Diagnostic Challenge

History

A juvenile bearded dragon (*Pogona vitticeps*) was presented to the Louisiana State University School of Veterinary Medicine with a history of lethargy and depression over a 3-day period. This animal was one of 20 bearded dragons obtained from a private breeder 4 weeks before presentation. The bearded dragons were being used to evaluate a new commercially prepared bearded dragon diet. All of the bearded dragons in the colony were housed individually in plastic, open-top containers (30.5 × 20.3 × 61 cm). The temperature of the room that the colony was housed in was 88°F to 92°F (31-33°C) during the day and 80°F to 82°F (26.7-27.7°C) at night. No full-spectrum lighting was provided to the lizards. All of the dragons were maintained on a newspaper substrate to enable caretakers to collect fecal samples for parasitic examination. Each dragon was offered 2 to 4 three-week-old crickets (*Acheta domestica*) daily. The crickets were gut-loaded for 24 hours with a commercial cricket chow (Fluker Farms, Port Allen, LA USA). The lizards were also offered fresh romaine lettuce daily. Fresh water was provided in a shallow bowl.

On physical examination, the dragon was alert but weak and depressed. The animal weighed 8 g. The oral cavity was pale pink in color and tacky. The eyes appeared sunken, and the skin elasticity was poor. The spine, pelvis, and caudal vertebrae were prominent. A Doppler ultrasound was used to measure the heart rate (36 beats per minute). The respiratory rate was 12 breaths per minute.

A fecal sample obtained from the dragon's cage revealed the organism found in Figure 1. Because the lizard was in poor body condition and belonged to a research colony, the decision was made to euthanize the dragon for a necropsy to rule out diseases that could affect the rest of the animals in the colony. The dragon was humanely euthanized with a ketamine (Ketaset, 50 mg/kg intramuscularly; Fort Dodge Animal Health, Fort Dodge, IA USA) and barbiturate (Beuthanasia, 0.03 mL intracardiac; Schering Plough Animal Health Care, Union, NJ USA) overdose.

Histopathology revealed a mild focal ulcerative colitis with neovascularized submucosa underlying the ulceration. A mild, multifocal, chronic interstitial inflammatory response, primarily characterized by lymphocytes, was observed in the kidneys. A focal lymphohistiocytic inflammatory response with a loss of hepatocytes was observed in the liver. Large, intranuclear inclusion bodies were observed in the peripheral hepatocytes (Fig 2).

At this time, evaluate the history, external physical examination results, fecal examination, and histopathologic findings to develop a differential diagnosis list.

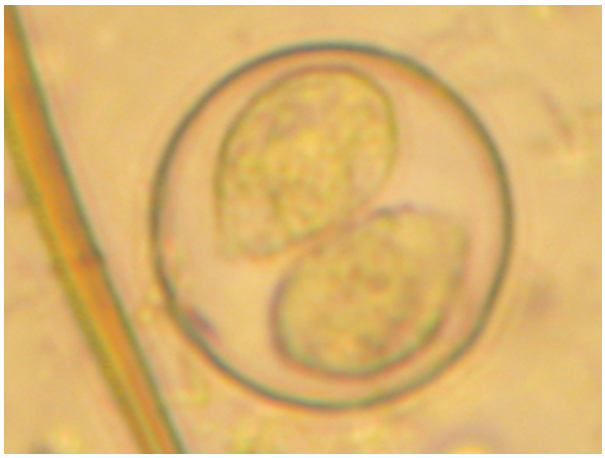

Figure 1. This organism was identified on a saline solution direct smear.

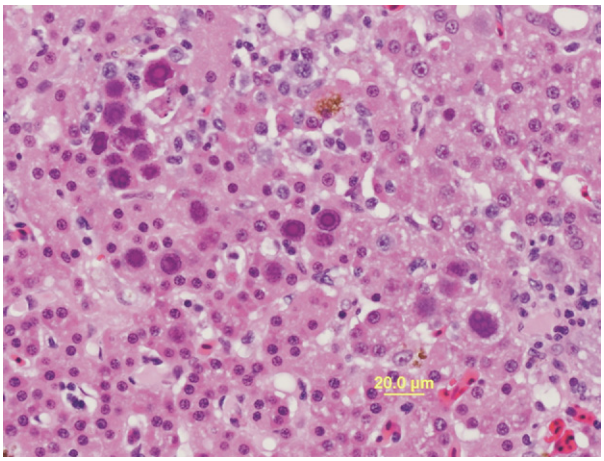

Figure 2. Histopathology results of the bearded dragon liver at postmortem.

Diagnosis

Based on the physical examination, fecal examination, and histopathologic findings, a diagnosis of adenoviral infection (Fig 3) with concurrent *Isospora amphiboluri* infection (Fig 4) was made. This dragon was euthanized because adenovirus was highly suspected from the clinical signs and history. Bearded dragon adenovirus was first identified in a confiscated adult female bearded dragon from New Zealand.[1] Since that time, 2 outbreaks in juvenile bearded dragon colonies in the United States have been reported.[2,3] This disease is likely more prevalent than has been described in the literature.

Comments

To date, there have been no studies to elucidate the epidemiology of adenovirus in bearded dragons. However, based on our knowledge of adenoviruses in other vertebrate species, it is presumed to be transmitted via the fecal-oral route. In one of the previously described outbreaks, the dragons were housed together, which probably resulted in the spread of the virus.[3] In that breeding colony, it was presumed that the adenovirus was introduced with the addition of new broodstock and the facility did not use a routine quarantine protocol. The animals obtained for this study were housed under similar conditions.

Diagnosing adenoviral infection in bearded dragons may be done at postmortem, as with this case, or antemortem. There are several tools that can be used to diagnose adenovirus infections in a bearded dragon at postmortem. Histologically, basophilic intranuclear inclusions (Fig 3) may be found in a variety of tissues, including the liver, alimentary tract, and kidneys. Electron microscopy can also be used to screen tissue samples for viral particles. If a specific virus is suspected, molecular techniques or culture can also be used to further characterize or confirm the presence of a virus. In this particular case, electron microscopy was used to confirm the presence of adenoviral particles in the liver as evidenced on histopathology.

For many clinicians, pet bearded dragons are presented with similar clinical signs, and an antemortem diagnosis is sought. Because the virus is shed through the feces, it is possible to confirm the presence of the virus with electron microscopy or a polymerase chain reaction assay.[4] Serial fecal samples should be submitted to minimize the likelihood of misclassifying animals that transiently shed the virus. A recent study suggests that polymerase chain reaction is considerably more sensitive than electron microscopy for diagnosing adenovirus in antemortem samples from bearded dragons.[4]

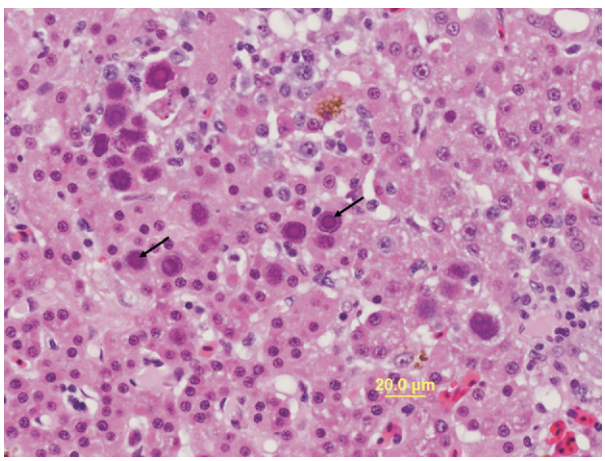

Figure 3. The large intranuclear inclusion bodies (*arrows*) observed in the peripheral hepatocytes are consistent with adenovirus infection.

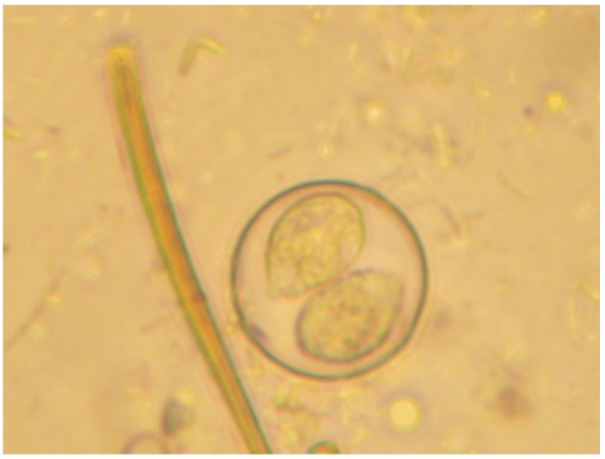

Figure 4. The organism identified in the fecal sample was *Isospora amphiboluri*.

Bearded dragons infected with adenovirus should be provided appropriate supportive care. Broad-spectrum antibiotics that are well distributed to the liver and gastrointestinal tract may be used to manage opportunistic bacterial infections. Fluid therapy to counter the losses associated with diarrhea should also be provided. In juvenile dragons, the provision of calories is essential. The authors have had success maintaining adenoviral infected juvenile dragons with Repta-Aid (Fluker Farms, Port Allen, LA USA). Until more is known about the epidemiology of this viral infection, animals that are confirmed to be positive should be considered reservoirs and culled or isolated and held in quarantine.

Isospora amphiboluri was also diagnosed in this dragon (Fig 4). This coccidian parasite is common in captive bearded dragons and, like other coccidians, is considered host-specific.[5] Adult bearded dragons with *I. amphiboluri* infections generally show no clinical illness, whereas juvenile bearded dragons often develop overt clinical disease signs, including diarrhea and dehydration. In this case, and with the case described by Kim and coworkers,[3] the coccidia infection was thought to further compromise the dragons.

Juvenile bearded dragons have limited fluid and calorie reserves compared with those of adult dragons, and can become dehydrated and emaciated with heavy coccidial infestations. Bearded dragons should always be quarantined before being added to a colony or household with established dragons. Fecal samples should be collected weekly and examined for the presence of the coccidian. The authors recommend 4 negative samples over a 4-week period before releasing the animal from quarantine. Current treatment recommendations for *I. amphiboluri* in bearded dragons are primarily based on empirical information. A single study to evaluate the efficacy of 5% *Aetheroleum* (oregano) against *I. amphiboluri* in juvenile bearded dragons concluded that the drug was ineffective.[6] More recently, a study evaluating ponazuril (30 mg/kg by mouth, 2 doses 48 hours apart) was found to effectively clear the parasites.[7]

Bearded dragons are popular pets in the United States and Europe, so it can be expected that these animals will continue to be presented to veterinarians for a variety of health issues. When working with these animals, it is important for veterinarians to consider both adenovirus and coccidial infections in the differential list for animals presenting with general malaise and gastrointestinal disturbances. Although this case involved juvenile dragons, adult animals are also susceptible to infection with both adenovirus and *I. amphiboluri*.

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