Chronic renal failure disease in adult green iguanas (*Iguana iguana*).[1]

Knotek Z[1,2], Dorrestein GM[1,3], Knotková Z[1], Zwart P[4]

[1]Avian and Exotic Animal Clinic, Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic; [2]Clinic for Avian, Reptile and Fish Medicine, University of Veterinary Medicine, Vienna, Austria; [3] Diagnostic Pathology Laboratory NOIVBD Veldhoven, The Netherlands; [4] Dept Veterinary Pathology, Utrecht University, The Netherlands; knotekz@vfu.cz

Summary

Thirty eight adult green iguanas (*Iguana iguana*) suffering from anorexia (92.1 %), weak muscle tone and limited hind leg movement (44.7 %) were included in this study. The complete blood count revealed elevated heterophils (6.15 ± 3.56 G/l), eosinophils (0.72 ± 0.51 G/l) and azurophils (0.92 ± 0.10 G/l). Abnormalities of the plasma chemistry panel included increased concentrations of uric acid (328.37 ± 196.22 μmol/l) and phosphorus (6.95 ± 3.35 mmol/l), increased activity of aspartate aminotransferase (431.14 ± 409.0 U/l) and creatinphosphokinase (3473.05 ± 940 U/l), as well as a decreased activity of alkaline phosphatase (29.94 ± 19.16 U/l). The calcium-to-phosphorus ratio fell down, to 0.29. Despite supportive treatment 15 of 38 patients died. Necropsy revealed renomegaly (80.0 %), with urinary bladder distension (86.7 %) and constipation of the colon (60.0 %). Histopathologic examinations demonstrated interstitial oedema, tubular necrosis, interstitial nephritis with calcification, tubulointerstitial nephritis with active inflammation, renal cysts, renal fibrosis, hepatic lipidosis, and hyperparathyreosis.

Introduction

In herbivorous lizards, metabolic diseases caused by mistakes in husbandry management and nutrition would result in different forms of renal diseases (Wright and Cooper 1981, Troyer 1984). Dehydration of the animal combined with metastatic calcification and defective renal

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function due to chronic renal parenchyma impairment is the typical end-situation of chronic metabolic disease in green iguanas (Boyer and others 1996, Ball and others 1999, Antinoff 2000). The problem in veterinary practice is that renal diseases in the form of glomerular, tubular and/or interstitial failure are frequently missed by the clinicians (Zwart 1992). Blood cytology and plasma chemistry values vary with gender, age and seasonal status but marked elevation of the packed cell volume usually indicates dehydration. However, in cases of chronic renal failure, non regenerative anaemia with a reduced packed cell volume may be evident and can mask serious fluid deficits (Divers 2000). Chronic renal failure in herbivorous lizards would be associated with elevation of plasma concentrations of minerals (especially phosphorus) and alteration of the calcium-to-phosphorus ratio (Knotek and others 2002). While this ratio falls to less than 1, being the first biochemical indicator of renal disease, significant elevation of plasma uric acid concentration is not apparent until the extensive renal tissue damage occurs (Divers 2000). Blood (plasma) chemistry is limited in detailing the type of the specific renal disease. Therefore the best diagnostic method is the morphological interpretation of the renal tissue morphology status (Zwart 1992, Divers 2000). The aim of this retrospective study was to characterize the chronic renal failure in 38 green iguanas by the use of the blood cell morphology, plasma chemistry, imaging techniques and histopathology.

Materials and Methods

A total of 38 green iguanas suffering from chronic renal diseases were included in this study. The first step consisted of a thorough history record taking (age of the animal at the time of first clinical signs, duration of the disease, associations with the environmental factors and food intake, health status of other animals kept). Such signs as the current temperament of the lizard, type of locomotion, appetite, faeces and urine character, hind legs status were evaluated. Lateral (LL) and dorsoventral (DV) full-body radiographs were made using a Proteus XR (GE Medical Systems, USA) and digital automatic system FCR Capsula XL (Fuji, Japan). A total volume of 1.0 – 1.5 ml of heparinised blood was collected from the ventral tail vein and packed cell volume was measured, using centrifugation in microheamatocrit capillary tubes. Total red and white blood cells counts were performed manually, using a haemocytometer with Natt and Herrick´s solution (staining solution in a 1:100 dilution). The Pappenheim method of biphasic staining with May-Grűnwald and Giemsa-Romanowski stain was used. Differential leukocyte counts were assessed by enumeration of 200 cells in each smear stained panoptically by the Pappenheim method.

Plasma chemical assays were performed by the use of automated analyzers – the concentration of total protein (TP), uric acid (UA), and phosphorus (P), as well as activity of alkaline phosphatase (AP), alanine aminotransferase (ALT), aspartate aminotransferase (AST) and creatin phosphokinase (CK) were analyzed with a CobasMira analyzer (Roche); plasma concentration of calcium (Ca) and potassium (K) were determined using a AA Series Spectrometer (Thermo Electron Corporation, UK).

The treatment of chronic renal failure consisted in intensive fluid therapy by subcutaneous administration of fluids, minerals, vitamins, glucose and amino acids (Duphalyte inj. ad us. vet., Fort Dodge Veterinaria S.A., Spain + 0.9% NaCl, Braun, Germany, 20 ml/kg body weight daily), and washing the cloaca and the urine bladder with lukewarm water. Tissues collected for histopathological examination during necropsy of the dead iguanas, were preserved in 10% buffered formalin and processed in a standard paraffin technique. Differentiation of inflammatory lesions, determination of individual types of changes, classification of neoplasia, and the diagnosis of possible infectious diseases were performed.

Results

Clinical signs associated with chronic renal failure in the group of 38 iguanas varied. Most affected lizards (30, 78.9 %) were in poor body condition, flaccid and weak with poor muscle activity. Anorexia was present in 33 (92.1 %) patients, frequently associated with limited hind l egs movement (17, 44.7 %). Swelling of the hind legs appeared in 12 (31.6 %) and tremor was present in 5 (13.2 %) iguanas. Mean values for PCV, RBC counts and WBC counts were within normal ranges for green iguanas. The results of the blood profile are presented in tables (Tab1, Tab 2). The complete blood count revealed elevated heterophils (6.15 ± 3.56 G/l), eosinophils (0.72 ± 0.51 G/l) and azurophils (0.92 ± 0.10 G/l). Abnormalities of the plasma chemistry panel included increased concentrations of UA (328.37 ± 196.22 μmol/l), marked elevation of the concentration of phosphorus (6.95 ± 3.35 mmol/l), increased activity of AST (431.14 ± 409.0 U/l) and CK (3473.05 ± 940 U/l), as well as a decreased activity of AP (29.94 ± 19.16 U/l). The calcium-to-phosphorus ratio dropped, to 0.29. Despite the treatment 15 of 38 green iguanas (39.5 %) died. Necropsy revealed renomegaly and urinary bladder distension in 12 of 15 iguanas (80.0 %) and 13 of 15 patients (86.7 %), respectively. Constipation as a secondary complication of the colon compression by the enlarged kidneys (Fig. 1.) was observed in 9 of 15 (60.0 %) iguanas. Histopathological examinations revealed tubular necrosis, interstitial nephritis with calcification, tubulointerstitial nephritis with active

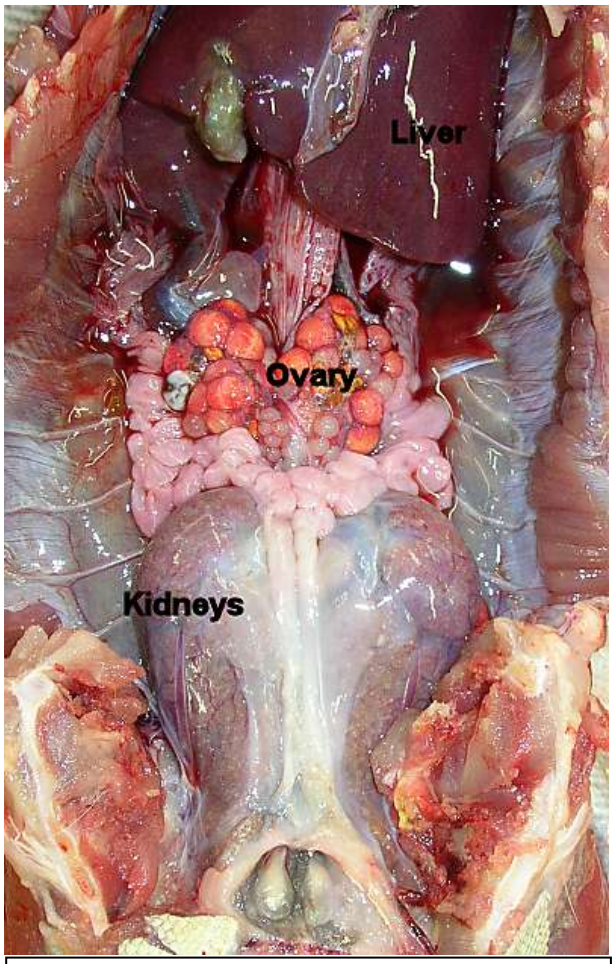

Fig. 1. Iguana with renomegaly (PA 07-0831 90/07)

inflammation, renal cysts, renal fibrosis, hepatic lipidosis, and hyperparathyreosis. Mineral deposits were present in the walls of veins and the trachea. No specific lesions were identified in the heart, spleen, pancreas, stomach and lung. No indication for a specific infectious disease was found in any of the animals in this study.

Discussion

A metabolic disease of the mid-age green iguanas which is characterized by derangements of the calcium to phosphorus ratio, depression, weight loss, anorexia and pale mucous membranes is common, but the etiology of this disease was described as not known by Rosenthal (2002), whereas the chronic renal disease was suggested by other authors (Knotek and others 2002). Renal disease is a common problem and a major cause of reptile mortality in captivity (Boyer and others 1996, Antinoff 2000). The clinical signs of severe chronic renal failure in green iguanas included anorexia, lethargy, tremors, dyschezia, bloat and paresis. Anorexia was the most frequent clinical symptom observed in iguanas with renal disease in our present study, which is in accordance with the authors cited above. Swelling of the hind legs was present in 31.6 % patients, associated in all cases with anorexia. Dyschezia as a consequence of colon compression by the kidneys was observed in 60.0 % of the patients that died. Boyer and others (1996) described tremor as a typical manifestation of severe renal failure in 66 % of green iguanas in his study, however among the present group of iguanas, tremor was observed in only 13.2 % patients. It is our experience that the exact size and/or shape of the kidneys in iguanid lizard cannot be assessed by dorsoventral nor by laterolateral radiographs. The kidneys normally do not extend to the cranial border of the pelvic canal. Therefore manual control of the kidneys size and shape is a feasible method which could be done by digital pressure laterally to the body as well as via the cloaca (Antinoff 2000, Knotek and others

2002). Ultrasound has proved to be more useful for the assessment of size and shape of the kidneys. It permits the examination and appreciation of the size, shape and contours of the kidney and facilitates the collection of multiple tissue biopsies under direct visual control. At our present study the mean values for the packed cell volume, RBC counts and WBC counts were within normal ranges for iguanas. A problem in communicating results is that the standard haematological profile established for healthy green iguanas is laboratory-specific (Harr and others 2001, Knotek and others 2002). Nevertheless, the number of heterophils in the peripheral blood of iguanas with renal failure described by Boyer and others (1996) seems to be high enough to be evaluated as a heterophilia. The mean values for heterophils in our present study could be generally evaluated as significantly elevated. We suppose that chronic renal failure in green iguanas is accompanied with high number of heterophils as well as low numbers of lymphocytes. In the group of thirty eight green iguanas of this study, mean values for total protein were lower than normal ranges for healthy green iguanas (Knotek and others 2002), whereas the activities of AST and CK were very high. These findings are in accordance with Boyer and others (1996) and also with the results of our previous study (Knotek and others 2002). The plasma levels of AP decreased; mean values for ALT and calcium were within normal ranges for healthy green iguanas. The marked effect of the reproductive activity and dehydration on the uric acid and phosphorus plasma concentrations has to be excluded. A primary metabolic disease of adult green iguanas with high aspartate aminotransferase, very high creatin phosphokinase, elevated phosphorus, abnormal calcium-to-phosphorus ratio, and normal uric acid was mentioned by Rosenthal (2002). It is known that the plasma level of uric acid can be normal, even in iguanas suffering from chronic renal failure. It may not elevate until the later stages of the renal disease, therefore the calcium-to-phosphorus ratio is considered to be a much more sensitive parameter (Divers 2000, Knotek and others 2002). Boyer and others (1996) observed leukocytosis, heterophilia and high packed cell volume in five iguanas with renal failure. In the present study renomegaly was found during necropsy in 80.0 % iguanas, with tubular necrosis, renal oedema, interstitial nephritis with calcification, tubulointerstitial nephritis with active inflammation, renal cysts and renal fibrosis. This in accordance with suggestion of Zwart (1992) that tubulonephrosis is a frequent disease of herbivorous green iguanas. There was extensive tubular and/or interstitial inflammation in 40.0 % of iguanas examined by post-mortem during the present study, with no evidence of any bacterial organisms.

The radiographic examination appeared to have limited practical use in the diagnosis of renomegaly in green iguanas. We recommend examination of the number of heterophils and

lymphocytes, as well as the plasma concentrations of uric acid, phosphorus and calcium (calcium-to-phosphorus ratio) in mid-age green iguanas, especially if chronic renal failure is suspected to be the cause of anorexia.

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Table 1. Haematological Profile in Green Iguanas with Chronic Renal Failure

Values	Units	Green iguanas with renal disease n = 38			Healthy green iguanas[1]
		Min.	Max.	Mean ± SD	Mean ± SD
PCV	l/l	0.22	0.42	0.37 ± 0.11	0.34 ± 0.04
RBC	T/l	0.69	1.20	1.18 ± 0.28	1.3 ± 0.20
Total WBC	G/l	7.60	23.4	12.80 ± 5.4	15.1 ± 5.9
Heterophils	G/l	4.20	8.20	6.15 ± 3.56	3.6 ± 2.3
Azurophils	G/l	0.31	1.00	0.92 ± 0.10	-
Lymphocytes	G/l	2.15	9.20	7.70 ± 5.12	9.7 ± 4.5
Monocytes	G/l	0	1.80	0.90 ± 0.79	1.3 ± 0.9
Eosinophils	G/l	0	1.00	0.72 ± 0.51	0.1 ± 0.2
Basophils	G/l	0	0.70	0.35 ± 0.14	0.4 ± 0.3

[1] Harr and others (2001)

Table 2. Plasma Chemistry Profile in Green Iguanas with Chronic Renal Failure

Values		Green iguanas with renal disease n = 38			Healthy green iguanas [1]		
		Min.	Max.	Mean ± SD	Min.	Max.	Mean
Total protein	g/l	22.00	56.00	35.24 ± 8.50	22.0	78.2	56.1
Uric acid	μmol/l	44.00	815.60	328.37 ± 196.22	70.4	145.3	89.3
AP	U/l	4.19	80.84	29.94 ± 19.16	41.92	293.41	155.69
ALT	U/l	3.59	153.29	47.90 ± 39.52	< 5.99	71.86	47.90
AST	U/l	11.98	2024.0	431.14 ± 409.0	< 5.99	95.81	71.86
CK	U/l	11.98	20958	3473.05 ± 940	< 5.99	< 5.99	< 5.99
K	mmol/l	3.69	6.51	5.25 ± 0.28	1.3	5.2	3.2
Ca	mmol/l	0.89	3.38	2.01 ± 0.69	2.2	3.5	3.3
P	mmol/l	2.51	11.90	6.95 ± 3.35	1.4	3.1	1.6

[1] Trnkova and others (2007)