Poxviruses and Australian mammals

Fact Sheet

October 2019

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. [1].

Poxvirus in common ringtail possums (*Pseudocheirus peregrinus*), was caused by an *Orthopoxvirus* [2]. Novel, unclassified poxviruses have been sequenced from free-ranging eastern grey (*Macropus giganteus;* EKPV) and western grey kangaroos (*M. fuliginosus*; WKPV)[3]. 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)* [3-13]
- **Possums:** common brushtail possum *(Trichosurus vulpecular*), common ringtail possum [2, 13, 14]
- **Monotreme:** short-beaked echidna *(Tachyglossus aculeatus)* [15]
- **Bats:** southern bent wing bat *(Miniopterus schreibersii bassanii)* [16], little red flying fox [17], grey-headed flying-fox
- **Cetaceans**: captive and free range Indo-pacific bottle-nosed dolphins *(Tursiops aduncus)* [18] 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 [19].

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 [6] 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 [7, 9-12, 20]. 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 [4, 8, 11, 13].

In reports in possums, lesions were raised, erythematous and ulcerated. They occurred on the tail, feet and tongue, and regressed over two months [2, 13].

Affected echidnas developed a severe proliferative dermatitis [15].

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 [13].

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 [2, 10, 11, 13, 15].

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. Secondarily infected masses can be treated with topical antimicrobials. Systemic antibiotics and supportive treatment may aid recovery [5].

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 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.

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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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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