Feline kidney disease: *its symptoms and management*

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Kidney disease is one of the most commonly diagnosed diseases in cats, particularly older animals where it is a common reason for death or euthanasia. As veterinary nurses you will deal with kidney disease on a daily basis, whether giving advice on the phone about the importance of pre-anaesthetic blood screening, dealing with fluid therapy and hospitalised patients or, perhaps, doing blood pressure measurements or subcutaneous fluid therapy on outpatients. It is therefore important to have a good understanding of its physiology, pathology and treatments.

Physiology

The kidneys produce urine firstly by filtering the blood in the glomeruli, in the outer layer of the kidneys – called the cortex (Figure 1). This filtrate is passed through the tubules of the kidney where it is modified to produce urine, which is excreted through the renal pelvis into the renal sinus and

then into the ureters. The kidneys are responsible for:

- maintaining fluid balance,
- electrolyte balance, principally sodium, potassium, chloride and phosphate,
- acid-base balance (through the secretion of excess acid into the urine),
- removing toxic waste products.

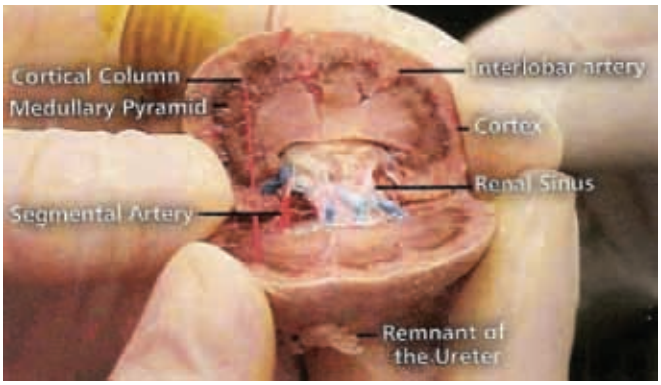

Figure 1

The most important hormone system controlled by the kidneys is the renin-angiotensin-aldosterone system or RAS, (Figure 2) which is activated when the blood pressure drops in the glomerulus. The activation of the RAS has many effects, including increased blood pressure, retention of sodium and chloride in the tubules, excretion of potassium and production of a more concentrated urine. In addition, the kidneys have other important roles such as metabolism of drugs, maintaining red blood cell production through the secretion of the hormone erythropoietin and maintaining calcium balance partly through the conversion of vitamin D to a biologically active form.

Pathology

There are numerous causes of kidney disease in cats. These include:

- congenital problems, such as polycystic kidney disease (common in Persians),
- kidney or urethral stones (commonly oxalate),
- toxins, for example
  - melamine; contamination of pet food caused a massive food recall last year in North America
  - antifreeze (propylene glycol)
  - plants such as lilies (both flowers and leaves)
  - many household disinfectants, cleaners and degreasers
  - drugs such as Gentamycin
- infections - they may be an ascending urinary tract infection or a blood borne pyelonephritis,
- neoplasia for example lymphosarcoma,
- glomerulonephritis – this is rare but can cause nephrotic syndrome, which can be spectacular as it involves extensive subcutaneous and internal fluid build up. The affected cat may swell up and have puffy legs, tail and face.

In most cases of kidney disease in senior cats, however, the underlying cause is never known. In these cats with chronic kidney diseases (CKD), there is irreversible progressive damage throughout the kidneys due to inflammation and fibrosis (chronic interstitial nephritis).

Case history

The following case history does not necessarily represent the "best" way to treat a cat with symptoms of acute kidney failure, but is a real life case from first opinion practice.

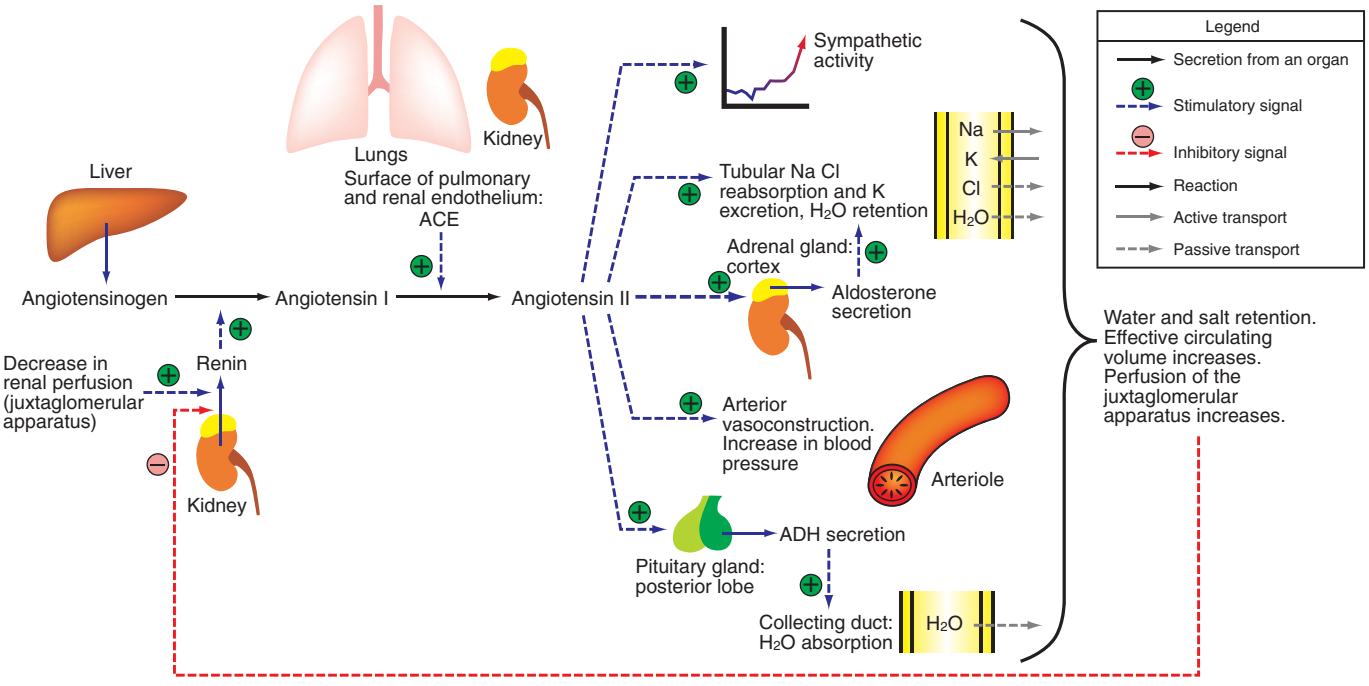

Figure 2: Renin-angiotensin-aldosterone system

Ciccio is a four-year-old male indoor and outdoor cat that was presented to me with a two-month history of weight-loss, a one-week history of poor appetite and a two-day history of severe lethargy. Ciccio is well loved but lives in a two-cat household, and so the owner was not sure how much he had been eating, what his stools were like or how much he was drinking.

On examination, Ciccio was extremely depressed and weak. He was pale with a normal capillary refill time, dental infection and stinky breath. His eyes were sunken and he had marked skin tent. He weighed 3.2kg with a body condition score of 2/5.

His heart rate was 150bpm, respiratory rate of 40bpm and his kidneys were slightly tender and irregular. He was very constipated with stool palpable throughout his colon. The bladder was not palpable. His temperature was 37°C.

The following tests were done immediately. The chemistry and complete blood count were sent out:

- total protein (high) and packed cell volume (PCV ok),
- blood urea nitrogen (BUN; very high),
- blood glucose (ok),
- doppler systolic blood pressure 95mmHg (low),
- ECG - hyperkalaemia (high potassium) can cause tall spiky T-waves, but this was not seen in this cat,
- urinalysis: urine concentration (USG) 1.020 (low) pH 6.0, protein 1+ (not excessive), granular casts, many epithelial cells, no crystals (this is important as many toxins, such as antifreeze, can cause urine crystals), no sign of bacteria or white blood cells,
- radiography showed large bilateral nephroliths or kidney stones (Figure 3).

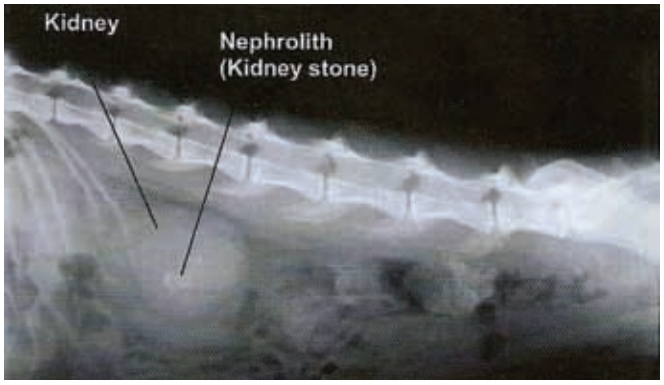

Figure 3: A nephrolith (kidney stone) was visible in Ciccio's kidney on lateral abdominal x-ray.

List of symptoms

- depression, anorexia and weight-loss,
- severe dehydration with an associated low blood pressure,
- increased respiratory rate (likely to be due to acidosis),
- hypothermia (common with kidney disease),
- abnormal kidney function with the possibility of a severe acid-base and electrolyte imbalance,
- possibility of anuria (no urine production).

Ideally, Ciccio should have gone to our local emergency service for immediate assessment of electrolytes and blood gas analysis, assessment of urine production and intensive care, but the client did not have a lot of money and was not able to afford the associated additional cost. Therefore, we were faced with treating this cat "blind" for the first 24hours until we got the serum chemistry results back.

Initial treatment

Ciccio's initial treatment consisted of:

- rapid rehydration with Lactated Ringers Solution (LRS) intravenously at 75ml per hour (using an infusion pump for accuracy) for four hours. As a rule of thumb an animal that is severely dehydrated needs about 10 percent of its body weight (3.2kg x 10% = 0.32litres or 320ml) in fluids to correct dehydration. LRS is a balanced electrolyte solution that has some potassium (usually not enough) and can be helpful for correcting metabolic acidosis, which is common with acute and chronic kidney disease,
- as we were concerned about anuria, we assessed Ciccio hourly for urine production. This could have been done by catheterisation, but we elected to check Ciccio by palpation of the bladder to make sure it was filling, and luckily after the first hour of fluids his bladder started to fill – phew!! In addition the heart rate, respiratory rate and general awareness were monitored hourly. Aggressive fluid therapy can cause a too rapid change in blood and oncotic pressure leading to cerebral and pulmonary oedema,
- after four hours Ciccio was a lot brighter and the fluid rate was turned down to three times maintenance (maintenance requirements approximately 2ml/kg/hour). Cats with kidney disease are often polyuric following rehydration and have increased maintenance requirements,
- the following morning Ciccio had gained 0.3kg, indicating that the rehydration was successful but not too excessive; weighing cats on IV fluids is very important to assess the success of treatment,
- Clindamycin (for the dental infection) and ranitidine (to control stomach acidity, which can lead to nausea and vomiting) were given. Ciccio was also given a mini-enema to relieve the constipation.

Follow-up care

The chemistry results came back the next day and were very bad (Table 1), with extremely high creatine and BUN indicating severe kidney disease. We discussed the guarded to poor prognosis and possible euthanasia with the client, but they elected to continue treatment.

Table 1 - Ciccio's serum chemistry on admission

Analyte	Result	Reference range
Total protein	85	60-80g/l
Albumin	45	25.0-45g/l
Globulin	40	25.0-45g/l
Creatinine	1150	20-177µmol/l
Urea	92	2.5-9.9mmol/l
Chloride	95	100-124mmol/l
Potassium	4.0	3.5-5.5mmol/l
Sodium	142	145-157mmol/l
Phosphate	6.1	0.9-2.2mmol/l
Calcium	2.1	2.0-2.5mmol/l
Bicarbonate	2	13-21mmol/l

It is important to remember that animals with acute kidney disease some or all of the kidney function can be recovered with aggressive prompt therapy. Even in cats with chronic or ongoing kidney disease the true extent of the kidney damage cannot be assessed until the cat has been rehydrated, as dehydration will markedly affect the creatinine and BUN concentrations. Young cats are relatively tolerant of moderate of CKD and can sometimes live for years with a moderately high creatinine concentration – if you can pull them through the acute phase of their disease.

Ciccio was treated with intravenous fluids, tailored to the specific electrolyte imbalances, for a total of three days before reassessing the creatinine and BUN. During this time he improved but would not eat, probably partly due to the development of mild uraemic mouth ulcers.

The follow-up chemistry showed a marked decrease in creatinine to 625mmol/l and after three days of treatment Ciccio started eating.

It is important not to offer a prescription kidney diet at this point as this can lead to the development of a food aversion. At this stage offer anything: baby foods, a prescription recovery diet, cooked chicken or fish. Find out what the cat's preferred food type is - sometimes they prefer dry food even when they're sick. Warm the food and hand feed them. Lots of tender loving care at this stage makes all the difference.

Ciccio was discharged after six days with antacids, antibiotics and laxatives (Table 2).

A low protein, low phosphorus kidney diet was introduced when he was eating well at home. This is the most effective long-term treatment for CKD in cats and the most important aspect of the diet is the reduced phosphorus level. High phosphorus causes an increased parathyroid hormone concentration that is thought to be damaging to the kidneys in the long term. Unfortunately due to the nephroliths, the long term outlook is poor for Ciccio.

Table 2 - Treatment

Treatment	Reason for treatment
Low protein and low phosphorus diet	Control renal secondary hyperparathyroidism
Phosphate binders	Required if the cat does not eat the prescription diet or if the phosphate concentrations are still too high
Potassium supplements	Hypokalaemia is common with CKD
Angiotensin converting enzymes (ACE) inhibitors	Alter the RAS system to modify intra-renal blood pressure and limit protein loss through the kidneys
Antacids	Control stomach acid and treat chronic mild vomiting
Subcutaneous fluids	Correct dehydration
Erythropoetin injections	Anaemia
Blood pressure medication	Hypertension
Laxatives	Constipation
Antibiotics	Especially with dental or urinary tract infection

Veterinary nurses play a crucial role in the prevention, diagnosis, care and treatment of cats with kidney disease, from client education about toxins, running the pre-anaesthetic and diagnostic tests, monitoring and maintaining intravenous fluid therapy and giving general nursing care the critically ill kidney patient needs, to understanding the importance of and the participation in, frequent revisits and on-going care of the CKD cat. The veterinary nurse is an essential part of the integrated team approach to client and patient care.

* These were often my favourite type of patients, challenging but oh so worthwhile. I have very fond memories of a particular patient (a Siamese called Chamois McKenzie, back in the early 1990's), who chose tomato soup and chicken flavoured crisps as his recovery diet!!

He did remarkably well and was a fabulous character.

Ed.