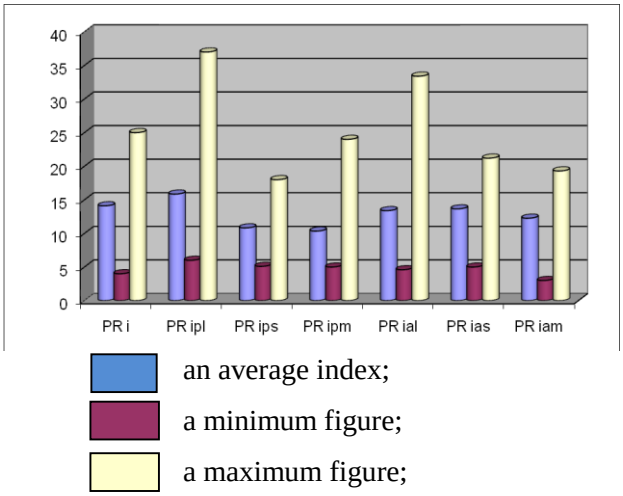

Fig. 2. Histograms of: renal pyramids heights figures of the kidney inferior extremity including three excretory sectors

When studying the minimum height values of renal pyramids we identified the smallest height in the lower anteromedial pyramid (PRiam) of 3.0 mm. The largest height of the minimum value we found in the lower posterolateral pyramid (PRipl) of 6,0 mm. It should be noted that the minimum heights of the front surface of pyramids of the kidney inferior extremity predominate over minimum renal pyramids heights of the inferior extremity rear surface of the organ.

The maximum values of the renal pyramids heights on the front and rear surfaces of the inferior extremity of a three-sector kidney are relatively evenly distributed. The main difference we observed on the rear surface of the kidney studied part. As here

we have identified the least 18.0 mm in the lower posterior median pyramid (PRips) and the highest 37.0 mm in the lower posterolateral pyramid (PRipl) of the studied height parameter. The highest maximum height on the front surface we noted in the lower anteromedial pyramid (PRiam) – 19.3 mm.

The greatest interest in our opinion, represents characteristic of renal pyramids volumes of the inferior extremity of a three-sector kidney (Fig. 3). The difference between the average volumes of renal pyramids, arranged on the rear surface, achieves to three times. Thus, the average volumes of the lower posterior-median pyramids (PRips) and lower posterior-medial pyramids (PRipm) are the smallest (674.79 mm and 630.4 mm³ respectively). At the same rear surface of the inferior extremity of the kidney and is a pyramid with the highest volume it is the lower posterolateral pyramid (PRipl) 2177,56 mm³. Average

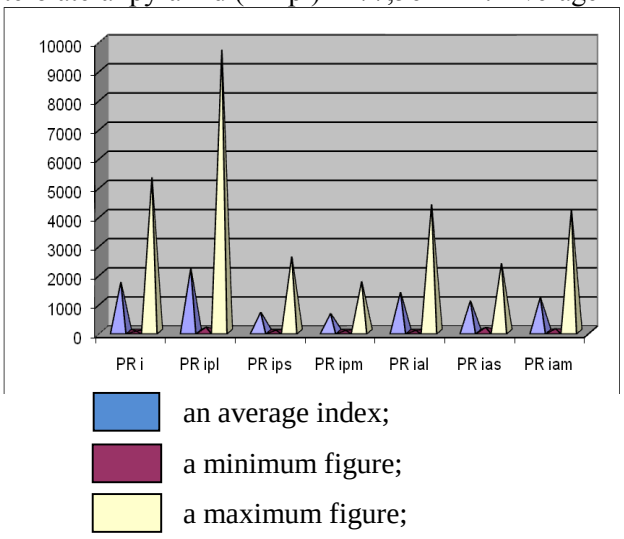

Fig. 3. Volumes of renal pyramids of the inferior extremity of the kidneys, including three excretory sectors

volumes of renal pyramids, lying on the front surface of the inferior extremity of the organ, are not sharply distinguishable from 1066.59 mm ³ (in the lower anteromedian renal pyramid (PRias) to 1360.45 mm³ in the lower anterolateral pyramid (PRial)). At the same time differences of minimum and maximum volumes of renal pyramids of the inferior extremity of a three-sector kidney are sharply expressed. Thus, the smallest minimum of the volume is defined by us in the lower renal pyramid (PRi) – 17 mm³, and the highest - in the lower posterolateral pyramid (PRipl) – 156 mm³. Noteworthy is also the lower anteromedian pyramid (PRias), its minimum volume achieves 150.0 mm³.The highest maximum volume according to our data, belongs to the lower posterolateral pyramid (PRipl) – 9685,0 mm³, and the smallest maximum of the volume of 1732.4 mm³ is marked by us in the lower posteromedial pyramid (PRipm). It must also be noted that the maximal values on the rear surface of renal pyramids volumes prevail over those on the front surface of the inferior extremity of the three-sector kidney.

Conclusions. 1. Thus, it can be concluded that volumes of pyramids of a three-sector kidney arranged on the front surface of the inferior extremity of the kidney are larger than the volumes of pyramids arranged on the rear surface of the organ. 2. The volume of pyramids arranged on the front surface, differ little from each other, while the volumes of pyramids on the rear surface differ by more than three times. 3. The largest volume belongs to the lower posterolateral pyramid (PRipl). The lower pyramid (PRi) has one of the largest volumes.

Prospects of further research. The data obtained in the study of individual anatomical features of renal pyramids of an inferior extremity of a kidney should be considered when performing anatomical organ-based operations. This, the further research will optimize approaches to surgical interventions on kidneys through individual planning of surgical interventions.

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МОРФОМЕТРИЧЕСКИЕ ХАРАКТЕРИСТИКИ ПОЧЕЧНЫХ ПИРАМИД НИЖНЕГО КОНЦА ПОЧКИ ЧЕЛОВЕКА, СОСТОЯЩЕЙ ИЗ ТРЕХ ЭКСКРЕТОРНЫХ СЕКТОРОВ

Резюме. На топографических срезах 89 почек человека изучены морфометрические характеристики почечных пирамид нижнего конца почки. Полученные данные могут быть использованы в оперативной нефрологии для разработки новых методик органосохраняющих вмешательств на почке.

Ключевые слова: почка, почечные пирамиды, индивидуальная анатомическая изменчивость.

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Abstract. On the topographical sections 89 human kidneys studied the morphological characteristics of the renal pyramids of the lower end of the kidney. The data obtained can be used in operational nephrology for developing new methods of organ interventions on the kidney.

Key words: kidney, kidney pyramid, individual anatomical variability.

Kharkiv National Medical University (Kharkiv)

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Рецензент – проф. Кривецький В.В. (Чернівці)