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Short Paper

A case of multipyramidal kidneys with smooth surface in a New Zealand white rabbit

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ABSTRACT

The focus of the present study was to present a case of multilobar kidneys with smooth surface in one New Zealand white rabbit. It is well known that the kidneys of rabbits are unipyramidal. During dissection, it was found that there was an exception in one female animal which was clinically healthy and sexually matured, aged 8 months and with weight 3.2 kg. After evisceration of both kidneys, and incision in the lateral border of the fresh organs, it was found that the cortex and medulla were constructed by pyramidal-shaped lobes. The apex of the lobes formed papillae and got up into calices into the renal sinus. The renal pelvis was a concave structure. We conducted an imaging anatomical study. The anatomical preparations were studied in liquid isotonic medium, using an ultrasound device with linear transducer. Thus, we confirmed the results with these of the organs' morphological features. The cortex with the fibrous capsule were hyperechoic, compared to the relatively hypoechoic image of the pyramidal lobes. The papillae forming the apex were outlined by the hyperechoic calices. The renal pelvis and hilus were hypoechoic findings. After fixation, the kidneys in 10 % water solution of formalin the pyramidal-shaped lobes were preserved and with well-distinguished papillae. The calices protruded into the sinus. In all methods, we found seven well-defined pyramidal-shaped lobes.

INTRODUCTION

Rabbit kidneys are paired organs which are included in *in vitro* studies to investigate renal function. The right kidney is with cranial location, compared to the left kidney. Both kidneys are visible with anatomical imaging technics such as X-ray devices. The organs have an important role in the calcium homeostatis (1).

The literature data describe the rabbit kidney as unipolar and with bean shape. At the same time, the rabbit kidney is unipapillary and is composed of the well distinguishable capsule, cortex, and medulla (2,3).

Other authors assume that the kidneys in the rabbit and rodents are unipapillate because there is only one calix that opens directly in the ureter (4).

It is known that the kidneys of rabbits are unipyramidal. They have a primitive structure. They are classified as unipapillary (unilobar, unipyramidal) (5-7).

Rabbit kidneys have asymmetrical and retroperitoneal localization. The cranial pole of the right kidney touches the caudate process of the liver. The caudal pole of the right kidney reaches descending part of the duodenum. The left kidney touches ventrally the jejunal loops, and ventrocranially - the descending colon and the body of the pancreas and laterally the left abdominal wall (5,8,9).

The contemporary investigations in Human Medicine include rabbits as animal models to study the protocols and approaches for transplantation, including the animals as recipients and donors. The rabbit kidneys are used as anatomical model to study the development of unilateral and bilateral kidney agenesis and kidney lesions in some animals (10,11).

MATERIAL and METHODS

During dissection it was found that there was an exception in one female rabbit which was clinically healthy and sexually matured, aged 8 months and with weight 3.2 kg. After evis-

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ceration of both kidneys, an incision in the lateral border of the fresh organs was performed. We conducted an imaging anatomical study. The anatomical preparations were studied in a liquid isotonic medium, using ultrasound device Diagnostic Ultrasound System (model DC-6V SHENZHEN MINDRAY BIO-MEDICAL, Electronics CO. LTD, CHINA) with linear transducer (model 6C2, with frequency of 10 MHz). After fixation of the kidneys in 10% aqueous formaldehyde solution (Merck KGaA, Darmastadt, Germany) the pyramidal shaped lobes were preserved. The obtained results were interpreted in accordance with the rules of Veterinary Gross Anatomical Nomenclature (12).

RESULTS

After evisceration of both kidneys, and incision in the lateral border of the fresh organs, it was found that the cortex and medulla were constructed by pyramidal-shaped lobes. The apex of the lobes formed papillae and got up into calices into the renal sinus. The renal pelvis was a concave structure (Fig. 1).

When study both kidneys in a liquid isotonic medium, it was found that the cortex with the fibrous capsule was hyperechoic, compared to the relatively hypoechoic image of the pyramidal lobes. The papillae forming the apex were outlined by the hyperechoic calices. The renal pelvis and hilus were hypoechoic findings. Thus, we confirmed the imaging results with these of the organs' morphological features (Fig. 2).

After fixation of the kidneys in 10 % water solution of formalin the pyramidal shaped lobes were preserved and with well-distinguished papillae. The calices protruded into the sinus. The renal pelvis was a concave structure (Fig. 3). Thus, the results confirmed the data, obtained on fresh anatomical preparations from both kidneys.

DISCUSSION

The results from our study confirmed the anatomical data for the rabbit kidneys because we found that the right kidney was cranially situated, compared to the caudal localization of the left kidney (1). At the same time, we assume that the obtained results could be applied successfully when study the imaging anatomical features of the organs, using different techniques.

According to us the rabbit kidneys are in a bean shape. Thus, our results correspond to the thesis for the organs' external view. But on the other side, our results are different from the given data, because we found a case in which both organs are multipyramidal with smooth surface, with distinguishable capsule, cortex, and medulla. Our theory differs from that in which the rabbit kidney is described as unipapillary (2,3).

Our thesis is that the right and left kidneys of the rabbit have seven well-developed pyramidal lobes, distinguished papillae, outlined by calices. In this aspect, our results contradict hypothesis (4) that the kidneys in this animal species are

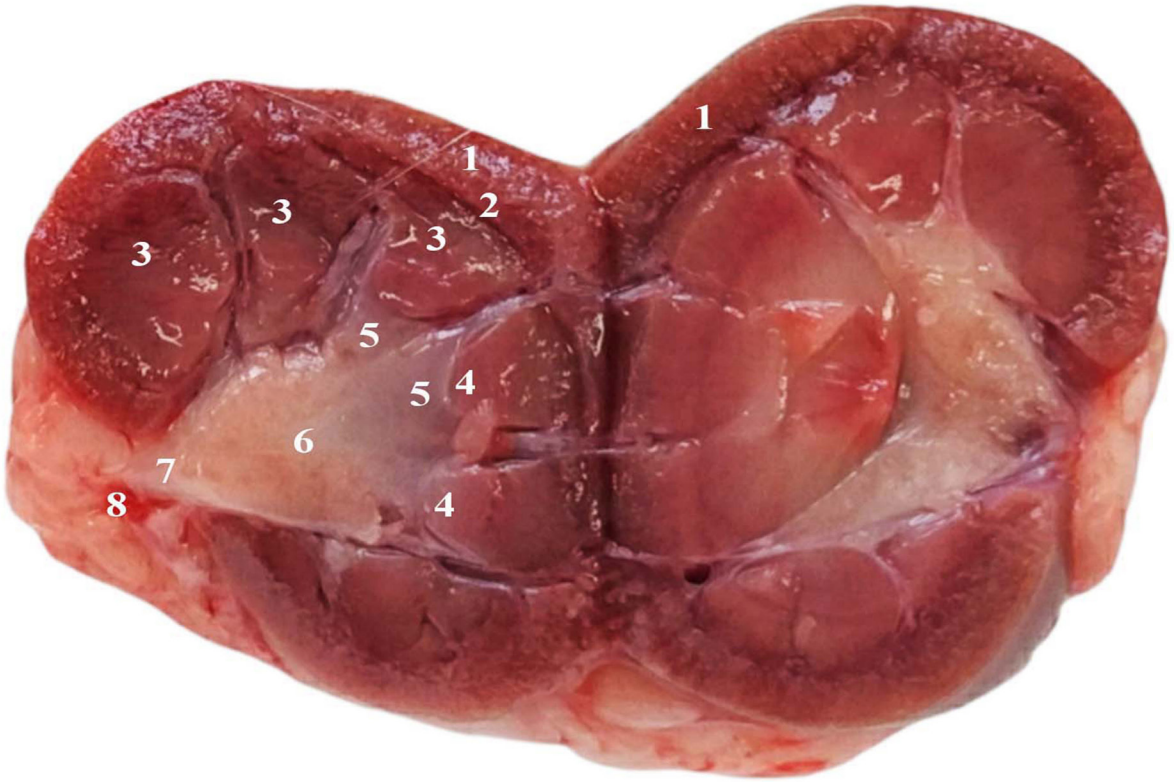

Figure 1. Middle cut of the rabbit kidney. (1) cortex of kidney; (2) medulla of kidney; (3) renal pyramid; (4) renal papilla; (5) renal calix; (6) renal pelvis, (7) kidney hilus; (8) adipose capsule.

Figure 2. Ultrasonic image of rabbit kidney in longitudinal aspect. (1) renal cortex; (2) renal medulla; (3) renal pyramid; (4) renal calix; (5) kidney pelvis; LM-liquid medium. (10 MHz linear probe).

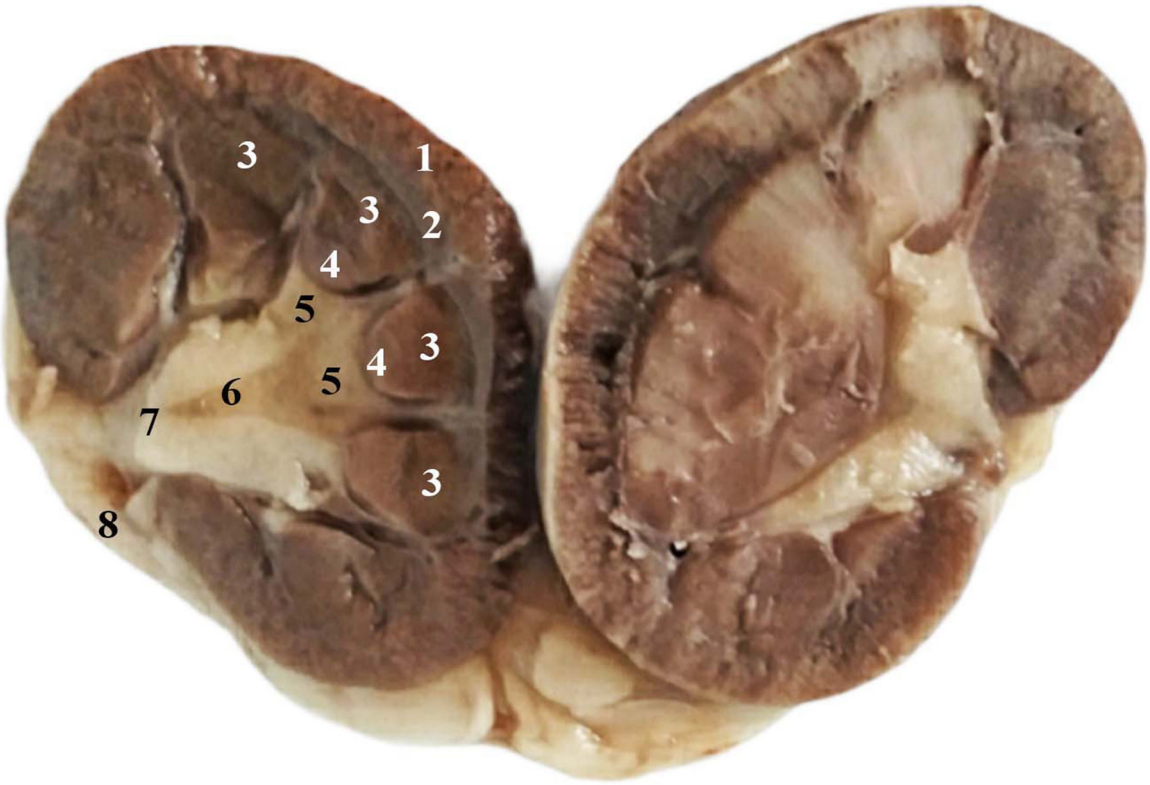

Figure 3. Middle cut of the rabbit kidney after fixation in 10 % water solution of formalin. (1) cortex of kidney; (2) medulla of kidney; (3) renal pyramid; (4) renal papilla; (5) renal calix; (6) renal pelvis, (7) kidney hilus; (8) adipose capsule.

unipapillary, with one calix.

The case, which we have presented demonstrated that the right and left kidneys have a complex structure, because they are composed of well-defined pyramidal lobes, with formed papillae, cup-like expansions and a concave renal pelvis. That gives us the motive to conclude that in the same examples the rabbit kidneys show variations, which are visible on fresh preparations, on ultrasound images, and after treatment with 10% of water solution of formalin. Our results differ from the data of some authors (5; 6; 7), who suspend the theory that the rabbit kidneys are unipyramidal because we prove that both kidneys are with smooth surface and multipyramidal.

CONCLUSIONS

We claim that these results could be applied as a morphological and imaging anatomical base when studying the protocols and approaches for transplantation and the development of unilateral and bilateral kidney agenesis and kidney lesions in some animals. That is in accordance with the thesis for the usage of the rabbit kidneys as an anatomical model (10,11,13).

DECLARATIONS

Ethics Approval

The experiments were conducted in strict compliance with the ethical guidelines of Trakia University (protocol 209/24.10.20 12;213/14.11.2012;220/12.12.2012; 231/04.02.2013).

Conflict of Interest

The authors declare that there have no conflict of interests.

Author Contributions

Idea, concept and design: KSY, RD, ÖG.

DataCollection and analysis: KSY, RD, AR, DY, NT, TH.

Drafting of the manuscript: KSY, ÖGD.

Critical review: RD, ÖGD, DY, GK.

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