

FUNCTIONAL ANATOMY OF THE KIDNEY IN THE BUFFALOES

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ABSTRACT

The morphology and the vasculature of the kidney of the Buffaloes was described. Information obtained from gross dissection of embalmed Buffaloes kidneys was correlated with latex and Cold cure solution injected vascular and in excretory casts. The functional significance of the renal apparatus was discussed.

INTRODUCTION

The morphological features of the kidney in most domestic animals have been reported in literature (1, 2, 3, 4, 5, 6, 7, 8, 9). and (10, 11, 12, 13). For instance, (14) studied the arcuate arteries of the camel, Whereas 15 reported morphometric observations on the camel kidney, others described the juxtaglomerular complex of the kidney in the camel (16). Intensive researchs on the renal function such as response of the renine aldosterone system (17), water turnover and renal function of the camel in the desert (18), and the role of antidiuretic hormone (ADH) and aldosterone in dehydrated and rehydrated camel (19) were reported. The purpose of this investigation was to describe the functional anatomy of the renal appearance of the buffaloes kidney and its relationship to renal blood vessels.

MATERIALS AND METHODS

Twenty fresh adult Buffaloe kidneys specimens without signs of renal disease or trauma were obtained from Basrah abattoir, Each kidney was thoroughly washed, after perfusing the specimens with heparinised saline via the ureter a modified, partially polymerized Cold cure denture base compound (prepared in 20% powder monomethyl-methacrylate and 80% liquid Methyl Methacrylate monomer (dental supplies LTD. surry GU22, England). They

were injected using a 25 ml automatic vaccinating syringe (Hauptner-Muto,Germany) and kept at room temperature for 24 hours for polymerization, they were corrosion casted in 30% NaOH at 60C for 24-48 hours, washed with tap water and photographed

RESULTS

The paired kidneys of buffaloes are located retroperitoneally inside the abdominal cavity; the right kidney being somewhat located more cranially than the corresponding left. after coursing They are elongated elliptical-shaped with lobulated surfaces (15-20 lobes) with red-brown coloration. The right kidney is situated ventral to the the last rib and the first two or three lumbar lumber transverse process. It measures about 23cm in length, 14 cm in width, and 6 cm in thickness, weighing 710 gm. Its cranial and caudal extremities are somewhat similar, the former being capped by the caudate lobe of the liver (renal impression). The left kidney occupies the sublumbar region ventral to the third, fourth, and fifth lumbar vertebrae and has small and pointed cranial extremity and large and rounded caudal extremity. It is about 18 cm in length, 12 cm in width, and 6 cm in thickness, weighing 650 gm. The lateral border of each kidney is convex and related to the lateral abdominal wall. The medial border is somewhat concave with an indented renal hilus transmitting the renal vessels, lymphatics and the ureter. The renal lymph nodes, adrenal (suprarenal) gland and the initial segment of the ureter are related to the medial border, in addition to the abdominal aorta to the left and the caudal vena cava to the right kidney. The flat dorsal surfaces of both kidneys are related to the psoas muscles and iliac fascia, but their slightly convex ventral surfaces have different relationships (Fig. 1). The left kidney is related ventrally to the spleen and the dorsal sac of the rumen, the right kidney to the colon. The examination of the cast of the excretory part of the kidney (Fig. 2) revealed an extensive elliptical cavity, The ureter begins at the junction of two wide ,thin-walled tube the major calyces, the caudal calyces is usually the larger, each major calyces gives off a number of branches and these divided into several funnel-shaped minor calyces ,each of which embraces a renal papillae. The kidney of buffaloes posses 15-25 renal papillae. The renal papillae is the blunt apex of each pyramids. On each renal papilla are small orifices by which the papillary ducts open into the calyx. .Each kidney is vascularized by the renal artery arising from the lateral aspect of the abdominal aorta, the right artery being longer,

than the corresponding left. Each renal artery laterally divides into dorsal and ventral branches before reaching the hilus. Each of these branches in turn splits into interlobar arteries, and after ascending along the opposed borders of the medullary pyramids they supply the respective surfaces of the kidney. Near the corticomedullar junction, the interlobar arteries branch into arcuate arteries that radiate toward the periphery of the cortex, where they again split into several interlobular arteries. Different arterioles leave these vessels to vascularize the glomeruli and, hence, the different arterioles (Fig. 3). The venous drainage of the kidney stems from the numerous capsular veins that, after converging, empty into the interlobular, arcuate interlobar and finally into the dorsal and ventral branches of the renal vein draining the respective surfaces of each kidney. Each dorsal and ventral branch again divides into the cranial and caudal branches. The cranial as well as caudal branches become confluent with each other inside the renal sinus which then continues as the renal vein. The left renal vein is longer than the right one, both of them opening into the caudal vena cava.

DISCUSSION

Presence of calyces of the multipapillated kidney of the buffalo was the most important anatomical characteristic feature which was designated as specialized fornices in ox and pigs. These structures should not, however, be confused with the recess of renal pelvis in sheep, dogs and camels(20). The buffaloes, differs from horse, sheep, goat and dog, Those animals possess a renal crest-type kidney. Whereas in buffaloes have a major and minor calyces. The angioarchitecture of the buffaloes kidney was similar to that of the ox (21). Examination of the kidney in buffaloes revealed that it has external lobation and has no renal pelvis or crest instead of expanding on entering at the hilus, the ureter of capillaries intermingling with elastic nets that apparently protecting the blood vessels were discernible. The functional role of these recesses is not clearly understood.(22) have reported that the cortex is the outer region of the kidney where the glomerular capsules (renal corpuscles) are located in the inner region. The medulla consists of pyramid shaped structures. The renal pyramids are made up of collecting ducts and renal tubules. Extensions of cortical tissue down into the medulla between the pyramids are the renal columns. The cortex and

medulla make up the parenchyma (i.e., the functional tissue of the kidney) where the urine is formed. The remainder is the drainage system or supporting tissue
As urine is formed, it travels down the collecting ducts in the renal pyramids. The collecting ducts is ended at the point end of the pyramids, which called the papilla, and there, the urine drains into a minor calyx. Each minor calyx receives urine from one renal pyramid. . The major calyces drains the urine finally into the ureter.



Fig 1; Kidney of the Buffaloes

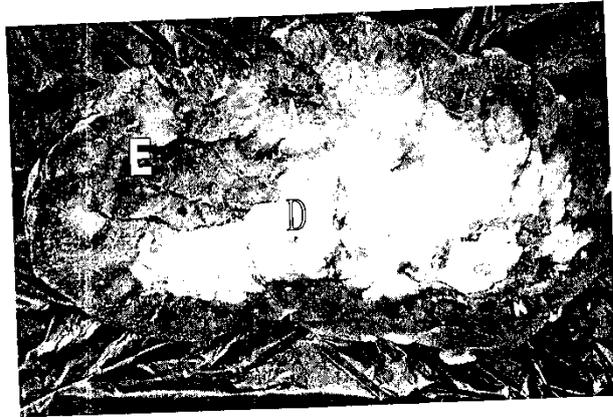


Fig.2 Sagittal section of the kidney.

A-Papillae B-Ureter C-Major calyces D-Renal Vein E-Minor calyces

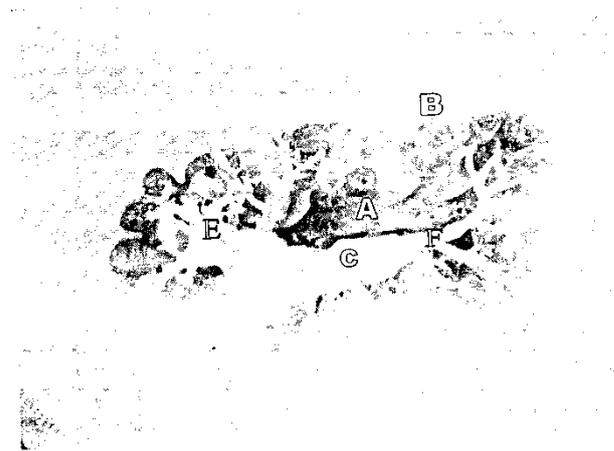


Fig 3: Cold cure cast of the vascular and excretory system of the kidney

A-Ureter B-minor calyces C-Renal artery D-Interlobar artery
E-Ventral Branch of Renal artery F-Dorsal branch of renal artery

دراسة تشريحية ووظيفية للكلية في الجاموس

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الخلاصة

اجريت هذه الدراسة للتعرف على التركيب التشريحي والمدد الدموي للكلية في الجاموس، تم استخدام طريقة القالب التاكلي وطريقة حقن اللاتكس عن طريق الاوعية الدموية والقنوات الافرازية للتعرف على الخصائص التشريحية والوظيفية للكلية في الجاموس.

REFERENCES

- 1- **Barone, R.** 1978, Anatomie compare des mammiferes domestiques. Tom 111 (Splanchnologie).
Ascicule 11:5-15. Laboratoire d'Anatomic, Ecole Nationale veterinaire, Lyon.
- 2- **Bourdelle, E.T. and C. Bressou.** 1949. Anatomie Regionale des Animaux Domestiques. Tome I, Equides. Librairie J.B. Bailliere et Fils, Paris.
- 3- **Bourdelle E.T. and C. Bressou.** 1953. Anatomie Régionale des Animaux Domestiques. Tome IV, Carnivores (Chien et chat) Librairie J.B. Bailliere et Fils. Paris.
- 4- **Bourelle, E.T. and C. Bressou.** 1978. Anatomie Régionale des Animaux Domestiques. Tome II, les Ruminants. J. B. Baillière (ed.), Paris.
- 5- **Bradely, M.P.** 1948. Urinary System in Embryology of the Pig. 3rd edition: 197-210 Mc Graw-Hill Book Company.
- 6- **Nickel, R., A. Schumer and E. Seirferle.** 1979. The Viscera of the Domestic Mammals. 2nd Edition. Verlage Paul Springer, pp 282.
- 7- **Getty.** 1975. The Anatomy of Domestic Animals. Saunders Co. Philadelphia- London- Toronto. Lsbre, M.F.X. 1903. Recherches Anatomiques sur les Camelides. Arch. Mus. d'Hist. Nat., Lyon.
- 8- **Moffat, D.B.** 1975. The Mammalian Kidney. 1st Edition. Cambridge University Press- London, New York.
- 9- **Miller.** 1979. Anatomy of the Dog. Second Edition. A.B. Saunders Co. Philadelphia- London- Toronto.

- 10-Al-Asadi**,F.S.2006.Some morphological studies on the kidney of sheeps with special technique of its arterial segmentation.*Bas.J.vet.Res.,Vol.5,No.1,p:44-48.*
- 11- Tayeb**. M.A.F. 1948. Urinary System of the Camel. *J. Am. Vet. Med. Ass.* 568-572.
- Tayeb**. M.A.F. 1948. Urinary System of the Camel. *J. Am. Vet. Med. Ass.* 568-572.
- 12-Abdalla**, M. 1973. Anatomical study of the urinary system of the camel. M.V. Sci. Khartoum University, Sudan.
- 13- El-Shaieb**, M.R., Fath El-Bab and A.S. Saber. 1982. Some morphological features of the kidney of the camel (*Camelus dromedarius*). *Assiut Vet. Med.*, 9 (17-18): 3-6.
- 14- El-Shaieb**, M.R., Fath El- Bab and A.S. Saber. 1981. The arcuate arteries and their branches in the kidney of the camel (*Camelus dromedarius*). *Assiut Vet. Med. J.*, 8 (15 -16):9-13.
- 15-Abdallah**, M.A. and O. Abdallah. 1979.Morphometric observations on the kidney of the camel. *J. Anat.*, 129 (1): 45-50.
- 16- Moussa**, M.H.G. 1983. The Juxtglomerular Complex of the One Humped Camel. *Vet.Bull.* 53 (1):123.
- 17- Finberg**, J.P.M., R. Yagil, and G.M. Berlyne. 1978. Response of the Renin-Aldosterone System in the Camel to Arcuate des Hydratation. *Appl. Physiol : Respirat. Exercise.Physiol.*, 44 (6): 926-930.
- 18- Siebert**, D.B. and W.V. Macfarlane. 1971. Water Turnover and Renal Function of Dromedarius in the Desert. *J. Physiol.*; 225-240.
- 19- Yagil**, R. and Z. Etzion. 1979. The role of ADH and Aldosterone in the dehydrated and rehydrated camel. *Comp. Biochem. Physiol.*, 63 (A): 275-375.
- 20- Pfeiffer**, E.W. 1968. Comparative Anatomical Observations of the Mammalian Renal Pelvis and Medulla. *J. Anat.*, 102 (4): 321-331.
- 21-Shively**,M.J.1984.veterinary anatomy.Texas A&M University press.p:326.
- 22-Gabriel**.N.,William,D. 2005.Renal,water and electrolyte homeostasis.In:Medical physiology curriculum object.Internet;www.aps.org/education/MedphysObj/htm