

Poxviruses and Australian mammals

Fact sheet

Introductory statement

Poxviruses are a large group of viruses that may be highly host specific, or that may have a wide host range. In Australian mammals, poxviruses have been reported primarily in macropods, with cases also reported in possums, echidnas, bats and dolphins. In Australian mammals, infection rates appear to be low and disease is usually relatively mild. This fact sheet provides information on poxvirus in Australian native mammals. See also the WHA Fact Sheets “Poxvirus and Australian Wild Birds” and “Diseases of Concern in Wild Australian Crocodiles” which include information on poxviruses in these species.

Aetiology, natural hosts and world distribution

Pox in native Australian mammals is caused by viruses of the family *Poxviridae*, subfamily *Chordopoxvirinae*. Poxviruses are large, 200 to 400 nm long, brick shaped, double stranded enveloped DNA viruses. The core is dumbbell-shaped. There are seven genera of mammalian poxviruses. (Robinson and Kerr 2001).

Poxvirus in common ringtail possums (*Pseudocheirus peregrinus*), was caused by an *Orthopoxvirus* (Vogelnest et al. 2012). Novel, unclassified poxviruses have been sequenced from free-ranging eastern grey (*Macropus giganteus*; EKPV) and western grey kangaroos (*M. fuliginosus*; WKPV) (Bennett et al. 2017). Many poxviruses in Australian mammals have not been typed.

It is likely that all mammal species are susceptible to poxvirus infection. Poxviruses are found worldwide.

Occurrences in Australia

Australian native mammals reported with poxvirus infection include:

- **Macropods:** red kangaroo (*Macropus rufus*), eastern grey kangaroo, western grey kangaroo, common wallaroo (*M. robustus*), tammar wallaby (*M. eugenii*), agile wallaby (*M. agilis*), swamp wallaby (*Wallabia bicolor*), quokka (*Setonix brachyurus*), Tasmanian pademelon (*Thylogale billardierii*) (Bagnall and Wilson 1974; Presidente 1978; Arundel et al. 1979; McKenzie et al. 1979; Rothwell et al. 1984; Speare 1988; Speare and Thomas 1988; Reece and Hartley 1994; Vogelnest and Portas 2008; Ladds 2009; Bennett et al. 2017)

- **Possums:** common brushtail possum (*Trichosurus vulpecular*), common ringtail possum (Samuel 1989; Ladds 2009; Vogelnest et al. 2012)
- **Monotreme:** short-beaked echidna (*Tachyglossus aculeatus*), (Whittington 1988)
- **Bats:** southern bent wing bat (*Miniopterus schreibersii bassanii*) (McLelland et al. 2013), little red flying fox (O'Dea et al. 2016), grey-headed flying-fox
- **Cetaceans:** captive and free range Indo-pacific bottle-nosed dolphins (*Tursiops aduncus*) (Fury and Reif 2012) and common bottlenose dolphin (*T. truncatus*).

Epidemiology

Poxviruses are extremely resistant, being able to survive in the environment for months to years.

Infections usually occur in juveniles and subadults and may be associated with stress (Vogelnest 2019).

Transmission is likely via arthropod vectors or close contact. However, poxviruses are unable to penetrate intact skin and need to gain entry through wounds.

Macropod poxviruses are believed to be species-specific. Speare (1988) cites an example of a captive macropod colony where only the eastern grey kangaroos were affected. Newly introduced eastern grey kangaroos developed the disease, while other species did not.

Clinical signs

Lesions in macropods may be solitary or multiple and vary in size from a few millimetres up to 5 cm. While they can be found anywhere on the body lesions are most common on the extremities tail, face, limbs (Papadimitriou and Ashman 1972; Bagnall and Wilson 1974; Presidente 1978; Arundel et al. 1979; McKenzie et al. 1979; Rothwell et al. 1984). Grossly, lesions can appear as an umbilicated firm papule containing creamy exudates of keratinised debris and purulent material or, more commonly, an irregular wart-type mass with a hyperkeratotic surface that becomes darker and hairless as it enlarges. There is no associated pruritus and lesions regress spontaneously over about three months, leaving a pigmented or non-pigmented hairless scar (Bagnall and Wilson 1974; Speare and Thomas 1988; Reece and Hartley 1994; Ladds 2009).

In reports in possums, lesions were raised, erythematous and ulcerated. They occurred on the tail, feet and tongue, and regressed over two months (Ladds 2009; Vogelnest et al. 2012).

Affected echidnas developed a severe proliferative dermatitis (Whittington 1988).

Diagnosis

Diagnosis is often presumptive based on typical appearance of lesions, along with case history. Histopathology and electron microscopy of lesions can be used to confirm diagnosis (Ladds 2009).

Pathology

Histologically, the epidermis is markedly thickened due to hyperkeratosis and acanthosis. The more superficial cells are enlarged, often vacuolated and may contain intracytoplasmic eosinophilic inclusion bodies up to 45 µm in diameter in macropods and 10 to 20 µm in diameter in possums. Lesions may be secondarily infected by fungi and bacteria resulting in a variable leucocytic infiltrate. Electron microscopy can be used to demonstrate typical poxvirus particles, which are 175 to 200 x 250 to 300 nm in macropods and 250 nm long

in possums. No inclusion bodies were found in affected echidnas but electron microscopy demonstrated poxvirus particles (Bagnall and Wilson 1974; McKenzie et al. 1979; Whittington 1988; Ladds 2009; Vogelnest et al. 2012).

Differential diagnosis

Differential diagnoses include diseases that can cause proliferative lesions, such as neoplasia, abscesses or granulomas. Hairless scars need to be differentiated from diseases that cause focal alopecia, such as ringworm.

Laboratory diagnostic specimens and procedures

Lesions should be excised and submitted, half in formalin for histopathology and half fresh/frozen for viral culture and PCR.

Treatment

Treatment is usually not necessary as lesions resolve over several months. Surgical excision can be undertaken if lesions are located near the eyes or mouth; once removed they do not recur. Secondly infected masses can be treated with topical antimicrobials. Systemic antibiotics and supportive treatment may aid recovery (Vogelnest and Portas 2008).

Prevention and control

Control of the disease in wild populations is difficult and should focus on reducing arthropod vectors. Captive animals can be held in screened insect-proof enclosures. Any diseased animals should be isolated and held in separate screened enclosures to prevent the disease spreading. Feeders should be cleaned regularly with a disinfectant such as bleach.

Surveillance and management

Wildlife disease surveillance in Australia is coordinated by 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 (www.wildlifehealthaustralia.com.au). 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. See the WHA website for more information:

www.wildlifehealthaustralia.com.au/ProgramsProjects/eWHISWildlifeHealthInformationSystem.aspx#requests

The national wildlife health surveillance system logs cases of poxviruses in native wildlife in the national database. There are over 20 cases of poxvirus infection in the National Wildlife Health Surveillance Database. It is likely that poxvirus infection in native Australian wildlife is far more common than the figures in the National Wildlife Health Surveillance Database suggest, as the disease is considered “common” and is probably underreported. We encourage those with definitive diagnoses of poxvirus infections in Australian native wildlife to submit this information to the national system for consideration for inclusion in the national database (contact admin@wildlifehealthaustralia.com.au).

Research

Relatively little is known about the poxviruses that have been reported in Australia. Many have not been characterised and there is little information on species specificity or transmission. More information on these areas, including the factors contributing to disease spread and expression, would be helpful.

Human health implications

There are no known zoonotic risks from poxviruses found in Australian mammals.

Conclusions

While poxviruses are likely widespread through the Australian native mammals there are relatively few reports of disease in the literature. Poxviruses do not appear to pose a threat to established populations of free-ranging species. However, increasing global temperatures could potentially result in increased vector numbers and longer periods of vector activity possibly resulting in higher incidence and prevalence of poxvirus infections. Ongoing surveillance and awareness of the possible consequences will be necessary to prevent or mitigate any resulting deleterious effects.

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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.

Disclaimer

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