Wildlife Health Australia

Inclusion body disease in Australian snakes

Fact sheet

Introductory statement

Inclusion body disease (IBD) is an important disease of snakes because of its 100% mortality rate and lack of definite knowledge regarding epidemiology, diagnosis, treatment and prevention. While IBD appears to be present in captive Australian snakes its diagnosis is still extremely problematic. Until recently diagnosis was purely histological, determined by the presence of inclusion bodies. However, inclusion bodies are not specific to IBD and are found in many viral infections. It seems entirely plausible that at least some of the snakes diagnosed with IBD were infected with a different virus. Recently arenavirus has been identified in snakes with IBD. A diagnostic test is now available in Australia. The effect of IBD on wild Australian snake populations is unknown as the IBD status of Australia's snakes, captive and free living, is also unknown.

Aetiology

Previously it was thought that IBD may be caused by a virus of the family *Retroviridae* (Schumacher et al. 1994). Although retroviruses have been isolated from affected snakes it has not been shown definitely that they were the cause of the disease (Jacobson et al. 2001). More recently researchers have found arenaviruses in six out of eight snakes diagnosed with IBD in the USA and eight IBD positive snakes examined in The Netherlands. These findings led the authors to speculate that arenavirus may be the causative agent of IBD (Stenglein et al. 2012; Bodewes et al. 2013).

Natural hosts

IBD is mainly a disease of the family *Boidae* (boas and pythons) but cases have also been described in an eastern kingsnake (*Lampropeltis getulus*), and a collection of palm vipers (*Bothriechis marchi*) (Raymond et al. 2001; Jacobson, 2007).

World distribution

The disease occurs worldwide.

Occurrences in Australia

The disease has been diagnosed in captive pythons throughout Australia. There are no definitive data that show that IBD is present in wild Australian snake populations.

Epidemiology

The route of transmission of IBD is unknown but likely involves direct contact. Venereal transmission has been suggested and the snake mite, *Ophionyssus natricis*, has been implicated as a potential vector as mites are often present in infected snake collections (Jacobson, 2007).

The incubation period is unknown but infected boas have been observed for over 12 months without developing clinical signs (Wozniak et al. 2000). Latent infections may be possible (Schumacher, 2006).

Clinical signs

In boas IBD is a slowly progressive disease developing over several months. The first clinical signs are regurgitation, occurring about a week after feeding, followed by anorexia, weight loss, and lethargy. Terminally, snakes develop neurological signs such as a head tremor, mydriasis, incoordination, opisthotonus, and a loss of the righting response.

In pythons, neurological signs appear to be more pronounced, occurring over a few weeks. Signs are similar to those seen terminally in boas and include a flaccid ascending paralysis. Regurgitation does not occur, but anorexia, weight loss and lethargy do.

Affected snakes commonly develop secondary diseases such as necrotic stomatitis, pneumonia, and necrotising dermatitis (Schumacher, 2006).

Diagnosis

IBD should be high on the differential diagnosis list for any python displaying neurological signs.

Biopsies of the oesophageal tonsils, liver and kidney can be examined for inclusion bodies. However, as the number and distribution of inclusion bodies is variable this test is not very sensitive. Boas are more likely to have inclusions in these organs than pythons.

PCR testing for arenavirus.

Necropsy: a diagnosis is made based on finding intracytoplasmic inclusion bodies (Jacobson, 2007).

Clinical pathology

Often early in the course of the disease affected snakes develop a marked leucocytosis, due to a pronounced lymphocytosis. In advanced stages lymphoid depletion may occur resulting in a marked leucopaenia. Inclusion bodies may be visible within circulating lymphocytes (Schumacher, 2006).

Pathology

There are no gross lesions. In boas, eosinophilic intracytoplasmic inclusion bodies are found most commonly in mucosal epithelial cells adjacent to the oesophageal tonsils, lymphoid cells in the oesophageal tonsils,

epithelial cells lining the gastrointestinal tract, renal tubular epithelial cells, pancreatic acinar cells and hepatocytes, but can be found in any organ. Pythons have intracytoplasmic inclusions within neurons in the central nervous system generally associated with a non-suppurative meningoencephalitis and perivascular cuffing.

Seen more frequently in boas, other lesions include exocrine pancreatic atrophy and necrosis, hepatocyte degeneration, renal tubular necrosis, and lymphoid depletion (Jacobson, 2007).

Differential diagnoses

Because clinical signs can be quite variable, at least initially, the list of differential diagnoses is long and should include bacterial infections, parasitic infections, trauma and exposure to toxins.

Laboratory diagnostic specimens

Heparinised and whole clotted blood should be collected from live snakes for haematology for PCR testing. Serum should be separated from whole blood as soon as possible after sampling. The serum and blood cells can be frozen and stored for PCR testing. A complete range of tissues should be collected in formalin from dead snakes.

Laboratory procedures

- PCR testing for arenavirus on serum and blood cells.
- Tissues should be stained with haematoxylin and eosin and checked for inclusion bodies.
- Electron microscopy can be used to examine the inclusions, which are non-viral but contain an antigenically distinct protein (Wozniak et al. 2000).

Treatment

There is no treatment. Mortality is 100% once clinical signs appear.

Prevention and control

As the cause of IBD is still subject to satisfying Koch's postulates and the mode of transmission and incubation period are unknown, it is difficult to make recommendations regarding prevention and control. Quarantine periods as long as 13 months have been suggested but cases have occurred in snakes that were isolated for two years (P Holz, pers. obs.). Blood can be tested in clinically unaffected snakes for leucocytosis and inclusion bodies, and biopsies can be examined for inclusions. However, neither method is very sensitive. Once commercially available in Australia, PCR testing for arenavirus is recommended for screening collections. Snakes should only be sourced from collections with no history of IBD. Good husbandry and early detection and aggressive treatment of mite infections is important for the prevention of IBD infection in a snake collection. Recommended disinfectants are sodium hypochlorite and chlorhexidine (Schumacher, 2006).

Surveillance and management

Wildlife disease surveillance in Australia is coordinated by the Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian

government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public. Coordinators in each of Australia's States and Territories report monthly on significant wildlife cases identified in their jurisdictions. NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. Please contact admin@wildlifehealthaustralia.com.au.

There is no targeted surveillance program or AUSVETPLAN for IBD. A technical issues paper entitled, "Generic Import Risk Analysis of Live Snakes" was released in 2003 and can be found at http://www.daff.gov.au/__data/assets/pdf_file/0013/12064/2003-07a.pdf. The status of Australia's wild snakes with respect to IBD is unknown. However, there is one published report of IBD in a captive carpet python (*Morelia spilota vareigata*) and a captive diamond python (*Morelia spilota spilota*) (Carlisle-Nowak et al. 1998).

Statistics

Limited information is available in the National Wildlife Health Surveillance Database. Cases reported in eWHIS as having IBD are all from captive snakes and include two centralian carpet pythons (*Morelia bredli*), three carpet pythons, four diamond pythons, one black-headed python (*Aspidites melanocephalus*), and one green python (*Chondropython viridis*) from New South Wales, and one diamond python from South Australia.

Research

Research is urgently needed in order to clarify virtually every aspect of this disease from cause to transmission to diagnosis. PCR testing for arenavirus is available at Murdoch University, Perth through Dr Tim Hyndman.

Human health implications

There are no reports of IBD in humans.

Conclusions

While IBD appears to be present in Australian snakes, diagnosis of the disease is still extremely challenging. Until recently cases were diagnosed solely on the presence of histological lesions (inclusion bodies). However, inclusion bodies are not specific to IBD and are found in many viral infections. Recently arenavirus was identified in some snakes with IBD. Nonetheless, further studies need to be done before it is clear whether this virus is the cause of IBD. PCR testing for arenavirus is now available in Australia but not yet on a commercial basis. The effect of IBD on wild Australian snake populations is unknown as the IBD status of Australia's snakes, captive and free living, is also unknown. Until a definitive ante mortem testing regime for IBD is available the condition will be impossible to manage.

References and other information

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To provide feedback on this fact sheet

We are interested in hearing from anyone with information on this condition in Australia, including laboratory reports, historical datasets or survey results that could be added to the National Wildlife Health Information System. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

Wildlife Health Australia would be very grateful for any feedback on this fact sheet. Please provide detailed comments or suggestions to admin@wildlifehealthaustralia.com.au. We would also like to hear from you if you have a particular area of expertise and would like to produce a fact sheet (or sheets) for the network (or update current sheets). A small amount of funding is available to facilitate this.

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email admin@wildlifehealthaustralia.com.au
or call +61 2 9960 6333