Listeria monocytogenes Septicaemia in an Inland Bearded Dragon, Pogona vitticeps

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Abstract: Listeriosis is a common disease of mammals, particularly ruminant livestock, but also of humans. It is frequently associated with low environmental temperatures, such as is encountered in the refrigeration of human foodstuffs, or in soil contamination in livestock. Here it is reported that Listeria monocytogenes caused a meningitis and septicaemic state in an inland bearded dragon, Pogona vitticeps after being fed infected frozen and then defrosted mouse pups.

Key Words: bearded dragon, Pogona vitticeps, listeriosis, Listeria monocytogenes.

Introduction

The inland bearded dragon, Pogona vitticeps, is a native of semi-deserts and savannahs of the Australian outback. Their natural diet is chiefly based on animal protein, with limited vegetable matter as a juvenile, becoming predominantly herbivorous as an adult. Their habitat is largely desert necessitating captive temperature ranges of 28 – 39°C (82 – 102°F) (Zimmermann, 1995).

Isolation of a single bacterial pathogen from reptiles is rare and identification of a primary agent is thus difficult (Jacobson, 1980). Some cases where specific bacteria have been isolated from reptiles include Escherichia coli which was isolated in pure growth from a myocardial abscess in a green iguana (Innis, 2000), and Clostridia spp. has been isolated from the blood of a variety of reptile species, particularly monitor lizards, Varanus spp., assessed as clinically healthy (Hanel, et al, 1999). Kostka and Helmut (1998) describe the ‘normal’ bacterial pharyngeal/cloacal flora of captive green iguanas, Iguana iguana, as Pseudomonas aeruginosa, E. coli, Serratia liquefaciens, Salmonella enterica and Proteus spp. with respect to Gram-negative bacteria and Staphylococcus spp., Streptococcus spp. and Bacillus spp. with respect to Gram-positive bacteria. Similar results were found in healthy monitors, Varanus gouldii, Varanus indicus, and green iguanas, Iguana iguana, (Schildger, et al, 1998). Pseudomonas aeruginosa was isolated frequently enough to conclude that it forms part of the normal flora. Mitchell and Shane (2000) also confirmed the presence of Salmonella spp. as a regular isolate from the gastro-intestinal tracts of adult and juvenile green iguanas. Despite this it is known that many of these bacteria have been associated with systemic and local disease in reptiles (Cooper, 1981). Listeria monocytogenes, has not been recorded as a ‘normal’ part of the gut flora in reptiles.

Septicaemia is common in reptiles, and can be due to bacteria causing local infections such as stomatitis, Pseudomonas spp. Aeromonas hydrophila, Mycobacterium spp. and Staphylococcus spp. which then go on to cause septicaemia (Frye, 1977, Cooper, 1981, Frye, 1991) or generalised lesions such as ‘blister disease’ due to several Gram-negative aerobic bacteria and fungi (Frye, 1991), or septicaemic cutaneous ulcerative disease (SCUD) due to Citrobacter freundii (Kaplan, 1957, Wallach, 1975). However, Clostridia spp. have been isolated from blood culture of clinically healthy reptiles (Hanel, et al, 1999).

Listeriosis has been extensively described in mammals with septicaemia, meningoencephalitis and abortion being the...
major diseases seen. The source of the infection is frequently soil-associated contamination of feed (Walker, 1990). More importantly is the occurrence of a low environmental temperature which allows preferential growth of the *Listeria* spp. over other bacteria (Walker, 1990) and which accounts for many human cases associated with refrigerated dairy products.

This report describes a case of *Listeria monocytogenes* septicemia and its origins in an inland bearded dragon.

**History and Signalment** – A 2.5 year old, 284 g male inland bearded dragon was presented with a history of three days anorexia with diarrhea. It was housed alone in a vivarium temperature range 20 – 28°C (68 – 82°F) and humidity of 50 – 75%. A water dish and 40 wt ultraviolet lamp (Reptisun® Zoomed) were provided with a daylight length of 10 – 12 hr. The vivarium substrate was sand. It was fed on locusts but had recently been supplemented with new born mice previously frozen and defrosted prior to feeding on a twice weekly basis. The last mouse pup was eaten three days prior to onset of clinical signs.

Physical examination revealed the body condition was moderate to poor as shown by decreased soft tissue covering of the pelvic bones and epaxial area of the tail. Clinically it was collapsed and unresponsive to stimulation (Figure 1). Petechiation was present orally. Auscultation of the lungs revealed crackling and fluid noises. The abdomen was swollen and gas/fluid noises could be heard.

**Investigation** — One ml of blood was taken from the ventral tail vein after scrubbing the skin with 1% povidone-iodide solution (Pevidine® Surgical Scrub, C-Vet Veterinary Products UK) and was transferred into a lithium heparin tube for biochemical and hematological evaluation. A blood smear of fresh blood was made on a microscope slide and air dried for cytological analysis. Biochemical analysis was performed on a dry chemical in house system (Vettest 8008®, Idexx Laboratories, UK) for all but the renal electrolytes which were analysed using the Vetlyte® (Idexx Laboratories, UK) system. Hematological counts were performed manually with a differential from a Leishman’s stained air dried blood smear.


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<th>Reference Ranges*</th>
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<tr>
<td>17-50</td>
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<tr>
<td>6.736 – 19.946</td>
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<tr>
<td>1.619 – 7.339</td>
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<td>4.012 – 12.033</td>
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<td>0.0 – 0.499</td>
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<td>0.205 – 3.191</td>
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<td>0.0 – 1.085</td>
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<td>7.7 – 16.2</td>
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<td>138.73 – 291.90</td>
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<td>1.60 – 11.40</td>
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Figure 2. Dorso-ventral radiograph of inland bearded dragon, *Pogona vitticeps*, showing gas filled gut (A).

Figure 3. Lateral radiograph of inland bearded dragon, *Pogona vitticeps*, showing gas filled gut and stomach.
The remainder was immediately centrifuged at 2000 rpm (11,200 g) for two minutes (StatSpin 3®, StatSpin Technologies Norwood, MA USA) and the plasma removed for biochemical analysis (Table 1).

Conscious lateral and dorso-ventral radiographs were performed using a Supermobile™ 500 Todd Research Ltd. radiography unit and Ultravision® radiographic film and Detail® cassette (Dupont). Extensive gas in the intestines and stomach was seen with no foreign bodies or ascites (Figures 2 and 3).

A 6 F urinary sterile catheter was passed per- os and a stomach wash performed with 5 ml of sterile 0.9% saline (Aqupharm®, No1, Animalcare Ltd, UK). This was aspirated and an air dried smear was made and stained using Gram’s Method. The remainder was sent to an outside laboratory for bacteriological/fungal culture and sensitivity.

Biomedical abnormalities included elevated phosphorus and potassium, toxic heterophils, azurophilia and lymphopenia. The stomach wash contained large numbers of Gram-positive cocco-bacilli bacteria but no parasites or fungi.

The lizard was placed into a warm vivarium [28 – 39°C (82 – 102°F)] and given a bolus of 2.7 ml of one third lactated Ringers solution (Aqupharm® No.11, Animalcare Ltd, UK), one third 0.18% sodium chloride 4% glucose (Aqupharm® No18, Animalcare Ltd, UK) and one third sterile water intravenously over two minutes via the ventral tail vein. In addition 10 mg/kg enrofloxacin (Baytril® 2.5% Injection, Bayer, UK PLC) was administered subcutaneously in the left forelimb after treating the skin with Pevidone®.

Six hours later the lizard died, exhibiting preterminal opisthotonic seizures. Post mortem swabs were taken from the pericardial sac, the left cut renal surface, and the right forelimb after treating the skin with Pevidone®.

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Histopathology revealed penetration of the bacteria into most areas of the body including the brain, kidneys, spleen, heart and liver, with micro-abscesses forming in all of these organs (Figure 4).

Bacteriological culture and sensitivity on swabs from cardiac blood of the remaining frozen mice also yielded Listeria monocytogenes in pure growth. They were incinerated and staff of the pet store in question warned of the zoonotic risk. No other animals had been fed mice from this batch but a warning was issued to patrons who may have purchased frozen mice from this source.

Discussion

Gram-negative bacteria are the commonest cause of septicaemia especially Aeromonas spp. and Pseudomonas spp. (Cooper, 1981) and Escherichia coli (Innis, 2000), the exception being septicaemic cutaneous ulcerative disease (SCUD) of turtles due to Citrobacter freundii (Kaplan, 1957) possibly with Serratia spp. (Jacobson, 1980, Frye 1991). Symptoms vary from sudden death to lethargy, and uncoordinated convulsing (Cooper, 1981). These findings correlate well with this case where the initially anorectic lizard became unresponsive and died after convulsing.

Septicaemia may cause peracute disease and hence bio abnormalities in biochemical/ hematological parameters (Cooper, 1981). However in this case we have toxic heterophils, a lymphopaenia with an azurophilia (Hawkey and Dennett 1989 a, b, LeBlanc, et al, 2000). Biochemically there was evidence of early renal damage with elevated potassium and phosphorus levels (Divers, 1997) although uric acid levels were within normal quoted ranges (Ellman, 1992). Histopathology showed that there was a moderate level of kidney damage suggesting that uric acid levels are not a sensitive indicator for acute renal damage in inland bearded dragons.

A low haematocrit and excessive quantity of haemosiderin in the liver and other organs maybe of use in determining septicaemia (Cooper, 1981). However there was no evidence of either abnormality in this case.

Histopathological findings of multi-organ microabscessation as described in other cases of septicaemia (Cooper, 1981, Frye 1991) with isolation of pure growths of the organism from heart blood, gut contents and internal organs suggested Listeria monocytogenes was a primary pathogen in this case. In addition presence of cloudy meningeal membranes is a common finding in mammals affected by listeriosis (Stotts, 1988).

Bacterial access to the bloodstream in cases of septicaemia may occur via a natural/surgical wound (Cooper, 1981, Storts, 1988) or from a build-up of bacteria in the environment with access through the gut (Boyer, 1995). In snakes it maybe associated with gut damage from Entamoeba invadens (Frye, 1977) or ectoparasitism and cutaneous damage due to Ophionyssus natricis [cf. Aeromonas spp. transmission (Mader, 1993)]. In this instance the bacterium appears to have followed an oral route, arriving in contaminated frozen food, a common method of transmission for listeriosis (Walker, 1990). However there was no evidence of endoparasitism to account for its entrance to the bloodstream, but the number of pathogenic units present in the food may have been sufficient in itself to produce disease, or it may have followed the route...
preferred in mammals via an oral cut or abrasion and then to the brain via the cranial/trigeminal nerves (Storts, 1988). Managemental problems contributing to the stresses placed upon the lizard (Jacobson, 1980), e.g. the vivarium temperature range of 20 – 28°C (68 – 82°F) may have lowered the lizards’ immune system (Frye, 1991) as inland bearded dragons’ recommended temperature range is 28 – 39°C (82 – 102°F) (Zimmermann, 1995) with other authors recommending an ambient daytime temperature of 27 – 29°C (81 – 84°F) with a basking site temperature of 32 – 35°C (90 – 95°F) (Stahl, 1999). There is only one recorded case of *Listeria monocytogenes* infection in reptiles mentioned by Frye (1991) in farmed crocodiles fed infected swine carcasses. Indeed as far as zoonotic diseases of reptiles are concerned *Listeria* spp. are not mentioned by Kolle and Hoffmann (1998).

This case illustrates that any animal consuming contaminated frozen food can be susceptible to listeriosis, suggesting that it can be a primary pathogen in reptiles as well as mammals.

**REFERENCES**


