



Histological study to the nephrons of the kidney in Dogs (*Canisfamiliaris*) in middle of Iraq

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Abstract:

In order to study the histology of the nephrons of Dogs. Samples were collected from middle of Iraq. The result revealed that the kidney of Dog had thick capsule. The kidneys occupied by long nephrons which excrete concentrated urine. The rest were short loop nephrons. Some renal corpuscles were present in the region of juxamedullary and midcortical cortex region. The large amount of renal corpuscle in juxamedullary region regarded as the structural properties of the dog kidney, to void concentration urine. The proximal convoluted tubules had large lumen and high cuboidal epithelium cells with spherical nuclei.

Key word: Nephrons, kidney, dogs, histological.

دراسة نسيجية لنفرونات الكلية في الكلاب (*Canisfamiliaris*) في وسط العراق

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الخلاصة:

من اجل اجراء دراسة نسيجية لنفرونات كلية الكلاب تم جمع عينات من مناطق الفرات الاوسط /العراق بينت النتائج ان محفظة كلية الكلاب سمكية. اظهرت النتائج ان الكليونات في كلية الكلاب من النوع طويل العرى والذي يطرح ادرار مركز اما المتبقي من النوع قصير العرى. وقعت معظم الكليونات في المنطقة المجاورة للربو والمنطقة وسط القشرة. العدد الكبير من الكليونات في منطقة المجاورة للربو يعد من خصائص تركيبية للكلاب لطرح ادرار مركز. احتوت النبيبات الدانية المتلوية على اقطار كبيرة وظهارة بطانية مكعبة عالية مع انوية دائرية.

Introduction:

The kidneys of carnivorous species are very mobile especially the left one. The anatomical land marks describe the most common location, the right kidney is more

cranial than the left one, lie beneath Lumbar1-Lumbar3 vertebra(1, 2).

In dog the basic form of kidney is bean shape the medial border of the kidney is

extended to form the renal hilus, through which the dilated region of the ureter, the renal pelvis exits and the renal vessels & nerves enter the kidney. The kidney of the dog has smooth surface and a single renal papilla; the kidneys are embedded with in external capsule of fat tissue. The renal cortex is reddish brown in color with a finely granular appearance. The cortex of kidney contains labyrinth and medullary rays. The cortical labyrinth includes the renal corpuscles and both distal & proximal convoluted tubules. Medullary rays are comprised of the straight tubules & collecting duct. The outer medulla of the kidney contains straight tubules, collecting duct & thin tubules in the inner strips. Thin tubules & collecting ducts are located in the inner medulla (3).

Nephron is the structural and functional unit of the kidney. Each nephron includes a renal corpuscle, proximal convoluted and straight tubules, thin tubules, distal straight and convoluted tubules (4).

Previous studies referred that there were three types of nephrons, short – looped nephrons, where the inner medulla has long – looped nephrons; The mixed type where there was both short & long looped in different percentage (5, 6).

The kidney has large amount of long loops which are capable of forming concentrated urine, while it has a few amount of long loop that produce diluted urine (7). The short loops originate from the renal corpuscles located near the surface of the kidney are the number type called subcapsular nephrons. The long loops come from the renal corpuscles near to the medulla. Occasionally the loops are very long extending nearly to apex of papilla (8,9). Dogs & cats have long – loop nephrons, therefore produce concentrated urine (10).

The renal glomerulus, a convoluted capillary tuft, forms the central structure of the renal corpuscle. The renal glomerulus is surrounded by glomerular capsule which the renal visceral layer is formed by

podocytes which envelope the glomerular capillary and the parietal layer formed from simple squamous epithelium. Between the two layers there is urinary space which has filtration barrier. This barrier includes the glomerular capillary endothelium, basement membrane & the slit diaphragm between the podocytes.

The urinary space of the glomerular capsule empties into the proximal tubule. The proximal tubule is lined by simple cuboidal epithelium with a well – developed apical border of microvilli. The proximal tubule continues as the thin tubule which is lined by simple squamous epithelium with spherical nucleus & protrude into the lumen. The distal tubules continue from the thin tubules as a straight segment passes at the pole of the renal corpuscles and end as the convoluted segment before emptying into the collecting duct. The distal tubule is lined by simple cuboidal epithelium. The collecting duct is lined by simple cuboidal epithelium. The epithelium cells change their shape to either protrude into the lumen or retract, depending on the secretory state (3,11). The aim of this study is to provide histological information about the nephrons and their distribution within the kidney dogs.

Materials and Methods:

Five adult dogs were sacrificed by anesthetizing. The animals were given atropine sulphate (0.04mg/kg B.W.) intramuscularly then a mixture of (xylazine hydrochloride 2% & 5mg B.W) and ketamine hydrochloride 5% (15mg/B.W) (12). After slaughtering, kidneys were collected rapidly then washed & kept for 48 hours in 10% buffered neutralized formaline solution. After fixation pieces were dissected from cortex and medulla. Dehydration, clearing and embedding in paraffin wax were done. Sections at (5-7mm) had been prepared by using rotary microtome. The Alum hematoxylin and

eosin stain were used for staining the section (13).

Results & Discussion:

The present study shows that the kidney of the dog is bean-shaped & has smooth surface with single renal papilla. The renal cortex is reddish brown in color, while the renal medulla has two zones (outer dark & inner paler) (Fig1). This result was in agreement with (4) who mentioned that the kidney of dog was bean shape & has smooth surface with single renal papillae. This study revealed that the capsule of the kidney in dog is thick. This agreed with the findings of (14), in Camel, ox and sheep (15) & in contrast with (16) in camel. The subcapsular region had little renal corpuscle; the number of renal corpuscle increased towards the midcortical region & increase more at the Juxtamedullary region, therefore the dog kidney has greater proportion of long-loop of Henle nephrons and fewer short-loop nephrons. This finding seems consistent with (10) who stated that the length of the loop of Henle seems to have some correlation with

the concentration of urine for instance, in cattle, swine, dog & cat are noted voiding relatively dilute urine in large amount, have relatively long loops. The present study believes that the large amount of renal corpuscles in Juxtamedullary & midcortical region that characterized by long loop of Henle, is regarded as the structural properties of dog to void concentrated urine. The renal corpuscles have two layers with tuft of capillaries, the proximal convoluted tubules have wide lumen with cuboidal cells epithelium with brush bordered and spherical nuclei. This result was similar to finding of (14,16) in camel, while disagree with the finding of (17) in buffalo who stated that the kidney's buffalo had small lumen of proximal convoluted tubule this is related with void of the dilute urine in buffalo. The distal convoluted tubule has cuboidal epithelium without brush border cells which are smaller, lighter than in proximal convoluted tubule with apical spherical nuclei. The collecting duct has simple columnar epithelial cells with large lumen this is in agreement with (3,11).



Fig(1) longitudinal section of kidney in dog. Cortex (1), outer medulla (2), inner medulla (3) and renal pelvis (4).



Fig(2) Cortex of kidney of dog . Showing the capsule (1) and distribution of renal corpuscles in subcapsular region(arrows).
H&Estain 10×

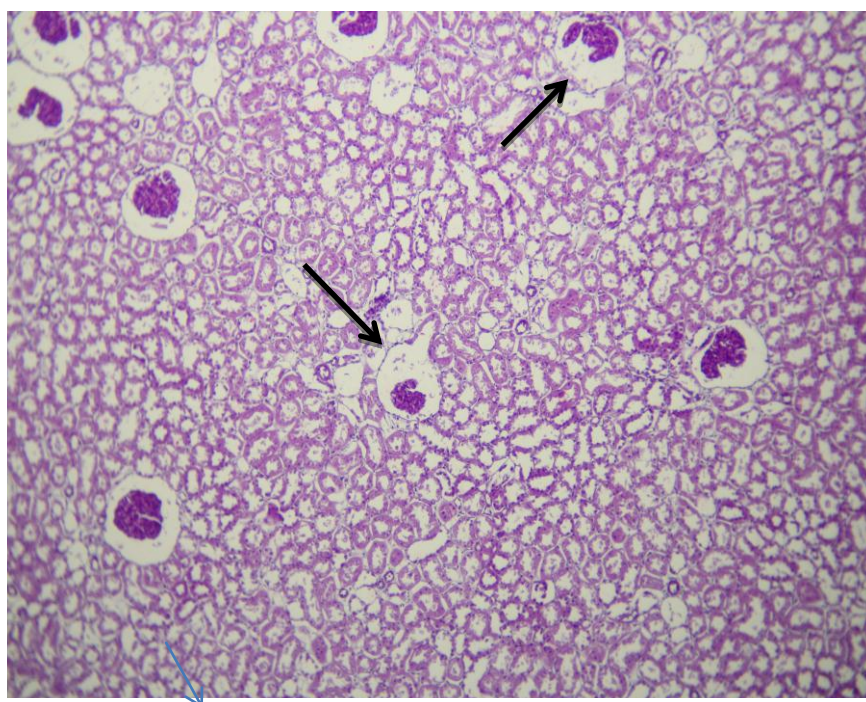
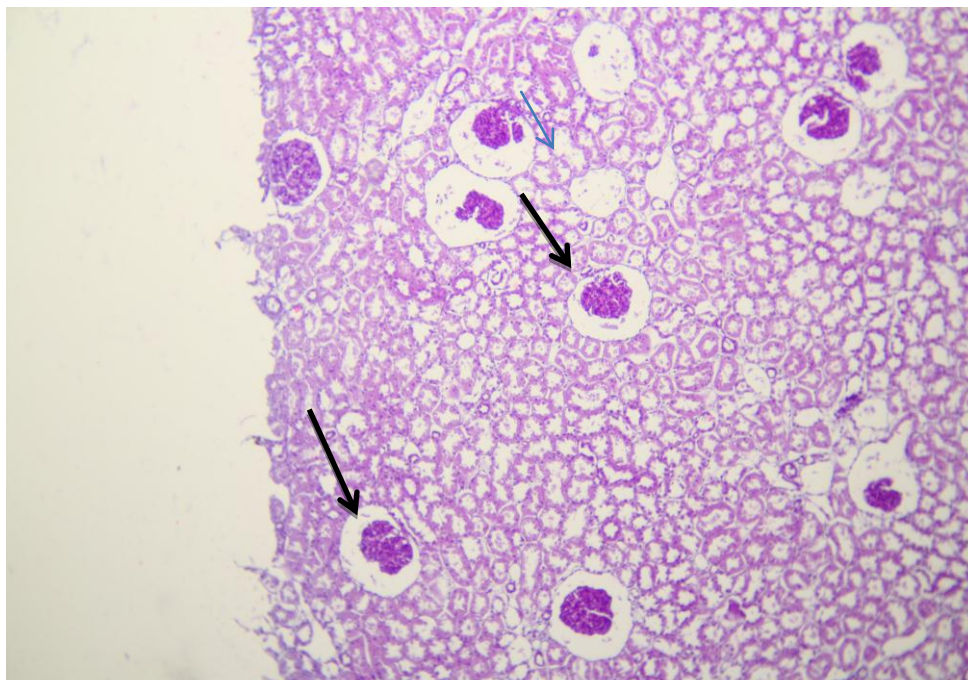


Fig (3) The distribution of renal corpuscles in midcortical region
. H&E stain 10×



Fig(4) The distribution of renal corpuscles in juxtamedullary region .
H&E stain 10×

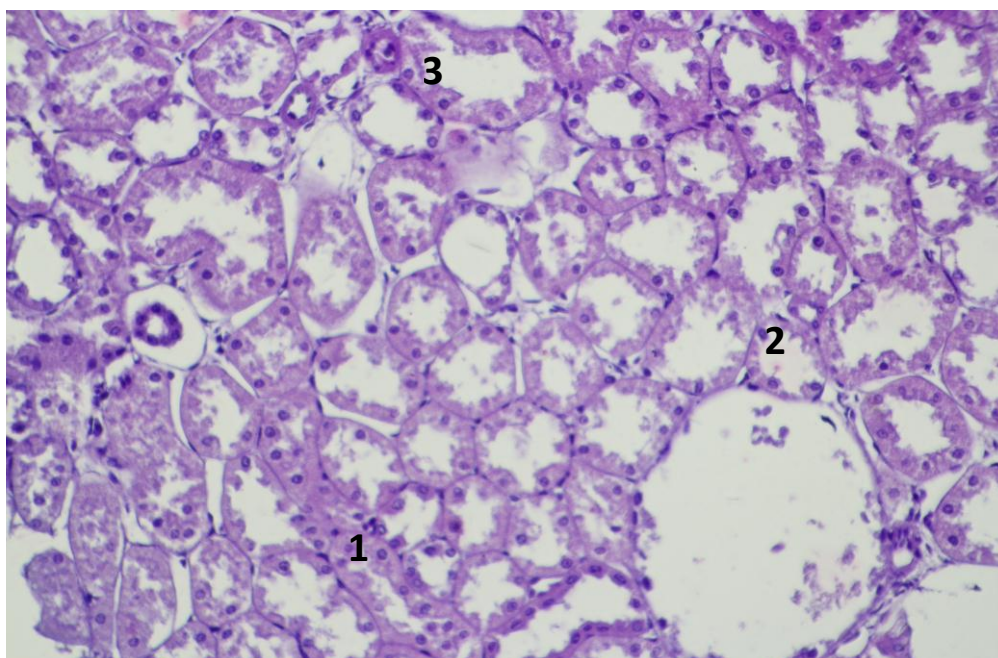


Fig (5) The proximal convoluted tubule (1) , the distal convoluted tubule
(2) and collecting duct (3) H&E stain 40×

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