RENAL FAILURE IN EASTERN GREY KANGAROOS

DR ROSEMARY AUSTEN and Professor Steve Garlick

Dr Rosemary Austen MBBS, PhD, FRACGP
Professor Steve Garlick MCom (Econ), PhD, FAUCEA

Possumwood Wildlife Inc.

1. Introduction

Renal failure is relatively common in eastern grey kangaroos but is often not diagnosed. In this paper a number of cases of eastern grey kangaroos with symptoms of renal failure are examined.

It is important that the possibility of renal failure is considered both from a preventative and a diagnostic and treatment perspective. With knowledge of the nature and causes of renal failure a carer can take steps to prevent its occurrence.

2. Renal failure: Definition and causes

Kidneys perform important functions in the body. These functions include: filtering waste products (e.g. urea and creatinine), balancing electrolyte levels (e.g. sodium and potassium), controlling body fluid, blood pressure, acid balance, and red blood cell production. Renal failure, or kidney failure, is when the kidneys can no longer perform these functions. Renal failure can be acute (often reversible) or chronic (not reversible).

In acute renal failure kidney function decreases rapidly and requires urgent intervention .It is often reversible. However, sometimes irreversible kidney injury occurs and the macropod develops chronic renal failure.

Causes of acute renal failure in macropods can include:

- Dehydration: - for example due to fence entanglement for hours in high temperatures
- Hypovolemia: – for example blood loss in a motor vehicle accident
- Rhabdolomyolysis: – muscle damage due to extreme exertion caused by a dog chase, fence entanglement, myopathy, snake bite or burns. Myoglobin, a breakdown product (protein) of muscle causes kidney injury
- Medication: - for example Gentamicin (antibiotic), Meloxicam (anti-inflammatory and analgesic)
- Severe infection: - for example peritonitis, severe untreated wound infections
- Crystalluria: a complete blockage of the urethra causes urine retention which can back up into the kidneys causing kidney shut down.

In chronic renal failure the decrease in kidney function occurs more slowly and it is likely that it is often not recognised until renal compromise is severe and irreversible. In many cases the cause of chronic renal failure is not obvious but it is likely that myopathy and consequent rhabdomyolysis is an important cause. Babesia and crystal nephropathy are other possible causes. As in many areas of wildlife medicine information is scant and evidence anecdotal.

3. Renal Failure: Symptoms

In acute renal failure carers might only notice that the macropod is passing no or little urine and that the urine is very concentrated (high specific gravity on urine analysis with a reagent strip). In chronic renal failure, macropod joeys often present as cases of failure to thrive. Carers notice that the joey is not gaining weight at the same rate as others. They are lethargic and never hoon like other joeys. They are thirsty and drink large quantities of water (polydipsia) because their kidneys cannot reabsorb water. As a consequence they produce large quantities of dilute urine-polyuria (low specific gravity on urine analysis with a reagent strip) and often wet their bags.

4. Renal failure: Consequences

As waste products which are normally excreted by the kidneys increase in the blood (e.g.. urea and creatinine), loss of appetite and lethargy develop. Inability to excrete potassium results in hyperkalemia (increased blood levels of potassium). As a result heart rhythm disturbance including cardiac arrest can occur. A metabolic acidosis (increased acidity of the body) develops because of an inability to manufacture bicarbonate. Excess fluid in the body can result in congestive heart failure.

5. Renal failure: Diagnosis

In acute renal failure the macropod will pass little or no urine which is very concentrated. The measure of concentration is specific gravity and is checked with a reagent strip.

If chronic renal failure is suspected in a macropod the first step is to collect a midstream sample of urine and test it with a reagent strip. Indicators of possible chronic renal failure are: 1. Low specific gravity (associated with thirst and ingestion of large volumes of water). 2. Presence of red blood cells. 3.Presence of protein.

If symptoms and the urine analysis are suggestive of renal failure, a blood test called a Veterinary Biochemical Analysis (VBA) can be requested. This requires blood to be taken from the animal and sent to a pathology laboratory. The main indicators in the VBA are elevated urea and creatinine. Some veterinary practices can do in house blood analysis for urea, creatinine and creatinine kinase (CK – the indicator of myonecrosis).This is a less expensive option but is adequate for diagnosis.

6. Case study one: Rudi

Rudi was a gentle male Eastern Grey (EG) raised with his friend Dasher in 2002 – our first two EG joeys. Both were chased by dogs on a hot day, Rudi for a longer duration than Dasher. The dogs were chased off and Dasher appeared to settle quickly. Rudi was taken indoors, cooled and offered water. Thirty minutes after the incident however, He was still breathing rapidly, had a stiff gait and was licking his forearms. Next day he still had a stiff gait but otherwise appeared normal. Due to our lack of knowledge of myopathy and renal failure in those early days Rudi did not receive any treatment. He became lethargic, anorexic and lost weight over the next few weeks and was eventually euthanased when he became very unwell - likely due to renal failure caused by the toxic effect of myoglobin on the kidneys. No investigations were done. Rudi might have survived if he had been treated more aggressively for myopathy and also for renal failure with intensive fluid therapy.

7. Case study two: India

India was an EG female orphan hand raised by another carer. She was translocated to a release site enclosure several weeks before her injury. In the enclosure a thunderstorm caused a pine tree to fall and India received a penetrating eye injury. She was retrieved for treatment of the eye injury but was not treated aggressively for myopathy. The eye injury responded to antibiotics but India became lethargic, lost weight and her fur was unkempt. Unfortunately, the veterinarian who treated India prescribed gentamicin. It is likely that the combined toxic effect of the gentamicin and myoglobin caused India's renal failure. A VBA confirmed her severe renal failure and she had to be euthanased. In Table1 note the elevated urea, creatinine and potassium indicative of renal failure and the high CK indicative of myonecrosis.

Table 1: Biochemistry for India

Parameter	Result	Std value*
Urea	164	8.6 mmol/L
Creatinine	1425	133 umol/L
Potassium	7.3	4.2 mmol/L
CK	13399	747 U/L

Parameter	**Result 07/ 04/ 10**	**Std value***

* Page 162. Vogelnest, L. and Woods, R.(eds).
2008 *Medicine of Australian Mammals*, Canberra, CSIRO

8. Case study three: Rex

Rex was an 8kg EG male joey raised by another carer. He was brought to us because the carer had noted that he was losing weight, his fur was unkempt and his appetite was poor. It was not clear what had caused his renal failure. His CK was not elevated. The other joeys with which he was raised were not affected. His renal failure worsened as indicated by subsequent VBA results and unfortunately Rex was euthanased. As indicated in Table 2 Rex had elevated urea, creatinine and potassium indicative of renal failure. His CK however was normal (CK has a range of +/- 762).

Table 2: Biochemistry for Rex

Parameter	**Result 22/07/08**	**Result 14/ 08/ 08**	**Std Value***
Urea	54.1	99.1	8.6 mmol/
Creatinine	315	455	133 umol/L
Potassium	7.3	7.3	4.2 mmol/L
CK	432	1243	747 U/L

* Vogelnest and Woods. *Opcit.*

9. Case study four: Rosie

Rosie was a 4kg female EG brought to us because of failure to thrive, lethargy and bag wetting. Rosie's carer had other in-care joeys that were well. Her carer often took her on trips when babysitting young grandchildren or house sitting for other carers. It was thought that stress myopathy and consequent rhabdomyolysis due to her frequent changes in environment was a possible cause of her renal failure. Table 3 shows her high urea, creatinine and potassium indicative of renal failure. She had a mild increase in CK.

Table 3: Biochemistry for Rosie

Urea	78.9	6.6 mmol/L
Creatinine	390	133 umol/L
Potassium	6.0	4.2 mmol/L
CK	2974	747 U/L

* Vogelnest and Woods, *opcit.*

10. Case study five: Pino

Pino was a 14kg EG translocated with her close friend Kiyo and 13 other friends from the pre-release enclosure to the release site enclosure for delayed release. Pino was found, after release, near the enclosure unwell and with fox attack wounds on her head. She was returned to the enclosure with her friend Kiyo and given vitamin E/selenium but not aggressive fluid therapy. She developed renal failure. Consecutive VBA results indicated deterioration in her renal failure and anaemia. Kidneys produce erythropoietin which stimulates red cell production. Anaemia is another consequence of renal failure. Unfortunately Pino had to be euthanased. Table 4 shows the elevated urea, creatinine and potassium indicative of renal failure; the deterioration in subsequent readings and her anaemia due to the renal failure. Myonecrosis is also evident. Myopathy was considered to be the cause of Pino's renal failure.

Table 4 Pathology for Pino

Parameter	Result 10/ 08/ 09	Result 05/ 09/ 09	Std Value*
Urea	38	56	8.6 mmol/L
Creatinine	330	520	133 umol/L
Potassium	5.8	4.9	4.2 mmol/L
CK	1223	8815	747 U/L
Hb	99	79	154 g/L

* Page 159 & 162, Vogelnest and Woods *opcit.*

Case study six Dasher, Ned, Bob, Lenny, Tulley, Flynn

About 10 years ago we unfortunately had five released EG come home unwell and die from what appeared to be renal failure. All were very healthy at release.

Ned, the largest male and Dasher were unwell for a long period. They lost weight and were lethargic, their fur was unkempt and became very dark (a chocolate brown). Both were euthanased. Bob had similar symptoms – losing weight and condition. He had a cardiac arrest in the veterinary surgery about five minutes after the veterinarian pronounced that he could not find anything wrong with him. Lenny had a VBA which showed renal failure. Renal tissue from Tulley showed chronic kidney disease on histopathology. The last member of the group was Flynn and he was becoming lethargic and losing weight (4kg). The possibility of Babesia infection was considered as we could not identify a cause of illness in this group of EG (refer Staker 2006:236). Flynn was treated with Imidocarb (Imizol) – the recommended treatment for Babesia. His illness resolved, he regained weight and his behaviour returned to normal.

11. Babesiosis

This case is interesting because it was reported in the *Australian Journal of Medicine,* (2012): 196 (5) that the first case in Australia of Babesiosis in a human had been identified at The Canberra Hospital in a man residing on the south coast of NSW. It is possible that the kangaroo flat fly (sub-family Hippoboscinae) could be a vector. All are parasitic and it is thought they could be vectors for a range of diseases in mammals (http://en.wikipedia.org/wiki/Hippoboscidae). Kangaroo flat flies bite and take blood from kangaroos and also bite humans. On the south coast ticks are also common and are known vectors for Babesia but are rarely seen on macropods in the Canberra/ Southern Tablelands area.

12. Crystalluria

Macropod joeys are at risk of developing crystals in their urine and if not treated progress to urine outlet obstruction and acute urine retention. Urine outlet obstruction can cause acute renal failure and possible irreversible damage to the kidneys resulting in chronic renal failure. It is possible also that a crystal nephropathy could cause chronic renal failure in EG as it does in koalas (Speight, et al 2012). The crystalluria cases we have seen have been in emerging joeys that are not lapping water well and have been eating lucerne. The pH of urine from joeys that are only having formula is acidic .Once eating lucerne or grass the pH of the urine becomes alkaline. Lucerne is high in oxalate - one of the crystals implicated in crystalluria (refer Staker 2006: 261). We treat crystalluria with increased fluid intake (subcutaneous

fluids if necessary), low dose diazepam (pamlin), hyoscine (buscopan), tamsulosin (flomaxtra), vitamin C injection (for alkaline urine) and trivetrin.

13. Myopathy

Stress myopathy is an important condition in macropods and is often unrecognised initially. Each EG has a different personality and some are more susceptible to stress than others. Sometimes it is the apparently self-confident boisterous EG who develops myopathy after transfer to a release site enclosure. It is recommended that urine analysis be done after any stress-inducing event, for example dog chase, transfer to a new enclosure or new carer. We routinely check the urine of in-care joeys brought to our Possumwood Wildlife recovery centre by carers or who have experienced a very stressful event at rescue, for example fence entanglement. If the urine analysis is suggestive of myoglobin in the urine then treatment with vitamin E /selenium and fluid therapy is instigated. This is important to prevent the development of renal failure as is evidenced by several of the case studies.

14. Conclusions

A recognition that acute renal failure can occur in certain situations, for example severe dehydration and crystalluria, is important so appropriate treatment can be given early.

Chronic renal failure is relatively common in EG kangaroos and should be considered in any small EG with failure to thrive and bag wetting and in larger EG with lethargy and weight loss and increased water consumption.

Any EG with myopathy needs intensive fluid therapy to prevent the toxic effect of myoglobin on the kidneys and consequent chronic renal failure

Knowledge on the causes of chronic renal failure in macropods is limited and mostly anecdotal.

References

Senanayake S.N., Paparini, A., Latimer, M., Andriolo, K., Dasilva, A. J., Wilson, H., Xayavong, M. V. Collignon, P.J., Jeans, P., and Irwin, P.J. 2012. “First report of human babesiosis in Australia”, case report, *Medical Journal of Australia*, 196 (5): 350-352.

Speight, K.N., Boardman, W., Breed, W.G., Taggert, D. A., Woolford, L. and Haynes, J. I. 2013. “Pathological Features of Oxalate Nephrosis in a

Population of Koala (Phascolarctos cinerus) in South Australia", *Veterinary Pathology*, 50(2): 299-307.

Staker, L. 2006. *The Complete Guide to The Care of Macropods.*Matilda's Publishing.

Vogelnest, L. and Woods, R. 2008 *Medicine of Australian Mammals* Canberra, CSIRO Publishing.

Wikipaedia. http://en.wikipedia.org/wiki/Hippoboscidae. Accessed 4 May, 2014.

DR ROSEMARY AUSTEN PHD, MBBS BSC (MED), FRACGP studied Zoology, Biochemistry and Chemistry at the University of NSW and completed honours and a PhD in Biotechnology. She did Post-Doctoral Research in Canada and further Post-Doctoral Research in genetically engineered animal vaccines in Australia. She then studied medicine and has been a General Practitioner for the last 17 years in the ACT and NSW.

PROFESSOR STEVE GARLICK BA, MCOM, PHD, FAUCEA

Professor Steve Garlick PhD, FAUCEA
University of Newcastle NSW, University of Technology Sydney NSW
2009 Shining World Compassion Award
President, Animal Justice Party of Australia
PO Box 326
Bungendore NSW 2621 Australia
Ph: +61 (0)2 62381533
M: +61 (0)428880564
Fax: +61 (0)2 62381116
E: steve.c.garlick@gmail.com

Steve has professorial positions at two Australian universities (University of Newcastle, University of Technology Sydney) and is an international expert in spatial economics and university/ community engagement. He has an extensive publication record and undertaken many country reviews for international and national agencies. He is an economist and applied ethicist specialising in wildlife welfare and sits on a number of international and national boards.

Steve's research interest in wildlife concerns their emotional behaviour, learning and cognitive justice. In 2009 with wife Rosemary, Steve was internationally recognised with the Shining World Compassion Award for the work he does rehabilitating severely injured and traumatised wildlife. With Rosemary, Steve runs a wildlife recovery and research centre for macropods and wombats. Together they have rescued more than 4000 injured wild animals, rehabilitated more than 1500 and returned many of these back to the wild. Steve is the founder and first president of the Animal Justice Party of Australia.