NEUROLOGIC DISEASES OF BIRDS AND REPTILES

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Abstract

Captive reptiles and birds are often presented to veterinary hospitals exhibiting neurologic disease signs. Neurologic disease conditions can be a diagnostic challenge for the clinician owing to limitations of laboratory testing, nonspecific clinical signs and the wide range of possible underlying disease causes of the identified problems. Both common and seldom reported neurologic diseases associated with infectious organisms, trauma, neoplasia, metabolic disorders, toxins and malnutrition are reviewed.

Key words: bird; infectious disease; neurologic; reptile; toxicosis

Neurologic diseases in both reptiles and birds occur for a variety of reasons, but obtaining an antemortem definitive diagnosis is often challenging. Depending on the species being examined, the patient's response to a neurologic examination may be compromised by innate "prey" behaviour. The benefit of a neurologic examination can also vary between species and even within the individual depending on external factors (e.g., environmental temperature). Diagnostic tests used for dogs, cats and small exotic mammals, such as advanced imaging, myelography or cerebrospinal fluid (CSF) analysis, may be difficult to perform or interpret in reptilian and avian patients owing to their size. However, a number of neurologic diseases have been characterised in reptiles and birds. Although published reports are limited regarding reptile and bird neurologic diseases, this information serves as a foundation for the medical review presented in this article.

REPTILES

Infectious Disease

Bacterial Infections. Bacterial infections may be the primary (infection of the nervous system itself) or secondary (infection of surrounding structures causing nerve compression) underlying cause of clinical neurologic signs. Gram-negative bacteria (e.g., *Salmonella* spp., *Staphylococcus* spp., *Listeria* spp., *Mycoplasma* spp. and *Mycobacterium* spp.) are the most common isolates from nervous system infections in reptiles.[1,2] Nonspecific clinical signs such as lethargy and reduced appetite may be initially observed, but as the disease progresses, more obvious neurologic signs (e.g., severely depressed mentation, reduced righting reflex, seizures and death) can occur. A definitive diagnosis of bacterial-induced neurologic disease is often obtained through a postmortem examination, but in larger reptile species, sampling of the CSF may lead to an antemortem diagnosis. As with all animals, the selection of an antibiotic agent should be based on culture and sensitivity of the CSF. However, if this is not possible, then one should select an antibiotic agent that has treatment activity against Gram-negative bacteria and crosses the blood-brain barrier.

Alternatively, infection of surrounding tissue/bone may cause nerve compression (i.e., osteomyelitis of the vertebrae can cause vertebral

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remodelling), which over time results in spinal cord compression causing progressive neurologic deficits.[3] Enlargements of the vertebral bodies are often easy to detect on physical examination and may be confirmed through radiographic imaging. To determine if vertebral remodelling is definitely due to bacterial infection may be more challenging as proliferative spinal osteopathy has also been reported without evidence of bacterial infection.[4] A definitive diagnosis of bacterial-induced osteomyelitis will require biopsy of the vertebrae for organism isolation, and histology and blood culture to determine if septicaemia is present. However, the aforementioned diagnostic test listed may not be appropriate in every case. Long-term antibiotic therapy is usually indicated, and surgical debridement of lytic lesions may be required to treat the underlying disease condition. Prognosis of bacterial-induced osteomyelitis in reptiles is guarded as the disease condition is often advanced by the time a patient is presented.

Viral Infections

Ophidian Paramyxovirus. Ophidian paramyxovirus (oPMV) is a significant viral infection in many snakes and especially common in viperids, although this virus also affects elapids, boids and colubrids.[5,6] The oPMV is mainly transmitted by direct contact with respiratory secretions, but there is also potential exposure via snake mites. A variety of respiratory, gastrointestinal (GI) and neurologic signs may be observed when snakes are infected with oPMV including stargazing, torticollis, a reduced righting reflex and death. Alternatively, some infected individuals have no overt clinical disease signs. Diagnosis has historically been based on paired serology or through postmortem examination. However, recently a oPMV polymerase chain reaction (PCR) test is commercially available, and an antemortem diagnosis can obtained using either an oral or cloacal swab. Supportive treatment may be provided to snakes exhibiting clinical signs, but euthanasia is generally advised.

Inclusion Body Disease. Inclusion body disease (IBD) is another significant viral infection in snakes, primarily affecting boas and pythons. Until the past few years, the exact aetiology of IBD was unknown until an arenavirus was proposed as the underlying cause of the disease.[7] Both neurologic and GI signs may be observed before death. Boas often present with a history of regurgitation and gradual weight loss, with neurologic signs only occurring at the terminal stage of disease. Consequently, pythons exhibit neurologic signs during early stages of the disease, which appears to quickly progress.[8] A definitive diagnosis has previously been based on histopathological examination of collected tissue samples. Biopsy samples are harvested from multiple organs to increase the possibility of detecting intracytoplasmic inclusion bodies. Liver, kidney and oesophageal tonsil biopsies may be collected antemortem or brain and pancreatic samples postmortem. Occasionally, inclusion bodies are identified in white blood cells.[9] A PCR test is now available to screen for arenavirus infection from a blood sample and/or an oesophageal swab. As with paramyxovirus (PMV), treatment is supportive, and euthanasia is recommended.

Agamid Adenovirus. Agamid adenovirus-1 is considered endemic in the pet bearded dragon (*Pogona vitticeps*) population and appears to be associated with both neurologic and GI signs, reduced growth and death.[10] Alternatively, in some dragons, the infection remains subclinical. Transmission of the agamid adenovirus-1 is via the faecal-oral route, with infection resulting in severe GI and hepatic pathology.[11] A definitive diagnosis is based on PCR testing of an oral or cloacal swab, and as with the other viral infections, treatment is supportive only.

West Nile Virus. West Nile virus (WNV) infection has been described in various alligator (*Alligator mississippiensies*) and crocodile species[12] in the USA and appears to be associated with progressive neurologic signs followed by death. Transmission is via an insect vector (e.g., mosquito) and direct contact. Crocodilians are thought to serve as an amplifying host owing to high levels of viraemia and viral shedding. Typical signs of disease associated with WNV infection include circling, ataxia, tremors and head tilt, although a lymphohistiocytic proliferative syndrome associated with skin lesions has also been described.[13] Thus far, definitive diagnosis of WNV in outbreaks has been based on viral isolation and PCR testing of postmortem samples, although serologic diagnostic testing is considered an alternative.[14] Euthanasia is strongly advised for infected animals owing to the zoonotic potential of this disease. A WNV vaccine (Boehringer Ingelheim, St. Joseph, MO USA) has been approved for use in alligators.

Fungal and Parasitic Infections. Other less common causes of neurologic disease in reptiles include both fungal and parasitic infections. Fungal diseases that may affect the reptile neurologic system include cryptococcosis (i.e., described in an anaconda with