Mycobacterial disease in wild Australian native reptiles

Fact Sheet

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Introductory statement

Mycobacterial disease (mycobacteriosis) is a serious disease across many animal species and has been described in the scientific literature since the 1880s (Reavill & Schmidt, 2012). Mycobacterial infections have been reported in a wide variety of reptiles (snakes, turtles, lizards and crocodiles).

Aetiology

Mycobacteriosis is caused by a group of bacteria which are Gram (+), acid-fast, aerobic or facultatively anaerobic rods that form filaments in culture. Many different species have been isolated from cases of disease in reptiles. These include *Mycobacterium avium, M. schlangen, M. tropidonotus, M. marinum, M. thamnopheos* and *M. xenopi*. Found in soil, water, dust and living as commensals in healthy snakes. Mycobacteria can remain infectious in soil for up to seven years (Holz and Barker, 2012).

Natural hosts

- Mycobacteriosis appears to be most common in aquatic reptiles, especially those in production systems such as crocodilians.
- Many affected chelonians are either wild animals being brought into captivity or free-ranging wild animals being rehabilitated in captivity (Mitchell, 2012).
- There appears to be no age or sex-linked predisposition to mycobacteriosis.

World distribution

Mycobacteriosis in reptiles occurs worldwide (Mitchell, 2012).

Occurrences in Australia

Mycobacteriosis occurs sporadically in captive reptiles in Australia. Cases have been reported in injured or diseased free living animals undergoing rehabilitation (https://arwh.org/).

Epidemiology

Limited research has been conducted in the epidemiology of mycobacteriosis in reptiles. A study showed that green anoles (*Anolis carolinensis*) inoculated subcutaneously with viable *M. ulcerans* developed slowly progressive lesions at the site of inoculation (Marcus, 1975). A diffuse,

granulomatous response with intracellular, or less commonly, extracellular acid-fast bacteria was described. The same species inoculated orally with viable *M. ulcerans* via a stomach tube (Marcus, 1976) actively shed the bacteria for up to 11 days after inoculation.

Histopathology showed that the organism had a predilection for the liver, with *M. ulcerans* being isolated from the livers of 15% (3/20) of the lizards.

Acid-fast bacteria were identified in the mucosa of the intrahepatic bile ducts in 66% (2/3) of the lizards in which the organism was found. The findings of the study reinforced that this species of lizard (and others) could serve as a reservoir or carrier of *M. ulcerans.* The findings also suggest that reptiles may be able to develop some form of resistance to these bacteria, reinforcing why the prevalence is low. This study was performed before PCR testing became available. Results may have been different (higher prevalence) had a more sensitive test been possible (Mitchell, 2012).

It is generally thought that the *Mycobacterium* spp. gain access through cutaneous routes and then spread haematogenously to a variety of tissues (Mitchell, 2012).

Clinical signs

Affected reptiles may be found dead with no clinical signs. More commonly they show vague non-specific signs such as anorexia, lethargy and emaciation. If spinal involvement occurs the snake may present with neurological abnormalities or evidence of a spinal fracture. (Holz and Baker, 2012)

Diagnosis

- According to some reports mycobacteriosis is relatively uncommon in reptiles (Reavill and Schmidt, 2012; Mitchell, 2012). However, it is possible that many cases go undiagnosed because of a lack of follow-through on cases by clinicians or pathologists (Mitchell, 2012).
- Ante mortem diagnosis is difficult unless granulomas are present in the skin or radiography detects osseous or space occupying lesions.
- At necropsy granulomas spreading through multiple organs is highly suggestive of mycobacteriosis.
- A presumptive diagnosis can be made by finding acid-fast organisms within the granulomas, but culture is required for a definitive diagnosis (Holz and Baker, 2012).
- PCR and DNA sequencing to confirm species of mycobacteria.

Laboratory diagnostic specimens and procedures

Samples required: liver, spleen, kidney, lung, gut; biopsies of lesions (frozen, formalin).

- Ziehl-Neelsen stain for acid-fast bacteria
- Culture
- PCR and DNA sequencing

Detailed information on laboratory diagnostic specimens procedures required for diagnosis of mycobacteriosis is available at the Australian Registry of Wildlife Health (https://arwh.org/).

Clinical pathology

- Bacteriology
  - Ziehl-Neelson stain for the presence of acid-fast organisms in lesions
  - Culture
- PCR and DNA sequencing
- Haematology – leucocytosis (azurophilia)

Pathology

- Grossly, multiple granulomas are spread through a variety of organs. The most common primary sites in reptiles are the liver, spleen and gut. Secondary involvement commonly occurs in the lung, bone and skin. Bone involvement produces osteomyelitis, discospondylitis and pathological fractures. Skin lesions appear as well-circumscribed subcutaneous nodules (Holz and Barker, 2012).
- Histologically, granulomas often have a central core of caseation surrounded by mononuclear cells. In the later stages fibroplasia occurs. Acid-fast organisms are visible within the granulomas (Holz and Barker, 2012).

Detailed information on the pathology of mycobacteriosis is available at the Australian Registry of Wildlife Health (http://www.arwh.org/).

Differential diagnosis

Any disease or condition that causes wasting, inappetence or lethargy.

Treatment

- Currently, there are no proven or approved treatments for mycobacteriosis in reptiles, and because of the zoonotic potential of these bacteria, none is recommended (Mitchell, 2012).
- Clinically affected animals should be euthanased.

Prevention and control

It is generally thought that the *Mycobacterium* spp. gain systemic access through cutaneous routes, so protecting cutaneous lesions during the rehabilitation process may limit a reptile's exposure to these pathogens. This is especially important in animals undergoing rehabilitation because they are generally considered to be immunocompromised and more susceptible to opportunistic infections (Mitchell, 2012). Animals showing signs of systemic mycobacteriosis should be euthanased.

Disinfectants

- *Mycobacterium avium* complex (MAC) has a high resistance to chemical disinfectants and ultraviolet (UV) irradiation (Whiley et al, 2012).
- *Mycobacterium chelonae* strains also may show high resistance to glutaraldehyde. (Russell, 1999).

- *Mycobacterium avium intracellulare* is generally less sensitive than *M. tuberculosis* to glutaraldehyde (Russell, 1999).

Research

The status of mycobacterial infection or disease in free living Australian reptiles is unknown. Research is needed to describe the incidence in both captive and free-living reptiles in Australia.

Surveillance and management

There is no targeted surveillance program, or AUSVETPLAN for mycobacteriosis in reptiles in Australia. As an "Interesting or unusual disease" cases of mycobacteriosis diagnosed in wild reptiles should, however, be reported and captured as part of Australia's general wildlife health surveillance system.

Wildlife Health Australia administers Australia's general wildlife health surveillance system, in partnership with government and non-government agencies. Wildlife health data is collected into a national database, the electronic Wildlife Health Information System (eWHIS). Information is reported by a variety of sources including government agencies, zoo based wildlife hospitals, sentinel veterinary clinics, universities, wildlife rehabilitators, and a range of other organisations and individuals. Targeted surveillance data is also collected by WHA. See the WHA website for more information https://wildlifehealthaustralia.com.au/Our-Work/Surveillance and https://wildlifehealthaustralia.com.au/Our-Work/Surveillance/eWHIS-Wildlife-Health-Information-System. 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. Negative data are also valuable. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

Statistics

Eight cases (8/24) in four species of marine turtle (*Chelonia mydas, Natator depressus, Caretta caretta* and *Eretmochelys imbricata*) and one freshwater turtle (*Emydura* sp.) have been reported by the National Wildlife Health Surveillance Database and the Australian Registry of Wildlife Pathology Database (3204/1, 4715/1, 6435/1, 6574/1, 7311/1, 7569/1, 8271/1, 8339/1). The remainder of cases were captive reptiles (16/24). Mycobacteria species identified were *M. abscessus, M. chelonae, M. fortuitum* and *M. avium intracellulare.*

Human health implications

Advice regarding human health implications of mycobacteriosis should be sought from your local public health department. Human infections generally occur through abraded or damaged skin leading to a localised granuloma, usually on the hand or fingers. *Mycobacterium avium* can cause respiratory disease in humans. *Mycobacterium marinum,* a common pathogen of fish and reptiles (including crocodilians), has also been reported in humans (e.g. fisherman's finger, swimming pool granuloma).

Conclusions

Studies are required to determine the incidence of mycobacterial disease and infection in free living reptiles. Precautions should be made by wildlife veterinarians and wildlife carers for early detection of mycobacterial diseases in rehabilitated reptiles. There is very little known about the carrier state of reptiles both captive and free living.

Acknowledgments

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Wildlife Health Australia recognises the Traditional Custodians of Country throughout Australia. We respectfully acknowledge Aboriginal and Torres Strait Islander peoples' continuing connection to land, sea, wildlife and community. We pay our respects to them and their cultures, and to their Elders past and present.

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References and other information

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