

Case 202: Bowel obstruction in a green iguana

CLINICAL PRESENTATION. An adult green iguana presents with an acute history of vomiting and general distress. A sausage-shaped mass is palpated in the caudal coelomic cavity.

DIFFERENTIAL DIAGNOSES. Constipation; obstruction from a gastrointestinal foreign body; obstruction from a mass of worms; intussusception of one or more segments of intestine; intestinal volvulus; intestinal ileus; gastric or intestinal neoplasia; an ingested toxic substance.

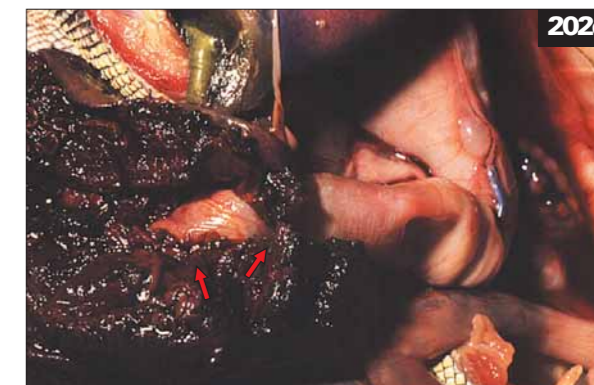
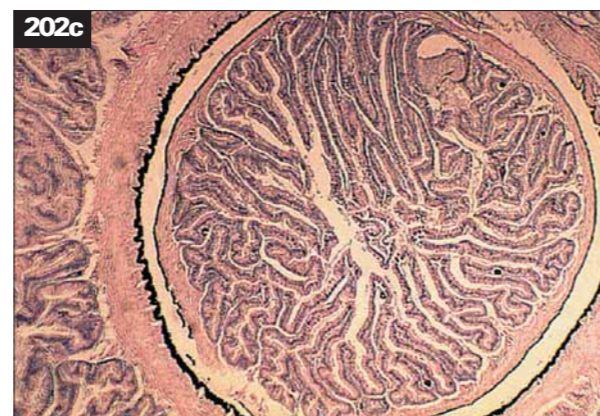
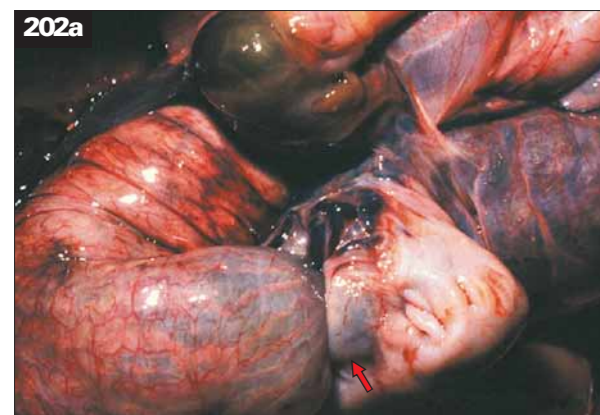
INVESTIGATION. Plain radiographs disclose a soft tissue density mass in the mid body with a gas-filled intestine proximal to the mass. Routine hematology and biochemistry studies reveal hemoconcentration, mild leukocytosis, lymphopenia, and mild hyperuricemia.

DIAGNOSIS. Intussusception.

ETIOLOGY. Intussusception is the telescoping of one segment of a hollow viscus organ, usually a length of intestine, into either a proximal or adjoining distal length or segment. Its prevalence is sporadic. Many instances of intussusception can be traced to chronic constipation and gastrointestinal parasitism, which often involves metazoan helminth parasites, predominantly nematodes. It can also be caused by intestinal protozoan infections. It is thought that these organisms induce local inflammation and accompanying repeated tenesmus. Continued straining, as if to produce stools, can induce one or more segments of intestine (duodenum) to invaginate either into the stomach proximally or distally into the jejunum (202a, b). Similarly, the jejunum can telescope proximally into the duodenum (histological section stained with H&E and photographed [202c] at $\times 27$ magnification), distally into the ileum, cranially into the jejunum, or caudally into the colon (202d, e).

The clinical signs of intussusception are those associated with complete or partial intestinal obstruction. Vomiting, bloating, distress, fluid and electrolyte shifts and, finally, shock, are commonly observed. Often, one or more sausage shaped masses can be palpated in the coelom. Plain or contrast radiography reveals one or more fluid density masses with or without entrapped gas proximal to the obstruction. Intussusception is an emergency that demands immediate attention.

MANAGEMENT. The intussuscepted segment(s) are reduced surgically, which will restore the mesenteric blood circulation that has been compromised. The tissues must be handled gently. If the telescoped segment(s) can be reduced, and are found to be vital, they are sutured to the body wall by creating an enteropexy to prevent subsequent intussusception.



It is essential that any underlying (inducing) etiology is treated effectively as well. Routine fecal analysis is advised. Gastroenteric parasitism must be treated with appropriate parasitocidal therapy.

PROGNOSIS. Guarded because intestinal intussusception is often discovered only after irreparable ischemic necrosis has occurred.

Case 203: Parasitic ovum identification in an Gila monster lizard

INVESTIGATION. After appropriate dilution and mixing, the wet preparation of a fecal sample is ready for microscopic examination and interpretation. Spherical to slightly elliptical thick-walled embryonated ova are identified. The embryos are characterized by having tiny refractile hooklets (203).

DIAGNOSIS. Cestode ovum.

MANAGEMENT. The lizard is treated with praziquantel (5–8 mg/kg, repeated in 2 weeks). Gila monster lizards and Mexican beaded lizards are venomous, and extreme

caution must be taken when medicating them. Therefore, the medication is placed into a dead rodent before feeding it to these lizards, thus avoiding having to handle the patient.

PROGNOSIS. Favorable.

HUSBANDRY. Many, if not most, cestodes utilize an indirect life cycle. Therefore, limiting the prey to healthy, laboratory-raised rodents will facilitate reducing a reptile colony's incidence of endoparasitism.



Case 204: Anorexia and severe lethargy in an adult male green iguana

CLINICAL PRESENTATION. A 1.4 kg adult male green iguana that was previously thriving presents with a history of anorexia that began approximately two weeks before the owners found the iguana upside down in its cage, apparently dead. However, when they prodded him, he responded by moving his limbs feebly. The iguana's diet consists primarily of mustard, collard, turnip, and dandelion greens and, occasionally, soft ripe fruit. The iguana is severely depressed. Its integument and oral mucosae are icteric and its oral mucus is viscous and sticky. The eyes are deeply sunken. No grossly visible lesions or palpable swellings are detected.

INVESTIGATION. Ultrasonic Doppler blood flow investigations detect loud bilateral atrioventricular and aortic valvular murmurs. A pretreatment whole blood specimen is withdrawn from the ventral caudal vein for hematology and biochemistry tests (below). The blood, which is very dark red, flows into the syringe substantially slower than normal and it clots almost immediately.

Based on the history, brief period of illness, and laboratory findings, various factors should be considered when attempting to arrive at a diagnosis. The diet is ideal. The blood sample is severely hemoconcentrated. Although the total WBC count is only mildly elevated, there is a substantial heterophilia. The monocytes are not increased; therefore, chronic disease is less likely to be a

factor. There is a significant glycosemia; the glucose is markedly elevated, which suggests (but does not confirm) diabetes mellitus. The CPK is elevated, which suggests increased myocardial exertion due to the greatly elevated PCV, muscle necrosis, muscle wasting and/or muscle injury. The LDH is elevated, which suggests a liver dysfunction or hepatocellular insult. However, the ALT, AST, and AP are not significantly elevated; this tends to help rule out hepatic necrosis. The serum cholesterol is moderately elevated, which suggests that the iguana is mobilizing fat stores as an energy source. The calcium is just slightly above normal. The phosphorus is markedly elevated. The TP is markedly elevated. This reflects the hemoconcentration noted above in the PCV value. The globulin fraction of the plasma proteins is significantly elevated. This reflects the A:G ratio of 0.4, which suggests either an infectious or an inflammatory response to an antigenic stimulus, or a neoplasm involving plasmacytes (B lymphocytes). However, the hemogram does not reflect the lymphocytosis or plasmacytosis that would be expected to be found with a B-cell leukemia or multiple myelosis. The sodium is slightly lower than normal. The potassium is extremely elevated to a level that would be clearly cardiotoxic and, therefore, fatal, in most mammals. The uric acid is markedly elevated to several times normal value and represents severe hyperuricemia. Both the BUN and creatinine are within normal limits.

Hematology			Biochemistry		
PCV	0.62 l/l	(62%)	Glucose	32.8 mmol/l	(590.4 mg/dl)
WBCs	13 × 10 ⁹ /l	(13 × 10 ³ /μl)	ALT (SGPT)	30 u/l	
Heterophils	83%		AST (SGOT)	114 u/l	
Lymphocytes	13%		CPK (CK)	1,731 u/l	
Monocytes	2%		LDH	1,110 u/l	
Azurophils	2%		AP (SAP)	0 u/l	
Thrombocytes	adequate		Cholesterol	9.2 mmol/l	(355.2 mg/dl)
			Calcium	3.7 mmol/l	(14.8 mg/dl)
			Phosphorus	6.1 mmol/l	(18.9 mg/dl)
			TP	93 g/l	(9.3 g/dl)
			Albumin	24 g/l	(2.4 g/dl)
			Globulin	69 g/l	(6.9 g/dl)
			A:G ratio	0.4:1	
			Sodium	123 mmol/l	(123 mEq/l)
			Potassium	15.3 mmol/l	(15.3 mEq/l)
			Uric acid	4.1 mmol/l	(69.3 mg/dl)
			BUN	2.14 mmol/l	(5.9 mg/dl)
			Creatinine	53 μmol/l	(0.59 mg/dl)

DIAGNOSIS. The most likely tentative diagnosis, particularly when evaluating the hematology and biochemistry results, is acute or subacute renal failure. This could be due to any of the following etiologies:

- Interstitial nephritis, glomerulonephritis, or pyelonephritis. Interstitial is the most likely.
- Ingestion of or iatrogenic injection of a nephrotoxic substance or agent.
- A neoplasm of the kidneys, while possible, is less likely because it almost certainly would have to be bilateral. If unilateral, the ipsilateral kidney should be able to provide adequate renal function.

MANAGEMENT. Based on the tentative diagnosis of acute or subacute renal failure, and because of the markedly elevated hemoconcentration, elevated PCV, hyperkalemia, and hyponatremia, physiological saline was infused (35 ml i/v and 65 ml i/c). **NB:** Ringer's solution *must not* be used because it contains potassium. Within five minutes of receiving the saline infusion, the iguana became much more animated and within an hour the hematocrit had been lowered to 42%. By the next morning the PCV had returned to normal (34%) and the blood flow murmurs were no longer detected with the Doppler device. Less than 24 hours after being presented in a moribund state, the iguana was actively trying to defend himself by lashing his tail and threatening to bite. Due to the hyperphosphatemia, the iguana should be placed on a regimen of saline diuresis, maintained at 45 ml/kg daily in two divided doses, plus as much orally provided fluid as it will tolerate without developing pulmonary edema or ascites. A course of enrofloxacin therapy was begun, and the iguana had an uneventful recovery.

The source of the hyperglycemia was not determined because the blood glucose level spontaneously returned to normal within a few days. The BUN and creatinine determinations in this iguana point to the fact that while these values are important in mammals, they are unreliable in reptiles because reptiles are uricotelic in their renal excretory functions. Therefore, the measurement of uric acid is the most accurate means for assessing urinary waste clearance of catabolyzed proteins in reptiles. Although the plasma calcium is essentially normal, the plasma phosphorus is approximately triple normal; this suggests that there is substantial renal retention of phosphorus. Had the loss of kidney function been more severe or more chronic, it is likely that the plasma calcium would have been significantly lower because hyperphosphatemia stimulates the secretion of parathyroid hormone (PTH) which, in turn, stimulates the mobilization of calcium stores from bone and eventually induces osteomalacia and (renal-associated) fibrous osteodystrophy ('renal rickets'). In this instance, skeletal disease was not observed because the course of the nephropathy was relatively brief and it resolved before it was manifested. Enzymatic diuresis was not employed because the iguana tolerated the saline diuresis well and voided abundant urates and fluid urine.

PROGNOSIS. Usually, severe renal failure and uremia proves fatal. However, this case illustrates that when the condition is diagnosed sufficiently early and is treated aggressively, acute renal failure can be resolved satisfactorily.

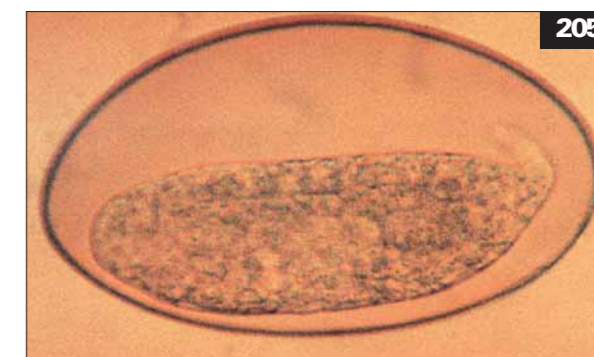
Case 205: Parasitic ovum identification in a green iguana

INVESTIGATION. After appropriate dilution, mixing, and centrifugation, the wet preparation of a fecal sample from a green iguana is ready for microscopic examination and interpretation. Elongated, 'D'-shaped embryonated ova are identified. The near-term embryos are characterized by having a very thin, curved, tail-like 'pin' structure at one end (205).

DIAGNOSIS. Oxyurid (pinworm) ovum.

MANAGEMENT. The iguana is treated with pyrantel pamoate (5 mg/kg p/o, repeated in 2 weeks) or fenbendazole (50–100 mg/kg p/o, repeated in 2 weeks) or ivermectin (200 μg/kg i/m, repeated in 2 weeks).

PROGNOSIS. Favorable.



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Case 206: Inky black, raised integumentary lesions in a European green lacerta lizard

CLINICAL PRESENTATION. A European green lacerta lizard is examined because its owner notices the relatively rapid appearance of multiple, raised, inky black integumentary masses on its rostrum, right thoracic wall, dorsum of pelvis, left forelimb, and tail (206a – photo courtesy Dr DR Mader). The masses are freely movable and, when touched, do not appear to elicit pain. The lizard is eating with a normal appetite, and its growth is normal.



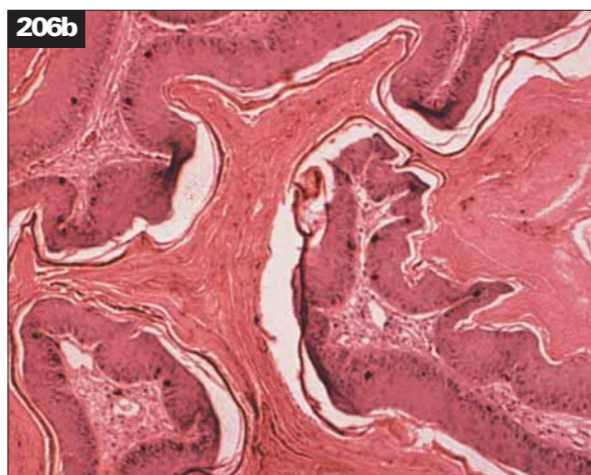
DIFFERENTIAL DIAGNOSES. Pigmented epidermal papillomata; malignant melanoma; benign pigmented nevi; eschar-covered healing traumatic wounds; mycotic dermatopathy; bacterial dermatopathy.

DIAGNOSIS. Transmissible epidermal papillomatosis.

ETIOLOGY. Transmissible epidermal papillomatosis is caused by a papillomavirus that is specific to lacertid lizards, especially *Lacerta viridis*.

PREVALENCE. Common, especially in naïve, usually young, lacertid lizards, which are most susceptible to this viral-associated, benign integumentary tumor.

MANAGEMENT. The lizard is anesthetized and one or all of the masses prepared for surgical excisional biopsy. The surgical specimens are preserved in a tissue fixative and processed for histopathology (206b).



PROGNOSIS. After a variable period, most lizards mount an immune response to the etiologic viral agent and, as a result, these benign neoplasms usually will regress spontaneously.

Case 207: Parasitic ovum identification of a fecal sample from a savanna monitor lizard

INVESTIGATION. After appropriate dilution, mixing, and centrifugation, a wet preparation is ready for microscopic examination and interpretation. Elliptical, thin-walled embryonated ova are identified. The embryos are characterized by having four pairs of tiny appendages (207). These appendages are lost soon after the parasites emerge from their eggs.



DIAGNOSIS. Pentastomid ova.

MANAGEMENT. The lizard is treated with ivermectin (200 µg/kg i/m, repeated after 2 weeks). **Warning:** Pentastomids have a potential zoonotic for human infection. Therefore, contamination when handling feces from reptiles known to be harboring these parasites must be prevented.

Case 208: Dermatitis, irritability, hyperesthesia, and nonspecific electrocardiologic alterations in a Mexican beaded lizard

CLINICAL PRESENTATION. A mature Mexican beaded lizard is suddenly exhibiting nonspecific signs consisting of dermatitis, irritability, and hyperesthesia. The lizard's diet consists of hen's eggs. After approximately three months of eating hen eggs, the lizard developed a moist dermatitis; it also twitched occasionally, as if it was being touched.



DIAGNOSIS. Biotin deficiency.

ETIOLOGY. Biotin is an essential water-soluble vitamin that is present in animal tissues, grains, and some other foodstuffs. It is only when the anti-biotin antagonist, avidin, which comprises part of avian egg albumin, is present in significant quantity that biotin deficiency is induced. Avidin-induced biotin deficiency probably does not occur under wild, natural conditions because egg-eating animals usually consume embryonated bird (or reptile) eggs. Avian eggs in which embryos are developing contain much less avidin than nonfertile or unincubated fertile avian eggs. Moreover, the embryo also contains biotin, thus lessening the degradation of stored biotin in the egg predator.

PREVALENCE. Sporadic, depending upon the captive diet eaten.

MANAGEMENT. The egg yolks should be separated from the albumin portion of the eggs (208).

Case 209: Identification of a mite found in a lizard cage

CLINICAL PRESENTATION. Tiny arthropods are collected from a cage in which lizards are housed. It is necessary to identify them and determine if they are parasitic.

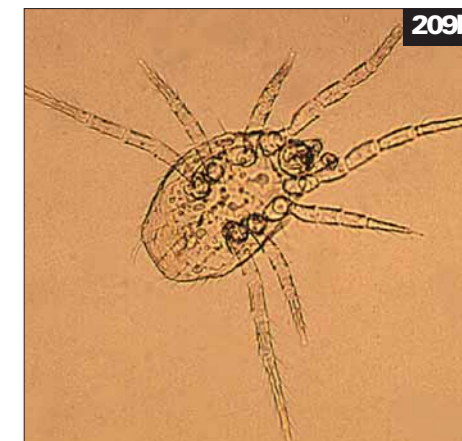
recognized by their three pairs of walking limbs (209a). Adults possess four pair of walking limbs (209b).

INVESTIGATION. These organisms can be identified by placing several of the organisms onto a glass microscopic slide, adding a drop of Hoyer's mounting medium (Frye, 1994), cover slipping, warming the slide gently until the mounted organisms have cleared and any bubbles have dissipated, and examining under low magnification.

PREVALENCE. Frequently observed in reptile collections.

DIAGNOSIS. Immature (nymphal) trombiculid grain mites.

ETIOLOGY. Pseudoparasitic mites, especially trombiculid grain mites, infest reptilian cages, especially those in which wood chips or similar particulate litter materials are used. During their immature nymphal stages, these mites can be truly parasitic. Nymphal mites are readily



Case 210: Bright red scleral coloration in a rock iguana

CLINICAL PRESENTATION. A male rock iguana is presented for evaluation because, as it has grown, it has gradually developed bright red sclerae (210). The iguana does not manifest any signs of illness or distress.

INVESTIGATION. When it is observed, care must be taken to differentiate the bright red-colored sclerae in males of this species from inflammatory ophthalmic disease such as keratoconjunctivitis.

ETIOLOGY. The males of this species (and some other species of *Cyclura*) possess bright red sclerae; this is a normal, sexually dimorphic characteristic.

PREVALENCE. Common.



Case 211: Crusty circumnasal accumulation in a green iguana

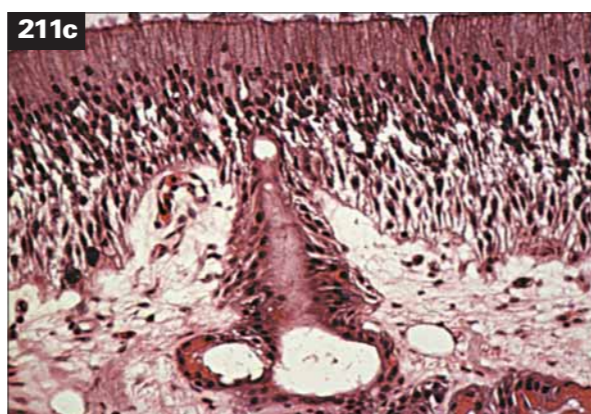
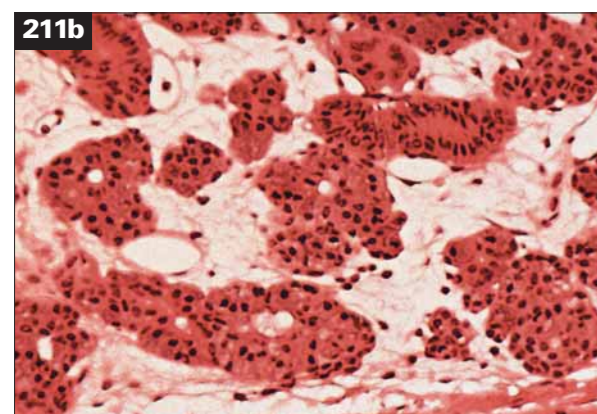
CLINICAL PRESENTATION. A mature green iguana has an accumulation of crusted white material around each nostril (211a). The iguana is healthy, and does not have any other medical problems.

DIFFERENTIAL DIAGNOSIS. Dried salt(s) of NaCl and KCl secreted from the nasal salt glands; an exudate arising from inflammation of the nasal mucosae.

DIAGNOSIS. Dried electrolytes secreted from the nasal salt glands.

ETIOLOGY. Some reptiles, particularly, but not limited to, those that have evolved to live in desert habitats, have behavioral and physiologic adaptations by which they conserve water. They are able to excrete electrolytes, especially sodium, potassium, and chloride ions, as NaCl and KCl salts in either their nasal (211b, c) or oral secretions. Some lizards, such as green iguanas, also employ extrarenal electrolyte secretion as a means of water conservation and electrolyte excretion.

Some plants, such as celery and many halogen sequestering plants native to deserts and some volcanic islands, contain very high levels of sodium and potassium.



It is normal behavior for these lizards to sneeze out their electrolyte-rich secretions; therefore, it should not be interpreted as evidence of an upper respiratory tract disorder. Often, these dried deposits can be seen on the interior walls of a terrarium in the area where a lizard has sneezed.

PREVALENCE. Very common.

MANAGEMENT. These dried electrolytes are normal; therefore, unless there is evidence of inflammation, no treatment is required.

Case 212: Swelling and lameness of all four limbs in a green iguana

CLINICAL PRESENTATION. An adult male green iguana has become progressively reluctant to bear weight on its limbs. It can walk but only with great difficulty. The iguana is eating but, because of its reluctance to walk, the owner has to hand feed it. All four limbs are swollen, firm to the touch, and very tender to even the most gentle digital palpation. Bilateral, slightly raised longitudinal ridges are seen on the lateral thorax. These ridges are especially apparent when the iguana takes a deep breath (these ridges are analogous to the 'heave lines' observed in horses with pulmonary emphysema and other chronic respiratory conditions). The iguana is permitted to roam the owners' home, and has learned to use the tray filled with silica-containing diatomaceous earth cat litter that is provided for the household cats' toilet needs. The diet of the iguana consists of green leafy vegetables and small amounts of canned cat food and primate biscuits.

DIFFERENTIAL DIAGNOSES. Metabolic bone disease (secondary nutritional hyperparathyroidism); primary hyperparathyroidism due to one or more functional parathyroid adenomatous tumors; HPOA; multiple appendicular fractures; osteomyelitis; osteoarthritis; rheumatoid arthritis; multiple myeloma; osteoma or another benign musculoskeletal neoplasm; osteogenic sarcoma or another malignant musculoskeletal neoplasm; secondary bone metastasis from a distant primary site; osteopetrosis.

INVESTIGATION. Results of hematology and biochemistry investigations are shown (below).

The most significant laboratory findings are mild to moderate hypoproteinemia, hyperuricemia, and azurophilia. However, azurophilia might have been a laboratory misinterpretation of the granulocytic cell type; it is possible that what are identified as azurophils are actually heterophils.

	Immediate result	One month later	Normal value(s)	
Hematology				
WBCs	16.3 × 10 ⁹ /l	(16.3 × 10 ³ /μl)	8.2 × 10 ⁹ /l	(8.2 × 10 ³ /μl) 1.2–22.5 (1.2–22.5)
PCV	0.2 l/l	(20%)	0.35 l/l	(35%) 0.16–0.3 (16–30)
Metamyelocytes	4 × 10 ⁹ /l	(4 × 10 ³ /μl)	0 × 10 ⁹ /l	(0 × 10 ³ /μl) n/a
Bands	4 × 10 ⁹ /l	(4 × 10 ³ /μl)	0 × 10 ⁹ /l	(0 × 10 ³ /μl) n/a
Azurophils	61 × 10 ⁹ /l	(61 × 10 ³ /μl)	28 × 10 ⁹ /l	(28 × 10 ³ /μl) n/a
Lymphocytes	31 × 10 ⁹ /l	(31 × 10 ³ /μl)	71 × 10 ⁹ /l	(71 × 10 ³ /μl) 21–91 (21–91)
Monocytes	0		0	0–10
Eosinophils	0		0	0–3
Basophils	0		0	0–3
Thrombocytes	Adequate		Adequate	
Biochemistry				
AST (SGOT)	213 u/l		253 u/l	200–300
Glucose	7.4 mmol/l	(133.2 mg/dl)	nd	<8.6 (<154.8)
Calcium	2.4 mmol/l	(9.6 mg/dl)	nd	2.9–3.5 (11.6–14)
TP	40 g/l	(4.0 g/dl)	28 g/l	(2.8 g/dl) 45 (4.5)
Uric acid	0.48 mmol/l	(8.1 mg/dl)	0.4 mmol/l	(6.8 mg/dl) <0.3 (<5.1)