

MORPHO – HISTOLOGICAL STUDY OF THE KIDNEY IN ONE – HUMPED CAMEL (*Camelus dromedarius*)

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ABSTRACT

The current study was carried out in the college of Veterinary Medicine-University of Basrah for observing the morphological and histological of the kidney in one-humped camel. In this study 5 fresh kidneys from adult healthy camel bought from slaughterhouse of Al-Samawah and Al-Zubair city. The morphological study include 4 kidneys, the measurement were recorded, including weight, length, width and thickness, 2 kidneys were used for histological study investigated by using histological methods, three stains were used H&E, PAS and Mallory. The morphological study revealed that the kidney in one – humped camel is bean shaped smooth, multipapillary, in which the fusion of renal crest, there are two areas, outer dark red color with granulated appearance cortex and medulla showed two zones outer red striated and pale inner. It is contributed about 0.6 % of the body weight. The ratio of the thickness of medulla to cortex was 4 : 1. The histological examination show that high number of long loops of Henle and vasa recta in the kidney. In the medulla the nephrons in dromedarian camel are occupied with well-developed loops of Henle and number of juxtamedullary nephrons kidney is very high. In the outer medulla, the vasa recta were grouped obviously in to specific vascular bundles which distributed within the bundles of Henle and collecting tubules. The inner medulla was thicker than the outer. Cup like structures were formed by projecting of the crescentic pelvis and extend to fit the apex of the (20 -24) renal pyramids. The characteristics

above showed that high percentage of long loop of Henle there for that the one – humped camel's kidney possessed a high reabsorption and hence promoting the production of high concentrated urine.

INTRODUCTION

Camels are a large animal that lives in deserts with harsh environments. In addition it is thought that the dromedary was first domesticated in southern Arabia about 5000 years ago. It is used for transport and for meat and milk (1). The function of urinary system, especially kidneys is to excrete the waste products and nitrogenous substances, and maintain the balance of salt in the body with regulation the blood pressure by manufacturing some enzyme such as rennin (2). The kidneys of dromedary camel are bean shape located in the lumber area, outside the peritoneal cavity and surrounded by large amount of fat. The renal parenchyma surrounded by thick fibrous capsule, and consist of two areas, cortex and medulla. Cortex is granulated appearance, reddish brown in color, the medulla is striated and pale (3). The histological and functional of kidney contain chiefly of renal nephron and collecting ducts. The thickness of medulla with the long loop of Henle is the best adaptive features in the kidney of animals (4). Kidneys in camel play a main function in the concentrated urine due to periodic differentiation of the cortex and medulla. Therefore the aim of study was to report some of the morphological and histological characteristics of the kidney in normal state to provide basic data which will utilized in the other studies.

MATERIALS AND METHODS

Five adult healthy kidneys of one – humped camel (*Camelus dromedarius*) were used in this study. The morphological study included 4 kidneys, after they removed from the animal, the morphological measurements were recorded, including weight, length, width and thickness. Two kidneys were used in histological study, the samples were fixed with 10% formaldehyde solution , and many slides prepared from upper and middle of the renal cortex and renal medulla from the center of the kidney. Their

size of pieces were 7mm*5mm*1mm. Paraffin sections were then stained with H&E, PAS and Mallory (5).

RESULTS

Morphological Study:

The present study revealed that the kidney of dromedary camel (fig.1) was bean shape, grey or blue organs with smooth surface, multilobar, unipapillary. Presence of large amount of adipose tissue, they were not surrounded by the peritonea. In right kidney both cranial and caudal ends were rounded, in left one the cranial pole was pointed, the caudal pole was rounded. At results mean weight, length, width and thickness of right kidney about (1160±31.725 gm), (15±0.562 cm), (11±0.42 cm), (6±0.155 cm), and the left one about (950±11.5 gm), (17±0.562 cm), (9±0.113 cm), (5±0.155 cm) respectively.(Table.1). Each kidney had convex lateral border and concave medial border, in the middle of medial border renal hilus was found in which renal vessels and ureter passes through. The ratio of kidneys weight to the body was 0.6. Through the kidney show that the renal parenchyma consist of two areas; outer dark red cortex and inner pale medulla. The renal medulla (fig.2) showed two areas outer red striated and pale inner, the cortical medulla ratio in was 1:4. The pyramids fussed as one papilla and forming renal crest. The thick renal crest is forming by convergence of the medulla pyramids before it projects into the cavity of crescentic renal pelvis.

Table (1) showing the measurements of left and right kidney

Measurements	Left kidney	Right kidney
Weight/gm	950±11.5	1160±31.725
Length/cm	17±0.562	15±0.46
Width/cm	9±0.113	11±0.42
Thickness/cm	5±0.155	6±0.07

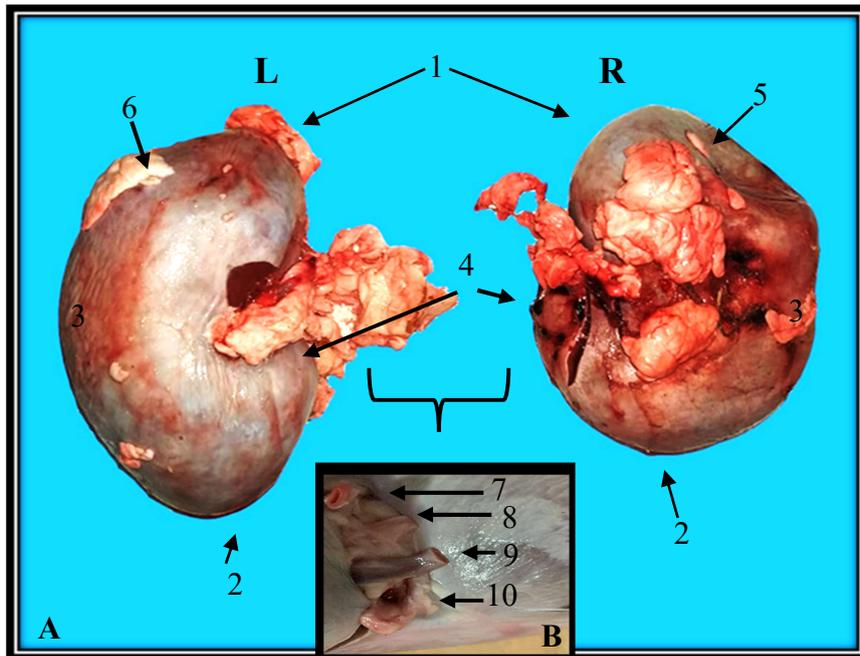


Fig.(1) show (A) right kidney(R), left kidney(L), cranial pole(1), caudal pole(2), lateral border(3), medial border(4), renal capsule(5), fat(6).(B) renal vein(7),branched of renal artery (8,9), ureter(10).

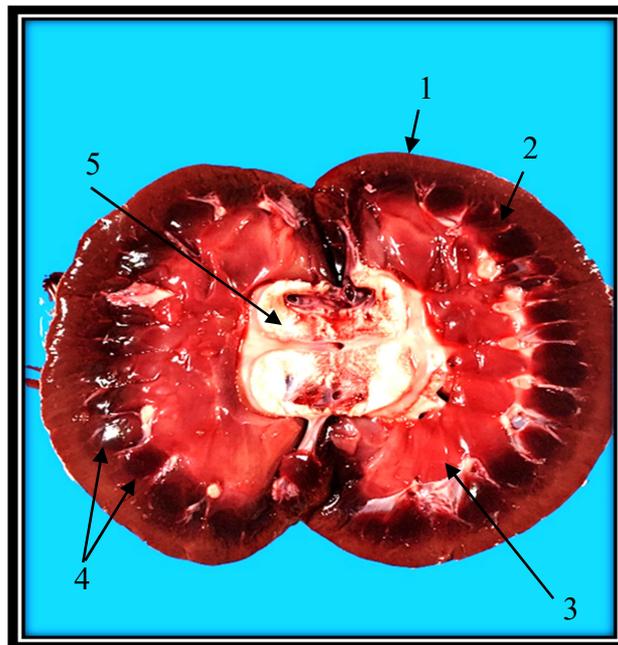


Fig.(2): longitudinal section in kidney show, renal capsule(1), cortex(2), medulla(3), renal pyramids(4), renal pelvis(5).

Histological study

The histological examination (fig.3) show the kidney is surrounded by a thick, dense irregular connective tissue with smooth muscle fibers called renal capsule. The outer part of renal tissue that located beneath the renal capsule it appeared as dark stained area: the cortex occupied all the renal corpuscles, the proximal, distal tubules and the blood vessels delegate with interstitial connective tissue. Each renal corpuscle (fig.4) composed glomerulus and Bowman's capsule, which formed of two thin layers, an outer parietal layer consist of simple squamous and an inner visceral layer. The cortex was consist of (fig.5) cortical labyrinth and medullary ray. The cross section of the proximal convoluted tubules in cortical labyrinth (fig.6) was further than the distal convoluted tubule. Moreover, the brush border of the proximal convoluted tubules was well developed. The numbers of the renal corpuscles (Table:2) were low in the sub capsular region which increasing towards the mid - juxtamedullary region. No significant differences in the renal corpuscle diameters were noticed between midcortical ($125\pm 0.3\mu\text{m}$) and juxtamedullary area ($124\pm 0.1\mu\text{m}$). Approximately (63.17%) nephrons originates in glomeruli located in sub- capsular & mid- cortical region of the cortex & have relatively short loops of Henle. The remaining (34.23 %) originate in glomeruli located in the juxtamedullary cortex, with long loop nephrons. The renal medulla was consist of outer and inner medulla. The vasa recta in the outer medulla were well developed. The change of the simple cuboidal epithelium lining the descending limb of loops of Henle was observed (fig.7). The wall of collecting tubules (fig.8,9) are lining of simple cuboidal epithelium. Their cytoplasm was bright and the boundary was clear.

Table (2): showing the distribution and diameters of renal corpuscles

Measurements of renal corpuscles	Percentage Means \pm S.F.	Diameter Mean \pm S.F.
Sub capsular region	24.12 \pm 0.13	112.3 \pm 0.5
Mid cortical region	39.05 \pm 0.12	125 \pm 0.32
Juxtamedullary region	34.23 \pm 0.12	124 \pm 0.12

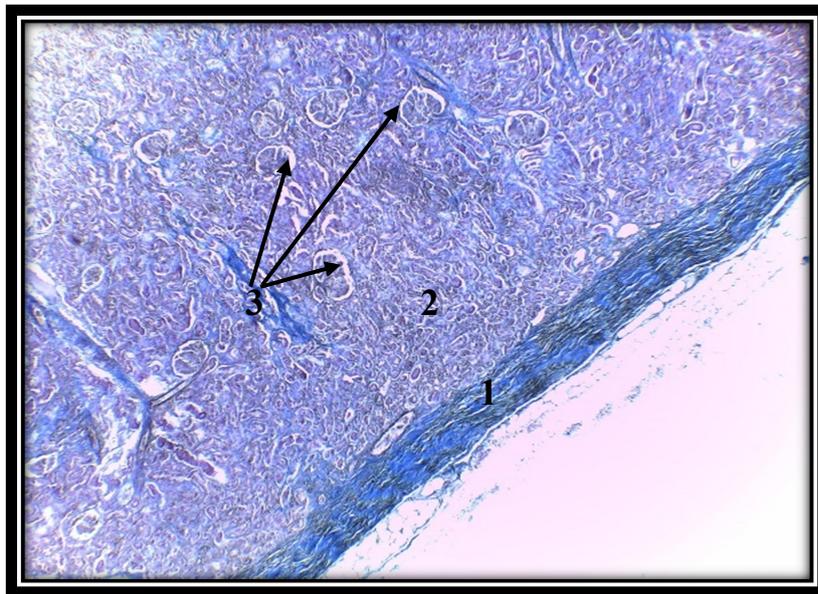


Fig.3 cross section of kidney show (1) renal capsule (2) renal cortex (3) renal corpuscles. Stained with Mallory, low power magnification 4x.

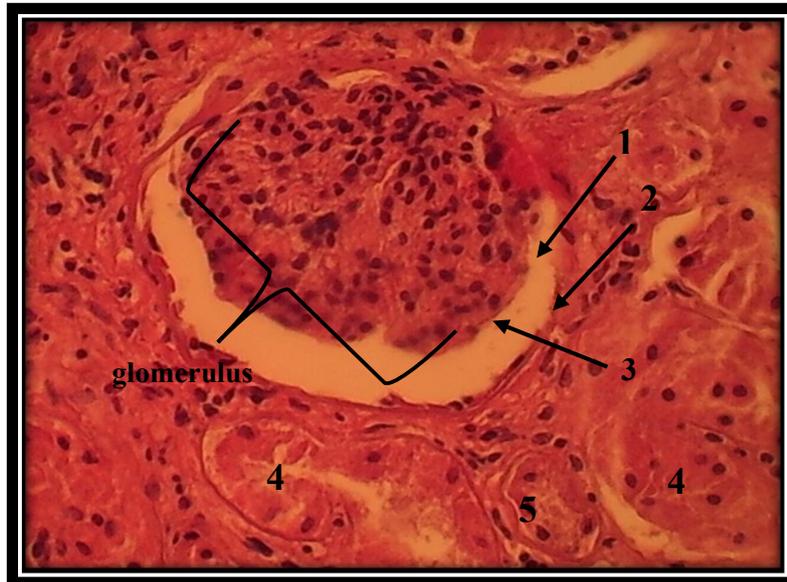


Fig.(4) renal corpuscle with glomerulus, Bowman space(1), parietal layer(2), visceral layer(3), Proximal tubule (4), distal tubule(5), high power magnification 40x. Stained with H&E.

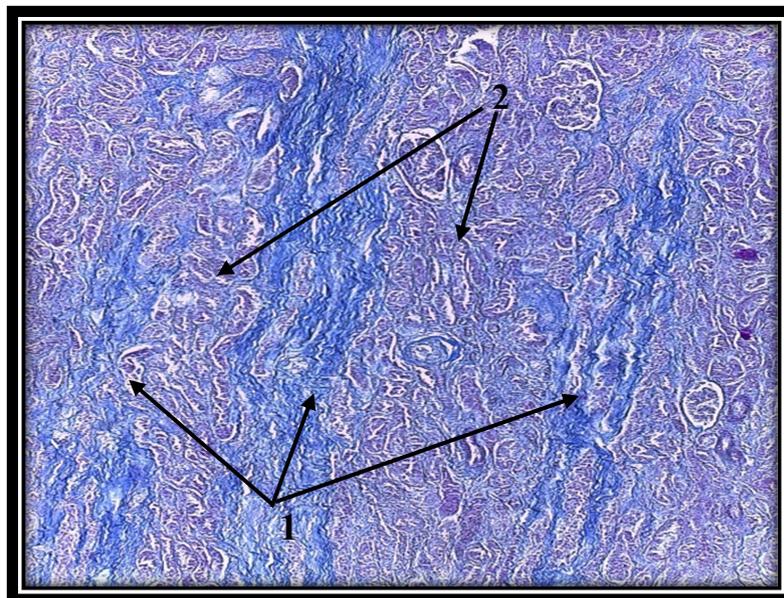


Fig.(5) cross section in cortex show, medullary ray(1), cortical labyrinth(2),low magnification 10x. Stained with Mallory.

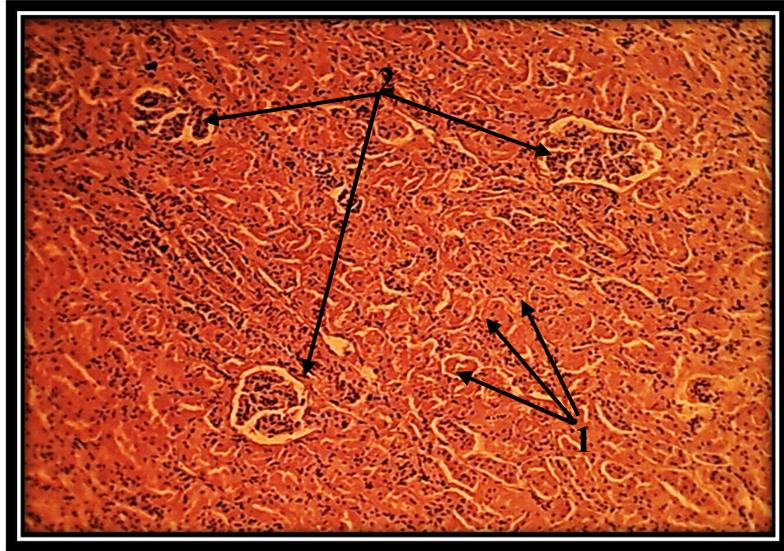


Fig.(6) cross section in cortex show proximal convoluted tubules(1), distribution of renal corpuscles(2), low magnification 10x. Stained with PAS.



Fig.(7) cross section in medulla show thick loop of Henle(1), collecting tubules(2), low power magnification 10x. Stained with H&E.



Fig. (8) cross section in medulla show collecting duct with cuboidal epithelium, high magnification 40x. Stained with H&E.

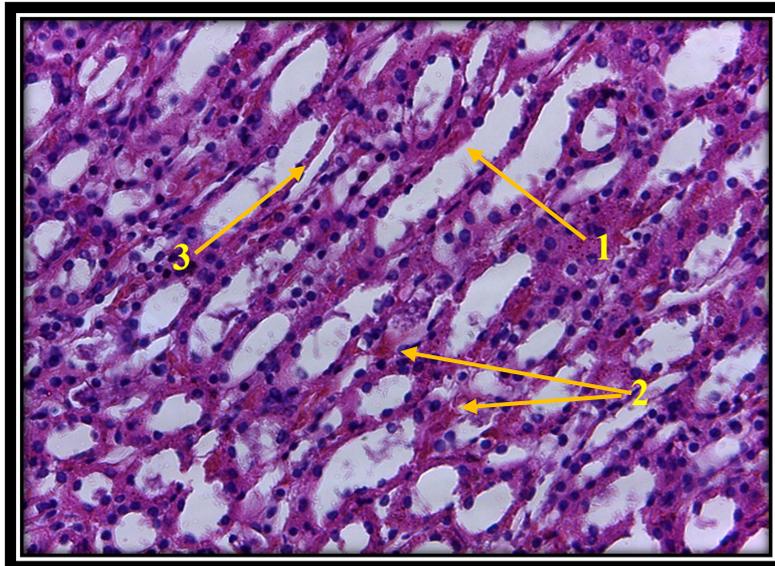


Fig.(9) cross section in medulla show collecting tubule (1), vasa recta (2), thin loop of Henel (3), high power magnification 40x. Stained with Mallory.

DISCUSSION

In the current study the kidneys were paired bean shaped grey or blue organs with smooth surface, multilobar, unipapillary, they were not surrounded by the peritonea with much perirenal fat gives more stable to external and act as a good isolater (1, 6) The left kidney lighter in weight than the right one and was caudally located and the ratio to body was 0.6% . The kidneys weight and its ratio to the body weight were different with species this agreement with (7) who mentioned that the weight of dog kidney was 25 gm.

The ratio was 0.2% the weight of goat kidney was 32.08 gm as reported by (8). These results agreement with (9) found that the ratio in African rat was low it was 0.4% and the animals kidney had less ability to conserve water and excreted concentrated urine. The cortex : medulla ratio was 1 : 4 this agreement with (10). Which indicated that loops of Henle in camel's kidney were very long, this agreement with (11).

The thickness of medulla gives an indicator for the ability of camels kidney to reabsorbed water. The study that the renal capsule of one camel composed of collagen fibers and smooth muscles fibers distributed deeply. This result was mentioned by (12) who found that the renal capsule of pig composed of dense fibrous connective tissue and smooth muscle fibers present in inner layer. In comparsion with renal capsule of dog was contained collagen fibers. (13) Showed that the renal capsule in rat sand rodent was devoid of smooth muscle fibers, this result disagreement with our result. Its conclude that the thickness of the capsule may play important role in the reabsorption function of the camel's kidney, this result was agreement with (14, 15) (16). They mentioned that the decapsulated kidney lost the ability of filtration blood and the parenchyma of kidney was easily to be damaged. In the middle region of the renal cortex, large diameter of the renal corpuscles were distributed. In camel, renal corpuscles had longer loops of Henle and high number. In desert animals, the microvilli of proximal convoluted tubules, cells were increased the water reabsorption. This mentioned by (16, 17,18) who enumerated many modifications which helped the animals to adept with water shortage. A close attachment between the collecting ducts and loops of Henle and blood vessels. The flat lining epithelia

play very important role to facilitated the transports of water and electrolytes. These leads to excrete a very concentrated urine, this fact was explained by (19) found that the endothelia thickness fenestrated blood capillaries and the internal veins are capable of sustaining passive transport between plasma and the renal interstitial connective tissue. The ability of kidney to concentrate urine was depended on the extensive length of the inner and concentrate urine was depended on the on the extensive length of the inner and outer medulla (20). All what was mention proved that the camel kidney had a good ability to conserve water and produce high concentrated urine.

دراسة شكلية نسيجية لكلية الجمل وحيد السنم

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الخلاصة

اجريت الدراسة الحالية في كلية الطب البيطري جامعة البصرة لغرض الدراسة المظهرية، النسيجية للجمل ذو السنم الواحد استخدمت في الدراسة خمسة نماذج من الكلى من المجازر في السماوة والزيبر. تضمنت الدراسة الشكلية موقع الكلى داخل الجسم حيث استخدمت المقاييس لقياس الوزن، الطول، العرض والسك. اما الدراسة النسيجية فقد شملت دراسة المقاطع النسيجية فقد استخدمت ثلاث صبغات صبغة الهيماتوكسولين ايبوسين و صبغة كاشف شف الدوري وصبغة ماسون ثلاثي الكروم. حيث اظهرت النتائج ان كلية الجمل ملساء خالية من الفصوص متعددة الاهرامات ، الى الداخل قشرة بنية محبية ولب داخلي يقسم بدوره الى نطاق خارجي يكون محمر يقع الى الداخل من القشرة و نطاق داخلي يكون بني فاتح يقع بمحاذاة الحوض و يشكل عرفا كلويا واحدا. تمثل كلى الجمل %0.6 من الوزن الكلي لجسم الجمل ، اما النسبة بين سمك اللب الى القشرة كانت 4 : 1 مما يدل الى ان عروة هنلي في الجمل كان طويل جدا. في اللب كان هناك عدد الكليونات اكثر من المنطقة المجاورة والتي كانت تمتلك طول اكبر لعروة هنلي . في اللب الخارجي كان هناك تجمع لحزم الاوعية الدموية ما بين عروة هنلي والنيبيبات الجامعة . اللب الداخلي كان اكثر سماكة من الخارجي . وجد ايضا تراكيب متخصصة كاسية الشكل تكون بروزات ممتدة من الحوض يبلغ عددها 20 – 24 تركيب . من اهم خصائص هذا النوع من الجمال ان له القدرة العالية على اعادة امتصاص الماء مما يؤدي الى انتاج بول بتركيز عال جدا .

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