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PATHOLOGICAL AND SEROBIOCHEMICAL STUDIES ON NATURALLY OCCURRING KIDNEY AFFECTIONS IN CAMELS (*Camelus dromedarius*)

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ABSTRACT

In the present investigation, gross and microscopic lesions of the kidney as well as some haematological and serobiochemical tests were studied in 50 adult camels. Fresh samples of blood and kidney tissues were collected from camels of both sexes at the point of slaughter in Al Ahsa abattoir, eastern region of Kingdom of Saudi Arabia. Grossly, out of 50 camels examined, 33(66%) had kidney lesions of one type or another whereas, 17 (34%) were apparently healthy. Only 2 (4%) kidneys showed hydronephrosis with clear watery fluid and hard on palpation. Renal haemorrhages and necrosis were observed in 10 (20%) of the collected samples of kidneys. Microscopically out of the 33 camel kidneys collected with naturally occurring lesions, glomerular shrinkage and hyalinisation were observed in 10 (33%) kidneys. Proteinaceous casts, (in the urinary spaces and renal tubules), were seen in 8 (27%) kidneys. Moreover, 6 (15%) kidneys showed cortical and medullary congestion whereas, tubular cell swelling, interstitial haemorrhage and thickening of the glomerular tufts were seen in 5 (15%), 2 (6%) and 2 (6%) kidneys, respectively. In addition, significant change was observed in Total Erythrocyte Count (TEC), Haemoglobin Concentration (Hb) and Packed Cell Volume (PCV) in camels with naturally occurring kidney lesions. However, the biochemical findings in camels with kidney lesions showed higher values of serum ALT, AST, GGT and creatinine, as well as, lower values of total protein. On the other hand, no change was observed in the concentration of blood urea nitrogen (BUN) in all camels. The present results indicate that the camels are exposed to nephrotoxins in the study area possibly from toxic constituents such as hazardous elements as they graze.

Key words: Camel histopathology, hydronephrosis, kidney lesion, serobiochemical changes

The kidney of the camel can conserve water by producing highly concentrated urine (Kataria *et al,* 2007; Ouajd and Kamel, 2009). The thick renal medulla with a cortico-medullary ratio of 1:4, the specialised folds of the renal pelvis (fornices) and the huge absorptive surface area of the proximal convoluted tubules combine to make the kidney of the camel very efficient in water conservation (Abdulla and Abdulla, 1979). The notion that the camel is very resistant to diseases appears to be unfounded, as the camel has been shown to suffer from many disease conditions including those that affect the kidneys (Abbas and Omer, 2005, Taha *et al*, 2007). The aetiology, epidemiology, clinical aspects pathology, diagnosis and treatment of many diseases in camelids have been extensively studied (Wernery *et al,* 2014).

Radostits *et al* (2007) reported that urolithiasis is common as subclinical disorder in animals grazing certain types of pasture. Camel diseases of the kidney e.g. nephrosis, glomerulonephritis, renal cysts, hydronephrosis, renal abscesses, urolithiasis and tumours were found coincidentally during either slaughter or postmortem examination (Fowler, 2010). Recently, dromedary camels in Saudi Arabia are implicated as possible viral reservoir for middle east respiratory syndrome coronavirus (MERS-COV) associated with severe respiratory and renal failure in infected patients (Zaki *et al,* 2012; Drosten *et al,* 2013). The present study is therefore, designed to assess the naturally occurring lesions in the kidneys of the camels and to correlate these lesions with the changes in some haematological and serobiochemical values.

Materials and Methods

The kidneys of 50 apparently healthy adult camels of both sexes were studied for gross and microscopic lesions after slaughter at Al Hofof abattoir. Blood samples were collected from the jugular vein immediately after slaughter, for haematological and serobiochemical analysis.

Total erythrocyte counts (TEC), haemoglobin concentration (Hb), packed cell volume (PCV), total

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leukocyte counts (TLC) and differential leukocyte counts (DLC) were determined using Abaxis Vetscan HM5–America analyzer.

Serum total protein, creatinine, urea and the serum enzymes alanine transaminase (ALT), aspartate transaminase (AST) and gamma-glutamyle transpeptidase (GGT), were determined using Abaxis Vetscan VS2–America analyser.

Results are expressed as mean ± SD and presence of significant differences among means of the groups was determined using one way ANOVA with a Tukey-Kramer post-test for significance. Values were considered significant when $P < 0.05$.

Kidney samples were fixed in 10% neutral formalin, mounted in paraffin, sectioned and stained with Haematoxylin and Eosin (HE) according to the method of Bancroft and Gamble (2008).

Results and Discussion

Grossly, out of 50 camels examined 33(66%) had kidney lesions of one type or another, whereas 17 (34%) were apparently healthy. Hydronephrosis with clear watery fluid and hard on palpation was observed in 2 (4%) samples (Fig 1). Renal petechial haemorrhages and necrosis were observed in 10 (20%) samples (Fig 2). Histopathological examination of the collected kidney samples revealed glomerular shrinkage and hyalinisation (Fig 3), proteinaceous casts (Fig 4), cortical and medullary congestion (Fig 5), interstitial haemorrhage (Fig 6), thickening of the glomerular tufts (Fig 7).

The haematological findings of healthy camels and camels with naturally occurring kidney lesions are given in table 1. Camels with kidney lesions showed a remarkable reduction in TEC, Hb. concentration and PCV. No significant changes were observed in TLC, neutrophils and lymphocyte count.

The serobiochemical changes in healthy camels and in camels with naturally occurring lesions are shown in table 2. Camels with naturally occurring lesions had significantly ($P<0.05$) lower values of serum total protein and higher values ($P<0.05$) for creatinine, ALT, AST and GGT whereas, no significant change was observed in the concentration of serum urea in all camels.

In this study, 66% prevalence of gross renal lesions in camels of AL Ahsa region was seen without evidence of any relevant clinical sign on antemortem examination. This is probably because renal diseases in animals, especially the camel are often subclinical (Aughey and Frye, 2001). This rate was also much higher than the 16.5% reported for some parts of Egypt (Salem and Hassan, 2007). A good reason for this high rate could be because most of the animals brought for slaughter were probably culls. There is also the possibility of the animals being exposed to nephrotoxic agrochemicals locally. Eastern province of Saudi Arabia is considered as a border of Saudi Arabia with Qatar and Bahrain. This region is characterised by petroleum industries, which might cause liberation of toxic constituents such as hazardous elements. These elements may deposit in soil then passed through the grazing plants to the different types of animals.

Table 1. Haematological parameters in healthy camels and camels with naturally occurring lesions (n=50).

Parameter	Camels with kidney lesions	Healthy camels
Total leucocyte count ($X10^6$/µl)	6.65±1.75[a]	8.81±2.50[b]
Haemoglobin concentration (g/dL)	10.11±1.02[a]	14.0±2.1[b]
Packed cell volume (%)	25.6±1.3[a]	35.3±1.4[b]
Total leucocytes count ($X10^3$/ µl)	13.3±2.1	12.9±1.8
Neutrophils (%) =7.53x10^3/ul	55.3±3.2	54.7±2.6l
Lymphocytes (%)= 5.38x10^3/ul	49.5±2.1	50.9±3.1
Monocytes (%)= 3. 38x10^3/ul	2.75±0.34	3.00±1.6
Eosinophils (%)= 1.83 x10^3/ul	1.38±0.11	1.35±0.41
Basophils (%)=0.12 x10^3/ul	0.09±0.04	0.10±0.06

Values in each row with different letters are statistically different ($P<0.05$).

Table 2. Biochemical parameters in healthy camels and camels with naturally occurring lesions (n=50).

Parameter	Camels with kidney lesions	Healthy camels
Total protein (mg/dl)	6.8 7±1.6[a]	9.11±1.7[b]
Creatinine (mg/dl)	1.81±0.18[a]	1.1 2±0.20[b]
Urea (mg/dl)	75.2±4.1	73.4 ± 3.6
Alanin transaminase(IU/l)	32.4±2.33[a]	12.4±3.1[b]
Aspartate transaminase (IU/l)	124.3±4.3[a]	100.1±3.1[b]
Gamma glutamyl transpeptidase(IU/l)	36.2±1.4[a]	24.2±2.4[b]

Values in each row with different letters are statistically different ($P<0.05$).

Minerals play a key role in the formation of the active chemical constituents present in plants and therefore they may contribute in their nutritional properties as well as toxic activities (Selvaraja *et al*, 2004, Selvaraj and Sumantha 2011). In this study, mild to moderate microscopic kidney lesions were observed in 33 (66%) of the camels studied. Previous reports have revealed that extensive damage to renal tubules

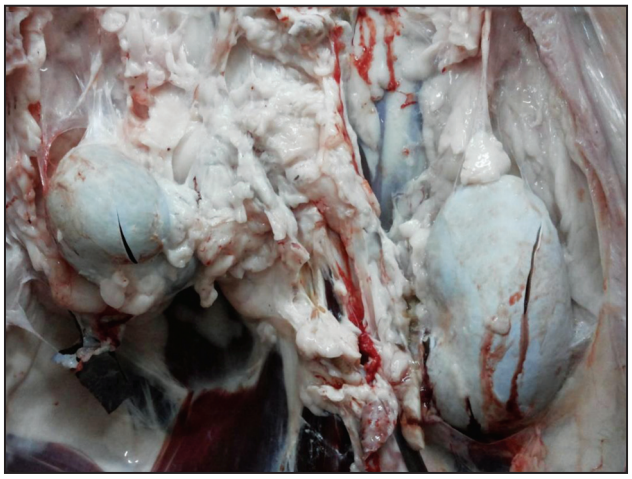

Fig 1. Left kidney of camel showing hydronephrosis.

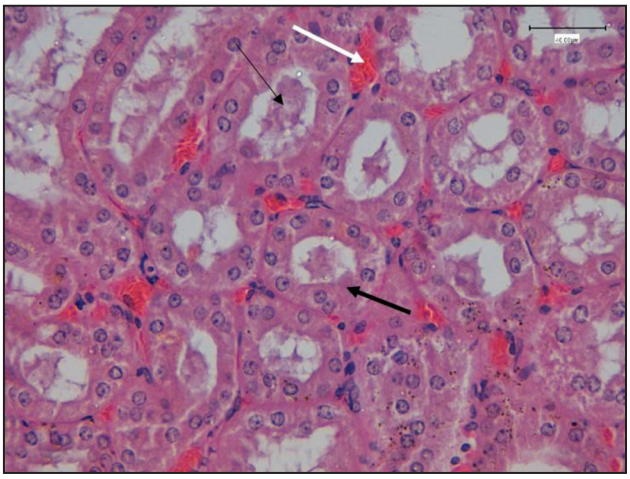

Fig 4. Kidney of camel showing tubular cell swelling (Thick arrow), protein casts (Thin arrow) and medullary congestion (White arrow) H&E X40.

Fig 2. Kidney of camel showing sub capsular haemorrhages and necrosis.

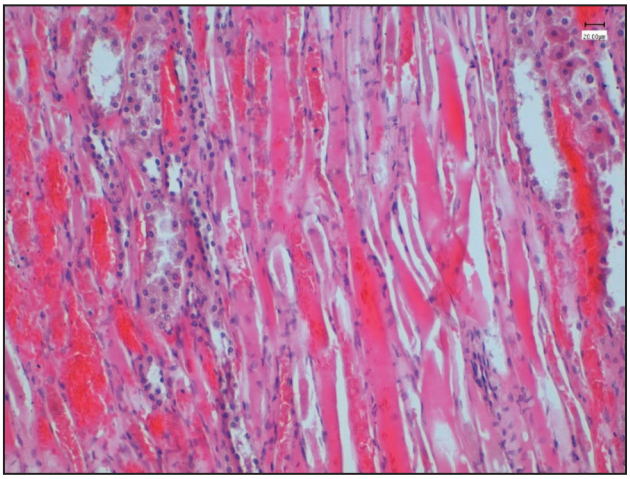

Fig 5. Kidney of camel showing interstitial haemorrhages and tubular cell necrosis H&E X20.

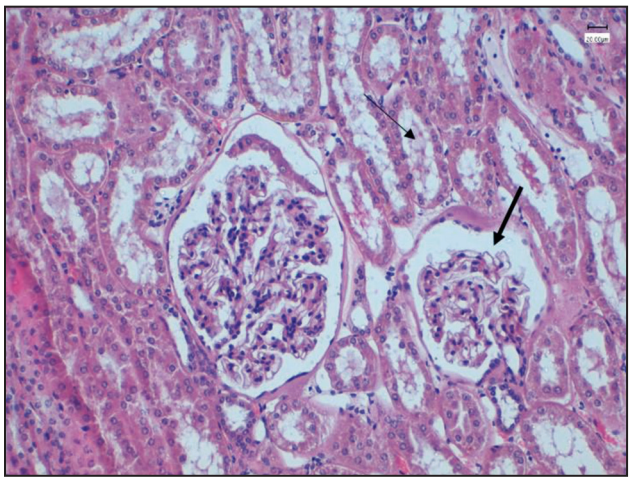

Fig 3. The kidney of camel showing glomerular shrinkage (Thick arrow) and protein casts in the proximal convoluted tubules (Thin arrow) H&E X20.

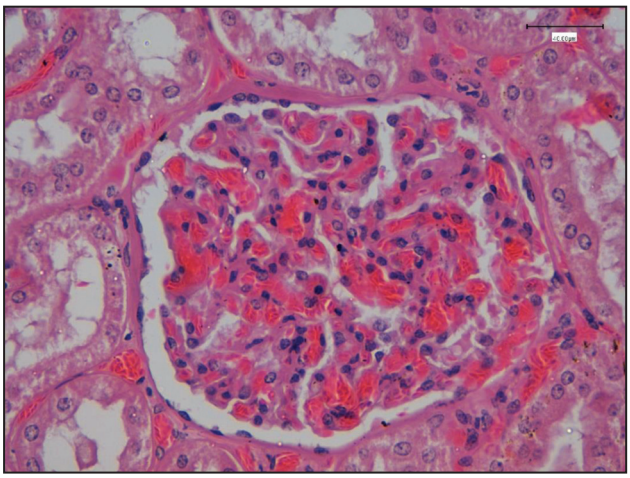

Fig 6. Kidney of camel showing cortical congestion and thickening of the glomerular tuft H&E X40.

can cause secondary atrophy of the nephron, making renal tubular degeneration and necrosis (nephrosis) a major cause of acute renal failure in man and animals (McGavin and Zachary, 2007).The Renal tubular degeneration indicates a mild to moderate reversible cellular injury that may advance to apoptosis or necrosis. The first step in the development of tubular degeneration and necrosis is the breakdown of ionic transport and the accumulation of sodium ions in the lumina of tubules, which stimulates the renin-angiotensin mechanism with subsequent vasoconstriction in the nephron (Salem and Hassan, 2007; McGavin and Zachary, 2007).

The present study showed mild alteration in in the blood constituents. A noticeable decrease in the total erythrocyte count, (TEC), haemoglobin concentration (Hb) and packed cell volume (PCV) was observed in camels with different kidney lesions. Incidence of anaemia in association with kidney diseases may be due to lack of food because of inappetence during the chronic course of kidney diseases, which may inhibit erythropoiesis (Feldman, *et al,* 2000). The obtained results showed no significant changes in total leucocyte count (TLC), neutrophils and lymphocyte count. Surprisingly, there was no evidence of a clearly defined inflammatory responses in the kidneys examined. This is not much different from the observations of Taha *et al* (2007) in which only 2% of camels examined showed mild mononuclear reactions. Salem and Hassan (2009) also reported focal mononuclear cell reaction despite acute tubular necrosis and other lesions in 2 animals out of 92. This could be partly explained by immunosuppression or unknown mechanisms that restrain inflammatory responses in order to limit tissue damage. The anti-inflammatory humoural mechanism and cytokine production was described in many species (Kelvin, 2007; Ivashkiv and Donlin, 2014). Accordingly, it seems possible to investigate this mechanism in dromedary camels.

The elevated levels of serum ALT, AST, GGT and creatinine obtained in this study suggest the occurrence of kidney damage and these serum enzymes may be a good indicators of such renal damage. However, previous reports have shown that the range of reference values of these enzymes varies considerably in dromedary camels (AL-Ali *et al,* 1988, Kataria *et al,* 2007).

Significant decrease in the level of serum protein was shown in camels with kidney lesions. It has been shown that protein casts are associated with protein loss leading to hypoproteinemia with resultant dependant edema in other animals (Aughey and Fyre, 2001). The effects of hypoproteinemia may not be apparent in the camel, because it may be able to maintain its blood pressure by adjustments in urea reabsorption and other water conservation mechanisms (Kataria *et al,* 2007; Oaujd and Kamel, 2009).

No remarkable change was observed in the concentration of (BUN) in all camels in this study. However, it has been reported that more than 50% of the renal mass must be damaged before any change in BUN is detected (Borjesson, 2003; Guyton, 2006).

Conclusion

Camels in the study area showed prevalence of renal diseases, especially those leading to chronic renal failure such as glomerular shrinkage and sclerosis with leakage of plasma proteins. Therefore, the presence of nephrotoxins in the study area is suspected.

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