

CASE STUDY

Acute Renal Failure in Rodents

May 2024

AmiShield x Jungle Exotic Animal Hospital



Case Study : Acute Renal Failure in Rodents

Introduction

Acute renal failure (ARF), also known as Acute Kidney Injury (AKI), is a term that describes a sudden decline in kidney function. There are various causes and can be categorized broadly into three types: 1.. Pre-renal failure, 2. Post-renal failure, and 3. Intrinsic renal disorder (Heyman, Samuel N., et al., 2009). This case report focuses specifically on pre-renal failure caused by insufficient water intake and dehydration.

Small mammals, including rodents, rabbits and marsupials, are particularly susceptible to pre-renal failure. These animals have a high metabolic rate and thus require a comparatively large amount of daily water intake (Heatley, J. Jill and M. Camille Harris, 2009). Once deprived of sufficient access to water, it would be highly possible for them to develop into acute renal failure.



Clinical presentations often involve non-specific chief complaints, such as lethargy, inappetence, and weight loss. These clinical signs can manifest across a wide age range and affect both male and female animals equally. Initial assessment for pre-renal failure in small mammals often includes blood tests to identify underlying causes and guide treatment planning. The biochemistry examinations typically reveal elevated serum creatinine and blood urea nitrogen (BUN) concentrations, which are established biomarkers of kidney dysfunction.

Following the diagnosis of acute kidney injury (AKI), a treatment plan is formulated, incorporating fluid therapy and potentially other medications. After a period of in-hospital treatment, most patients would recover and could complete their treatment regimen with oral medications at home.

◆ Case 1

A six-month-old intact male hamster weighing 46 grams was presented to the clinic for a two-day history of lethargy and inappetence. The owner also reported a weight loss of 6 grams over the past week. After physical examinations, showing no other significant signs, the patient was sedated and underwent a comprehensive diagnostic workup, including radiography, complete blood count (CBC), and biochemistry analysis. Plain radiographic examination was unremarkable. However, laboratory evaluation revealed elevated BUN levels (Table 1). Based on the comprehensive evaluation, acute kidney injury (AKI) was suspected.



▼ **Table 1.** Result of biochemistry analysis (10/30/2023)

Test Item	Result	REF. Range/units
Glucose	147	37 - 198 mg/dL
CREA	0.2	0.4 - 1 mg/dL
BUN	37	12 - 26 mg/dL
PHOS	7.1	3 - 9.9 mg/dL
CA	10.2	5.3 - 12 mg/dL
TP	6.4	5.2 - 7 g/dL
ALB	3.3	3.5 - 4.9 g/dL
GLOB	3.1	2.7 - 4.2 g/dL
ALT	49	22 - 128 U/L
AST	61	28 - 122 U/L
TBIL	0.35	0.1 - 0.9 mg/dL

The patient was hospitalized after the examinations. Initial management prioritized the maintenance of adequate renal perfusion through fluid resuscitation. The patient received a total of 6 mL/day of lactated Ringer's solution administered subcutaneously (SC) in divided doses (3 mL bid). Additionally, oral medications were prescribed (Table 2) to be administered concurrently. Tube feeding was initiated to meet daily energy requirements, with the patient receiving 1 mL of EmerAid Intensive Care Omnivore® per feeding, delivered 4-6 times daily.

▼ **Table 2.** Oral medication prescription, 7 days, BID (10/30/2023)

Medicine	Dose (mg/kg)
Enrofloxacin	5.82
Prednisolone	0.78
Cyproheptadine	0.39
Metoclopramide	0.97

During the three-day hospitalization, the patient's body weight increased from 44 grams to 49 grams. Subsequently, the patient was discharged home on 2023-11-01 for continued outpatient treatment. A follow-up appointment one month later (2023-11-30) revealed improved mental status, normal activity levels, and a further increase in body weight to 54 grams. To



assess renal function, blood tests were performed. Biochemical analysis (Table 3) demonstrated a decrease in BUN concentration, suggesting improvement with the implemented treatment regimen. Notably, the previously prescribed oral medications were continued. The patient then scheduled a follow-up appointment for one month later.

▼ **Table 3.** Result of biochemistry analysis (11/30/2023)

Test Item	Result	REF. Range/units
Glucose	145	37 - 198 mg/dL
CREA	0.3	0.4 - 1 mg/dL
BUN	31	12 - 26 mg/dL
PHOS	8.4	3 - 9.9 mg/dL
CA	10.8	5.3 - 12 mg/dL
TP	6.0	5.2 - 7 g/dL
ALB	3.3	3.5 - 4.9 g/dL
GLOB	2.7	2.7 - 4.2 g/dL
ALT	61	22 - 128 U/L
AST	27	28 - 122 U/L
ALP	127	99 - 186 U/L
TBIL	0.43	0.1 - 0.9 mg/dL

At the final follow-up appointment on 2024-01-05, the case was closed. The patient exhibited normal behavior and the owner reported no concerning clinical signs. Comprehensive blood tests were performed, revealing favorable recovery of renal function (Table 4).

▼ **Table 4.** Result of biochemistry analysis (01/05/2024)

Test Item	Result	REF. Range/units
Glucose	164	37 - 198 mg/dL
CREA	0.5	0.4 - 1 mg/dL
BUN	24	12 - 26 mg/dL
PHOS	8.2	3 - 9.9 mg/dL
CA	10.3	5.3 - 12 mg/dL
TP	5.7	5.2 - 7 g/dL
ALB	2.8	3.5 - 4.9 g/dL
GLOB	2.9	2.7 - 4.2 g/dL
ALT	24.5	22 - 128 U/L
AST	34	28 - 122 U/L
ALP	172	99 - 186 U/L
TBIL	0.73	0.1 - 0.9 mg/dL

Both creatinine and BUN levels had normalized. However, a mild elevation in alanine aminotransferase (ALT) concentration was observed. This elevation was likely attributable to the use of oral steroids, and gradual dose reduction would be recommended following medication completion.

◆ **Case 2**

A 63-gram hamster presented to the clinic for evaluation of lethargy and inappetence. The patient had a one-month history of treatment for dermatophytosis and mild respiratory infections. During the treatment course, the patient exhibited a progressive decline in activity level. Consequently, the owner requested comprehensive blood tests to investigate the etiology of these clinical signs. Following sedation, blood was collected for analysis. Biochemical evaluation revealed isolated hyper BUN (Table 5), suggestive of acute kidney injury. Given this new finding, the original treatment plan for the skin and respiratory tract was discontinued, and subsequent management focused on addressing the AKI.



▼ **Table 5.** Result of biochemistry analysis (01/11/2024)

Test Item	Result	REF. Range/units
Glucose	95	37 - 198 mg/dL
CREA	0.5	0.4 - 1 mg/dL
BUN	34	12 - 26 mg/dL
TP	6.2	5.2 - 7 g/dL
ALB	3.5	3.5 - 4.9 g/dL
GLOB	2.7	2.7 - 4.2 g/dL
ALT	69	22 - 128 U/L
ALP	128	99 - 186 U/L

Following the owner's decline of hospitalization, an outpatient management plan was formulated. This plan included subcutaneous (SC) fluid resuscitation with lactated Ringer's solution at a dose of 5 mL, BID, administered every 1-2 days. Additionally, enclosure changes were recommended, including placing more sipping bottles and shallow plates to make an easier access to hydration for the patient, to accommodate potential improvement of the illness. The outpatient treatment plan was implemented for a one-month period, from 2024-01-11 to 2024-02-07. A follow-up appointment was scheduled for 2024-02-22. Subsequent blood tests revealed normalization of BUN concentration (Table 6). Additionally, the patient exhibited no clinical signs, and the owner reported no other complaints.

▼ Table 6. Result of biochemistry analysis (02/22/2024)

Test Item	Result	REF. Range/units
Glucose	136	37 - 198 mg/dL
CREA	0.5	0.4 - 1 mg/dL
BUN	20	12 - 26 mg/dL
TP	6.8	5.2 - 7 g/dL
ALB	3.5	3.5 - 4.9 g/dL
GLOB	3.3	2.7 - 4.2 g/dL
ALT	89	22 - 128 U/L
ALP	118	99 - 186 U/L



◆ Case 3

A 59-gram gerbil presented for evaluation of lethargy, inappetence, and weight loss. Physical examination was unremarkable. To investigate the underlying etiology of these clinical signs, comprehensive blood tests were recommended. Biochemical analysis revealed elevated blood urea nitrogen (BUN) concentration, suggestive of acute kidney injury (AKI), along with increased activity of hepatic enzymes, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) (Table 7). These findings indicated concurrent AKI and hepatic inflammation, prompting immediate hospitalization.



▼ Table 7. Result of biochemistry analysis (11/10/2023)

Test Item	Result	REF. Range/units
Glucose	107	37 - 198 mg/dL
CREA	0.5	0.4 - 1 mg/dL
BUN	51	12 - 26 mg/dL
PHOS	6.0	3 - 9.9 mg/dL
CA	10.6	5.3 - 12 mg/dL
TP	5.7	5.2 - 7 g/dL
ALB	3.0	3.5 - 4.9 g/dL
GLOB	2.7	2.7 - 4.2 g/dL
ALT	184	22 - 128 U/L
AST	127	28 - 122 U/L
ALP	203	99 - 186 U/L
TBIL	0.18	0.1 - 0.9 mg/dL

The treatment plan aimed to address both conditions, focusing on anti-inflammatory medications and fluid resuscitation. Accordingly, oral medications were prescribed (Table 8), and subcutaneous (SC) fluid therapy

with lactated Ringer's solution (3 mL, BID) was initiated. However, two days after hospitalization, the patient continued to exhibit weight loss. Therefore, tube feeding support with EmerAid Intensive Care Omnivore® (2 mL, four times daily) was implemented.

▼ **Table 8.** Oral medication prescription, 14 days, BID (12/11/2023)

Medicine	Dose (mg/kg)
Bromelain	3.57
Biotase	0.30
Silymarin	90.80
Ursodeoxycholic	15.13
Metoclopramide	0.78

Following one week of inpatient hospitalization, the gerbil was discharged exhibiting improved activity level and normal behavior. Body weight remained stable within the range of 54-57 grams throughout the treatment course. A follow-up appointment was scheduled one month later (2023-12-11). During this visit, the gerbil underwent sedation for blood collection. Biochemical analysis revealed a decrease in BUN concentration and normalization of ALP activity (Table 9). However, persistent elevations in ALT and AST levels suggested an inadequate response to the prescribed oral medications. These findings indicated the possibility of underlying hepatic pathology beyond the initial diagnosis. Consequently, advanced radiographic imaging, such as ultrasonography or computed tomography (CT), was recommended for further investigation.



▼ **Table 9.** Result of biochemistry analysis (12/10/2023)

Test Item	Result	REF. Range/units
Glucose	106	37 - 198 mg/dL
CREA	0.3	0.4 - 1 mg/dL
BUN	35	12 - 26 mg/dL
PHOS	5.3	3 - 9.9 mg/dL
CA	10.7	5.3 - 12 mg/dL
TP	6.2	5.2 - 7 g/dL
ALB	2.9	3.5 - 4.9 g/dL
GLOB	3.3	2.7 - 4.2 g/dL
ALT	294	22 - 128 U/L
AST	149	28 - 122 U/L
ALP	149	99 - 186 U/L
TBIL	0.66	0.1 - 0.9 mg/dL

Conclusion

All three cases presented with non-specific clinical signs and unremarkable physical examination findings. Biochemical analysis emerged as the primary diagnostic modality, highlighting its importance in identifying underlying conditions. Following the diagnosis of acute kidney injury (AKI), all patients demonstrated significant improvement in renal function after receiving a course of fluid therapy.

◆ Reference:

This case study was conducted by Chung-Jui Chen, Director of Jungle Exotic Animal Hospital. The biochemical profile tests in cases here were measured by AmiShield veterinary chemistry analyzer and the exclusive Comprehensive Plus Panels.

1. Heatley, J. Jill, and M. Camille Harris. "Hamsters and gerbils." Manual of exotic pet practice. WB Saunders, 2009. 406-432.
2. Heyman, Samuel N., Seymour Rosen, and Christian Rosenberger. "Animal models of renal dysfunction: acute kidney injury." Expert opinion on drug discovery 4.6, 2009. 629-641.