

Histopathological Investigations on Renal Lesions in Slaughtered Camel (*Camelus dromedarius*) in North East of Iran

Annahita REZAIE ¹ 
Saharnaz ANBARI ²

Babak MOHAMADIAN ¹
Kamal HOSSEİN ZADEH ²

¹ Department of Pathobiology, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz - IRAN

² Graduated in Veterinary Medicine, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz - IRAN

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Summary

Camel can tolerate water deprivation conditions more than two months. Kidneys are vital organs in this case. The objective of this study is recognition of kidney lesions. In this study 38 samples of kidney were collected from slaughter house of Tabbas and Mashhad. Specimens were fixed in 10% neutral buffered formalin for at least 24 hours and then routinely processed and then the sections were stained with Haematoxylin and Eosin (H&E), special staining and immunohistochemistry. Histopathological study revealed different lesions and the most common were glomerulonephritis. Other lesions were acute tubular necrosis (ATN), renal cyst and interstitial nephritis. Vascular calcification was significant lesions which were characterized with basophilic material in the intima of vessels. Renal adenoma was diagnosed in one camel and according to review literature it is the first report in camel.

Keywords: Kidney, Renal Adenoma, *Camelus dromedaries*, Histopathology, Immunohistochemistry

İran'ın Kuzey Doğusunda Kesimi Yapılan Develerde (*Camelus dromedarius*) Böbrek Lezyonları Üzerine Histopatolojik Araştırmalar

Özet

Deve su yoksunluğu koşullarına iki aydan fazla dayanabilmektedir. Böbrekler bu durumda hayati organlardır. Bu çalışmanın amacı, böbrek lezyonlarının belirlenmesidir. Bu çalışmada 38 böbrek numunesi Abbas ve Meşhed kesimhanelerinden toplandı. Numunelerin en az 24 saat % 10 nötral tamponlu formalinle tespit ve rutin işlemlerinin ardından kesitler Hematoksilin ve Eosin (H & E), özel boyama ve immünohistokimya ile boyandı. Histopatolojik inceleme en yaygın glomerulonefrit olmak üzere farklı lezyonları ortaya koydu. Diğer lezyonlar akut tübüler nekroz (ATN), renal kist ve interstisyel nefrit olarak belirlendi. Vasküler kalsifikasyon damarların intimasında bazofilik materyal ile karakterize önemli lezyonlardı. Renal adenom bir deve de belirlendi ve bu durum literatür incelemesine göre develerde ilk kez bildirilmiştir.

Anahtar sözcükler: Böbrek, Renal adenom, *Camelus dromedaries*, Histopatoloji, İmmünhistokimya

INTRODUCTION

Camel is a comparatively hardy animal and is less susceptible to many of the diseases that affect other livestock species in the same area ^[1]. However, it is apparent that we know too little about the diseases from which it does suffer. In different reports, tubulonephrosis due to DNA virus ^[2] and Rickettsia-like organisms ^[3], glomerulonephritis due to aflatoxicosis ^[4], glomerulonephritis and interstitial nephritis ^[5] were described. Kidney lesions, especially nephritis, are major diseases of domestic

animals. Outbreaks occur in camel, cattle, buffaloes and small ruminants in various countries of the world. This study was conducted with the objective of identifying the types of histopathological kidney lesions of slaughtered camels in north east of Iran.

Tumours have been rarely documented in captive camelids. In the Arabian dromedary (*Camelus dromedarius*) there have been reports of an ovarian teratoma ^[6],



İletişim (Correspondence)



+98 611 3330010/4131



a.rezaie@scu.ac.ir; rezaie20a@yahoo.com

bronchioloalveolar adenocarcinoma [7], lymphocytic leukaemia [8], renal cell carcinoma [9] and osteosarcoma [10]. According to the authors knowledge no reports on renal cell adenoma have been published and this paper described the pathological and immunohistochemical findings of this tumor.

MATERIAL and METHODS

Thirty eight kidneys which exhibited grossly lesion were obtained from abattoir in Mashhad and Tabas in Iran. The tissues were fixed in 10% neutral buffered formalin for 48 h and processed according to routine procedure and sectioned at 5 µm and stained with Haematoxylin and Eosin (H&E). Selected sections were stained with von Kossa for demonstration of calcium deposition and periodic acid-schiff (PAS). Immunohistochemical staining has been carried out for cytokeratin in a kidney suspected to tumor. The sections were examined using light microscope.

RESULTS

The kidneys of slaughtered animals showed different lesions which are summarized in [Table 1](#).

Glomerulonephritis was the most common lesions recorded in 29% of the camels. Glomerular tufts were enlarged and occupied the Bowman's space and also adhesions to parietal layer of Bowman's capsule were seen and the capillaries of tufts were congested. This category has been done according to histochemical staining (PAS) slides. Seven (18.4%) cases were diagnosed as membranous glomerulonephritis with increased mesangial matrix and basement membrane thickening in glomerular tufts. In most cases, the Bowman's spaces were filled with serofibrinous exudations ([Fig. 1](#) and [Fig. 2](#)) which were positive in PAS staining and were encountered as proteinuria. The amounts of mentioned materials in some cases were increased and so the cell elements of glomerules were vanished.

ATN was counted as second ranked lesions. The epithelium of proximal tubules showed pyknosis with eosinophilic cytoplasm ([Fig. 3](#)).

Table 1. Different renal lesions encountered on slaughtered camels

Tablo 1. Kesilen develerde karşılaşılan farklı renal lezyonlar

Lesions Type	Number (%)
Glomerulonephritis	29 (76.3%)
Acute tubular necrosis	10 (26.3%)
Vascular calcification	5 (13.1%)
Renal cysts	2 (5.3%)
Interstitial nephritis	1 (2.6%)
Renal cell adenoma	1 (2.6%)

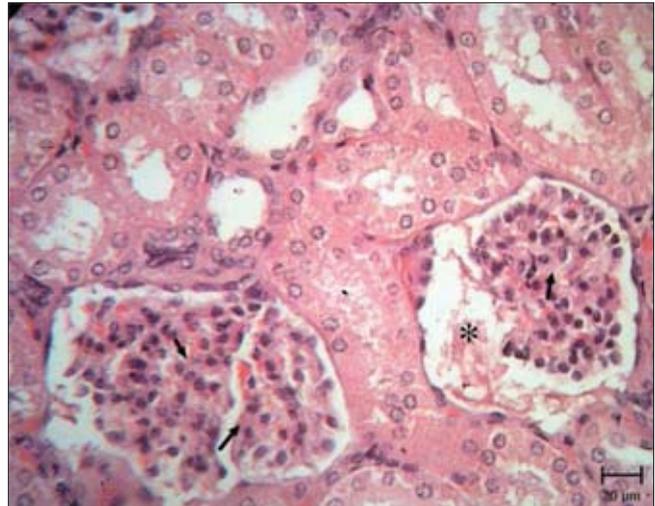


Fig 1. Camel kidney. Glomerulonephritis. Note to increasing mesangial matrix (arrows) and proteinuria (star) with amorphouse eosinophilic materials in Bowman's space (H&E)

Şekil 1. Deve böbreği. Glomerülonefrit. Bowman's alanında artan mesanjial matris (oklar) ve şekilsiz eozinofilik materyalli proteinüri (yıldız) görülmektedir (H&E)

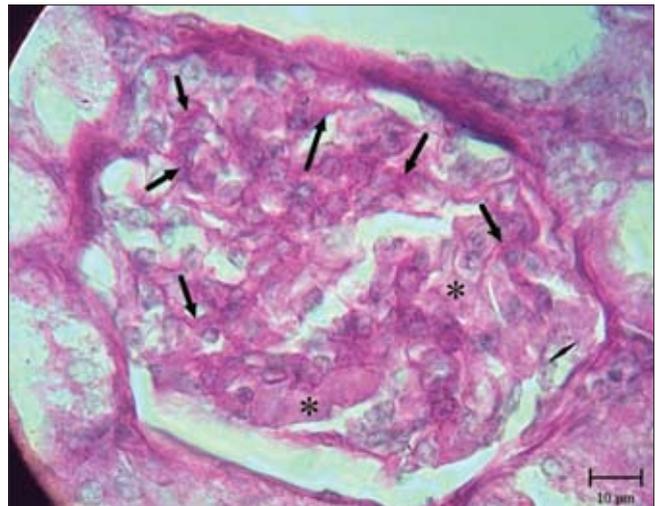


Fig 2. Camel kidney. Glomerulonephritis. Thickening of basal membrane (arrows) and increased mesangial matrix (star) is obvious (PAS staining)

Şekil 2. Deve böbreği. Glomerülonefrit. Bazal membranın kalınlaşması (oklar) ve artan mesanjial matris (oklar) oldukça belirgin (PAS boyama)

Mineralization of vessels walls were detected in five kidneys in various degrees. Purplish color granules with different sizes which stained black color in von Kossa staining method were deposited in vessels. The calcium salts were completely replaced the muscular fiber in affected vessels ([Fig. 4](#) and [Fig. 5](#)).

Renal cysts were seen in two cases. The cysts were single and covered by flattened epithelium. They were elliptical and minimum diameters were 600 µm. Also they located sub capsular ([Fig. 6](#)).

Focal interstitial nephritis was observed in one kidney. It was characterized by accumulation of lymphocytes

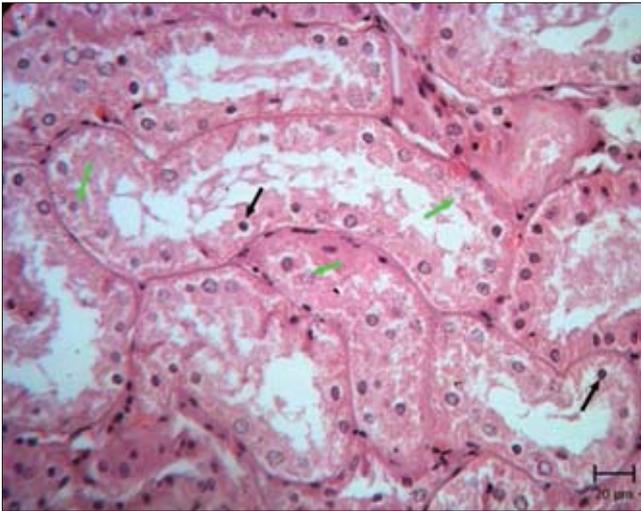


Fig 3. Camel kidney. Acute tubular necrosis. Note to pyknotic nuclei (dark arrows) and karyolysis (green arrows) which indicated coagulative necrosis of renal proximal tubules (H&E)

Şekil 3. Deve böbreği. Akut tübüler nekroz. Piknotik çekirdekler (koyu oklar) ve renal proksimal tübüllerin koagülatif nekrozu belirtisi olan karyoliz (yeşil oklar) görülmektedir (H&E)

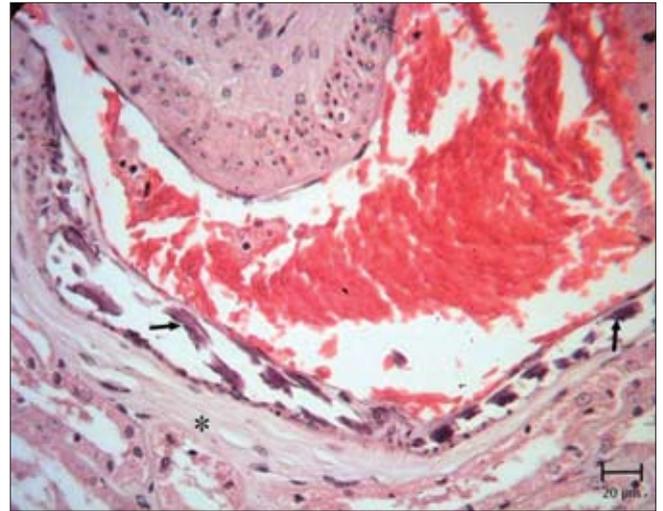


Fig 5. Part of figure 3 with high magnification. Purple precipitation (arrows) is obvious beneath endothelial layer and between smooth muscles of medial layer (star) (H&E)

Şekil 5. Yüksek büyütme ile Şekil 3'ün bir bölümü. Mor presipitasyon (oklar) endotel tabakasının altında ve medial katmanın düz kasları arasında belirgindir (star) (H&E)

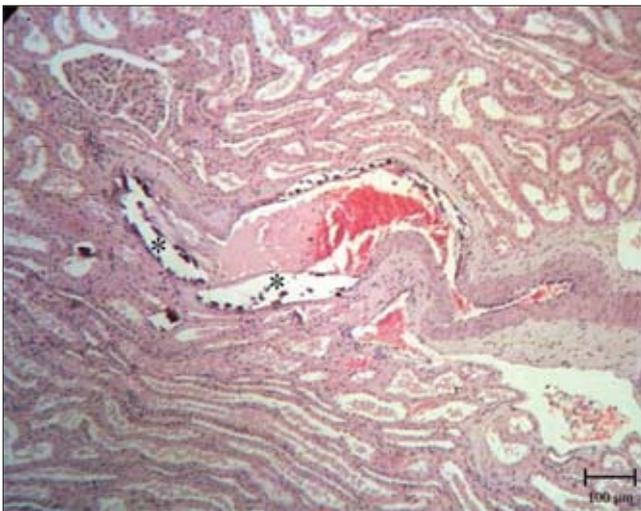


Fig 4. Camel kidney. Note to calcification of vessel wall (star) (H&E)

Şekil 4. Deve böbreği. Damar duvarında kalsifikasyon (yıldız) görülmektedir (H&E)

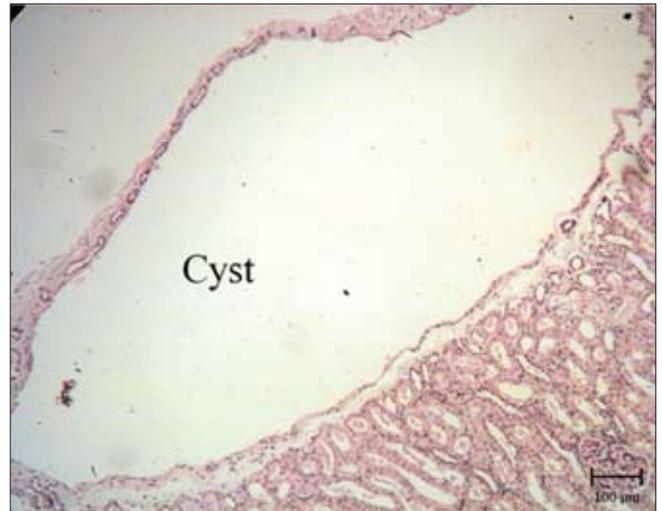


Fig 6. Camel kidney. Renal cyst is located in cortex. Note to flattened epithelium which covered the cyst wall (H&E)

Şekil 6. Deve böbreği. Böbrek kisti kortekse yerleşmiştir. Kist duvarını örten düzleşmiş epitel tabakası görülmektedir (H&E)

and plasma cells in cortico medullary area and in one case they were accumulated around glomerulus (Fig. 7).

Renal adenoma with tubulopapillary pattern was diagnosed in one of the kidneys. There were multiple foci of proliferated tubules which were covered by cuboidal epithelial cells. The cells had single nuclei with single nucleolus. Also papillary projections were seen and comprised of fine, richly vascularized stroma covered with one or more layers of neoplastic cuboidal cells. In some areas the papillae were dense or finger-like projections proliferating into cystlike microcavities (Fig. 8 and Fig. 9). Tubules pleomorphism, cellular atypia, mitotic figures and nuclear hyperchromatism were rare.

Immunohistochemical staining illustrated strong reaction in proliferated cells for cytokeratin. They showed dark brown staining (Fig. 10 and Fig. 11).

DISCUSSION

In the present work, type and frequency of microscopic kidney lesions were encountered on camels slaughtered in north east of Iran, Mashhad and Tabas. Histopathological study of the kidneys revealed different lesions such as glomerulonephritis, acute tubular necrosis, interstitial nephritis, vascular calcification and renal adenoma. Other

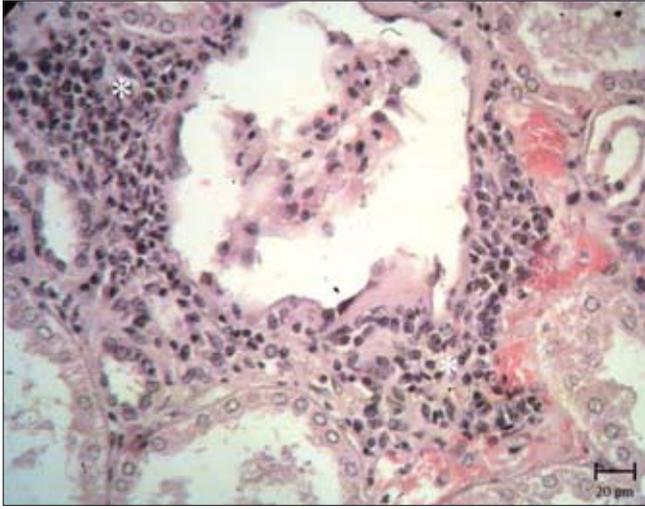


Fig 7. Camel kidney. Note to accumulation of inflammatory cells in the interstitial tissue (*star*) (H&E)

Şekil 7. Deve böbreği. İnterstitial doku yangı hücrelerinin birikmesi (*yıldız*) görülmektedir (H&E)

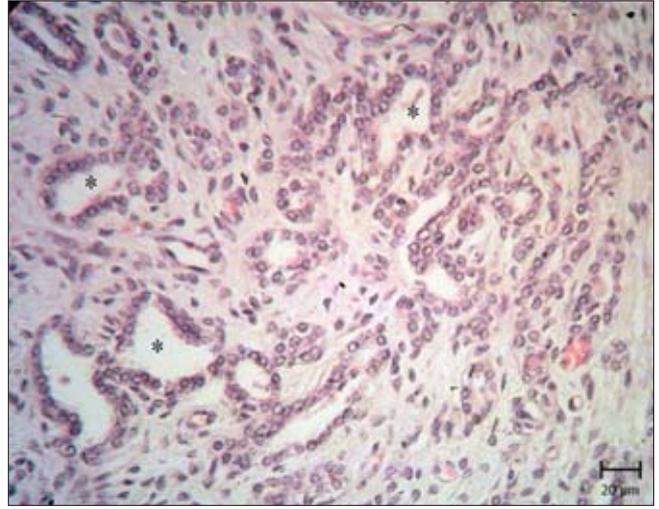


Fig 9. Part of Fig. 7 with high magnification. Note to new tubules (*star*) which covered by uniform epithelial cells and loose connective tissue around tubules (H&E)

Şekil 9. Yüksek büyütme ile şekil 7'nin bir bölümü. Aynı yapıllı epitel hücreleri ile çevrili yeni tübüller (*yıldız*) ve tübüller çevresinde gevşek bağ dokusu görülmektedir (H&E)

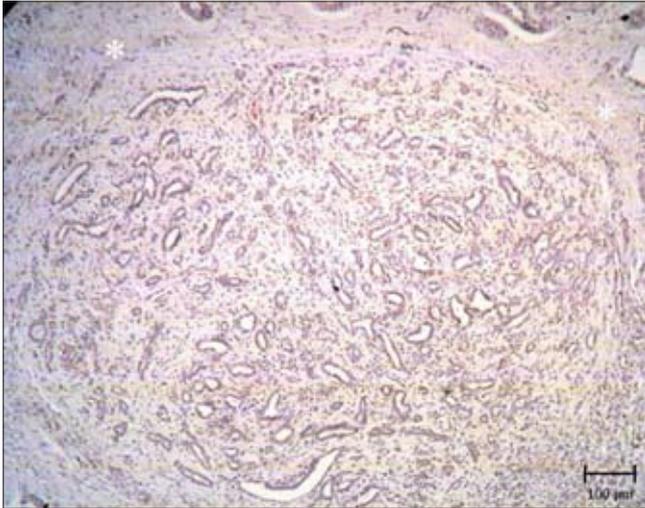


Fig 8. Camel kidney. Big foci of proliferated cells which formed tubules and surrounded by connective tissue (*star*) are seen (H&E)

Şekil 8. Deve böbreği. Tübülleri oluşturmuş ve bağ dokusu ile çevrili çoğalmış hücrelerin büyük odakları (*yıldız*) görülmektedir (H&E)

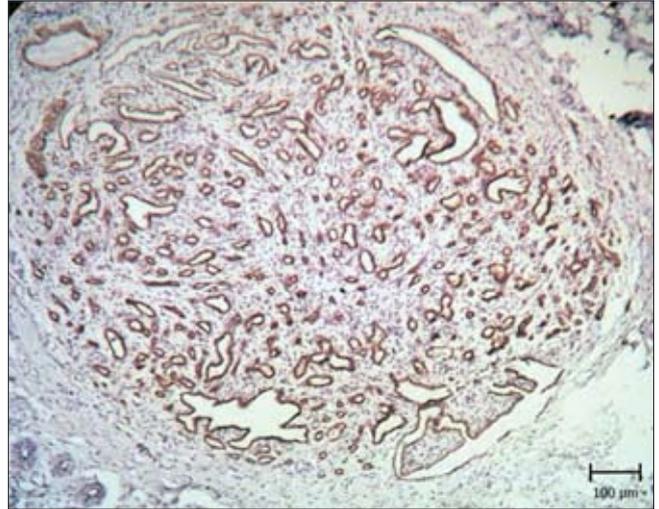


Fig 10. Renal adenoma. Note to brown tubules which are located near together. Cytokeratin immunostaining, haematoxylin counterstain

Şekil 10. Renal adenom. Yakın olarak birlikte bulunan kahverengi tübüller görülmektedir. Sitokeratin immünboyaması, hematoksilin zit boyaması

researchers also have been reported high prevalence of renal lesions in other countries [5,11]. This high prevalence of kidney lesions especially renal cell adenoma could be due to the older age of animals at slaughter with possibility of being exposed at least once to one or more agents that can induce renal disease.

The most recorded lesions of kidney were glomerulonephritis in this study. Glomerulonephritis results often from immune - mediated mechanism, which is due to involving antibodies to glomerular basement membrane or deposition of soluble immune complexes within the glomeruli. Second type of glomerulonephritis occurs in association with persistent infections or other diseases that characteristically have a prolonged antigenemia [12,13].

In this study the cause of glomerulonephritis probably is prolonged infectious disease which is unclear and needs to investigate in future. Glomerulonephritis is relatively prevalent in domestic animals and represents a common form of renal disease. It also has been reported as a sequel to chronic infectious disease [14].

ATN was showed in 10 cases. It is usually due to ischemic or a toxic insult to the renal tubular epithelial cells. In first one, disruption of the tubular basement membranes occur and tubular repair in such kidneys is imperfect. The second one is due to various classes of

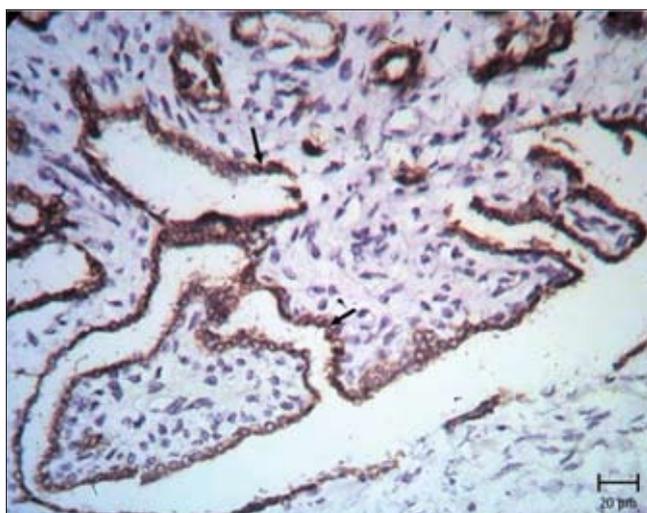


Fig 11. Part of figure 9 with high magnification. Note the brown nuclei of the epithelial cells covered the tubules (arrows). Cytokeratin immunostaining, haematoxylin counterstain

Şekil 11. Yüksek büyütme ile şekil 9'un bir bölümü. Tübüller tarafından kaplanmış epitel hücrelerinin kahverengi çekirdekleri (oklar). Sitokeratin immünboyaması, hematoksilin zıt boyaması

naturally occurring or synthetic compounds. Nephrotoxins usually do not damage the tubular basement membranes [12,13]. ATN which were observed in this study may be due to nephrotoxins which were naturally consumed by animals because the basement membranes of renal tubules were intact.

Renal cysts were seen in 2 cases. Renal cyst is common in pigs and calves. Taha et al. [11] reported cystic dilation of renal tubules in camels. Renal cyst may located anywhere in either cortex or medulla and they range from those barely visible to those several centimeters in diameter [12,13]. In these cases, the cysts were hardly seen in macroscopic and they were in cortex. They have thin walled and lined by flattened epithelium [12] which is in agreement with these cases characteristics. Also they are usually spherical. In this study mentioned cysts were elliptical and may be this is due to processing steps.

Vascular calcification was detected in more than 13 percent of slaughtered camels. These precipitations were seen in muscular middle layer (tunica media) of arteries. This finding is equivalent of Monckeberg's arteriosclerosis or medial calcific sclerosis of humans [15]. Minor degrees of calcification of the cardiovascular system are common in elderly people [16]. Vascular calcification results from deposition of calcium phosphate crystals (hydroxyapatite) as a consequence of disordered calcium phosphate regulation in the blood vessels. The mechanism of vascular calcification is not fully understood, but probably involves a phenotypic change in the vascular smooth muscle cells in the wall with activation of bone-forming program [17,18]. According to review literature there was no report in camelide about vascular calcification and maybe this is

due to their age.

Renal adenoma is rare tumor in domestic animals and when found it usually is an incidental lesion at necropsy or slaughter because these tumors are clinically silent [19]. Also this case was related to a camel which slaughtered. They are said to occur more often in cattle and horses than in other species [12,13]. In dogs they comprise about 15% of primary renal epithelial tumors. Renal adenoma arises from epithelium of the proximal convoluted tubules. Grossly, they tend to be solitary nodules less than 2 cm across but occasionally are larger. They grow expansively. Microscopically, the tumor cells are cuboidal with moderate to abundant acidophilic cytoplasm. They form tubules and acini that may be subclassified as tubular, papillary, or solid based on the major histopathological pattern: central or elongated lumen (tubular type); papillary growth of varying sizes that project into lumens (papillary) or solid sheets. Mixtures of all three types can occur [19]. In this case mixtures of tubular and papillary form were seen and solid sheets were absent. Histologic differentiation of adenoma and renal carcinoma is sometimes impossible. A few adenomas may be small well differentiated carcinoma [13]. In this case pleomorphism, cellular atypia and mitotic figures were rare so it was detected as renal adenoma. According to histopathological and immunohistochemical testing and to the best of author's knowledge; this is the first report of renal adenoma in a *Camelus dromedarius*.

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REFERENCES

1. Khalafalla AK, Saeed IK, Ali YH, Abdurrahman MB, Kwiatek O, Libeau G, Obeida AA, Abbas Z: An outbreak of Peste des petits ruminants (PPR) in camels in the Sudan. *Acta Tropica*, 116, 161-165, 2010.
2. Mostafa S, Abou El-Fetouh, Ibrahim MI: Pathological and virological studies on the encephalitis syndrome in camel (*Camelus dromedarius*). *Zag Vet J*, 21, 205-213, 1993.
3. Wernery U, Musa B, Kinne J: Rickettsia-like disease in dromedaries. *J Camel Practice Res*, 8, 7-9, 2001.
4. Samy M, El-Kholy AA, Osman N: Spontaneous aflatoxicosis in UAE camels. *Egypt J Comp Pathol Clin Pathol*, 6 (1): 25-35, 1993.
5. Fouad IA: Some studies on renal affections in camels. *Assiut Vet Med J*, 50, 101, 2004.
6. Mesbah SF, Kafi IM, Nili H: Ovarian teratoma in camel (*Camelus dromedarius*). *Vet Rec*, 151 (25): 776, 2002.
7. Gameel AA, Hegazy AA, Yassein N: Primary bronchioalveolar adenocarcinoma in a dromedary camel (*Camelus dromedarius*). *Vet Rec*, 142 (10): 252, 1998.
8. Tageldin MH, Alsumry HS, Zakia AM, Fayza AO: Suspicion of a case of lymphocytic leukaemia in a camel (*Camelus dromedarius*) in Sultanate of Oman. *Revue d Elevage ed de Medecine Veterinaire des Pays Tropicaux*, 47, 157-158, 1994.

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- 9. Vitovec J:** Renal cell carcinoma in a camel (*Camelus dromedarius*). *Vet Pathol*, 19, 331-333, 1982.
- 10. Tuttle AD, Frederico L, Linder K, Gunke C, Remick A, Redding R:** Pathological feature of the ulna due to osteosarcoma in an Arabian camel (*Camelus dromedarius*). *Vet Rec*, 161, 30-33, 2007.
- 11. Taha K, Shalaby A, Sami MB, Deeb S:** Pathological studies on the association of pneumonia and kidney affections in camels (*Camelus dromedaries*). *Egypt J Comp Path Clin Path*, 20 (1): 235-262, 2007.
- 12. Newman SJ:** The urinary system. In, Zachary JF, McGovin MD (Eds): *Pathologic Basis of Veterinary Disease*. 5th ed., 589-643, Elsevier, Missouri, 2012.
- 13. Maxie M, Newman SJ:** Urinary system. In, Maxie MG (Ed): *Jubb, Kennedy and Palmer's Pathology of Domestic Animals*. 5th ed., 61, Saunders, London, 2007.
- 14. Bourgault A, Drolet R:** Spontaneous glomerulonephritis in swine. *J Vet Diagn Invest*, 7, 122-126, 1995.
- 15. Maxie M, Robinson WF:** Cardiovascular system. In, Maxie MG (Ed): *Jubb, Kennedy and Palmer's Pathology of Domestic Animals*. 5th ed., 61, Saunders, London, 2007.
- 16. Amann K:** Media calcification and intima calcification are distinct entities in chronic kidney disease. *Clin J Am Soc Nephrol*, 3 (6): 1599-1605, 2008.
- 17. McCullough PA, Agrawal V, Danielewicz E, Abela GS:** Accelerated atherosclerotic calcification and Monckeberg's sclerosis: A continuum of advanced vascular pathology in chronic kidney disease. *Clin J Am Soc Nephrol*, 3 (6): 1585-1598, 2008.
- 18. Liu Y, Shanahan CM:** Signaling pathways and vascular calcification. *Front Biosci*, 16, 1302-1314, 2011.
- 19. Meuten DJ:** Tumors of the urinary system. In, Meuten DJ (Ed): *Tumors in Domestic Animals*. 4th ed., 509-512, Ames, Iowa, 2002.