Bandicoot papillomatosis and carcinomatosis syndromes

Fact sheet

Aetiology

Bandicoot papillomatosis carcinomatosis viruses (BPCVs). (These are presently unclassified virus types and may actually represent the first members of a novel virus family. They demonstrate greatest genomic and morphologic similarity to papillomaviruses and polyomaviruses).

Natural hosts

- BPCV1 affects western barred bandicoots (*Perameles bougainville*)
- BPCV2 affects southern brown bandicoots (*Isoodon obesulus*)

World distribution

Known only from Western Australia (so far) ^2,5^.

Occurrences in Australia

- *P. bougainville* from Bernier Island, Dryandra Woodland and Kanyana Wildlife Rehabilitation Centre have been diagnosed with BPCV1 infection. *P. bougainville* from Dorre Island, Faure Island and the Arid Recovery Reserve at Roxby Downs have not yet been detected with papillomas or carcinomas ^3,4,5^.
- Only 1 case of BPCV2 infection in *I. obesulus* has been detected to date ^2^.

Epidemiology

The attack rate of the western barred bandicoot papillomatosis and carcinomatosis syndrome in captive populations was greatest in individuals >2 years ^3^. The mean age at first lesion detection was 3.17 years and the proportion of affected individuals increased with age from 2.6% (animals aged between 0.5-1 year old) to ~75% (animals aged >4.5 years) ^3^. The comparatively higher frequency of this syndrome in older animals may
reflect a long incubation period, or long period of latent viral infection \(^3\). The BPCVs appear to be species-specific and at present are thought to be transmitted between individuals through direct (and indirect) contact. Based on the knowledge of the two most similar virus families, *Papillomaviridae* and *Polyomaviridae*, the BPCVs are likely to resist desiccation and persist in the environment for extended periods of time.

**Clinical signs**

Affected individuals displayed single or multiple thickenings of the epidermis, muco-cutaneous junctions and/or mucosal surfaces \(^2,3,4\). The paws, distal limbs, eyelids and lips were most commonly affected \(^3,4\). Lesions caused difficulties for affected individuals in terms of their vision, locomotion and ability to eat and drink depending on the anatomic location of the lesions \(^3,4\). These lesions could also become abraded, ulcerated and secondarily infected, leading to sometimes fatal complications \(^3,4\).

**Diagnosis**

Diagnosis is achieved through observation of clinical signs consistent with those described above, combined with histopathology +/- *in situ* hybridization of biopsied lesions, PCR testing of superficial skin swabs, +/- demonstration of the virus DNA or virions in fresh (frozen) lesions \(^1,2,3,4\). Other differential diagnoses (such as fungal, parasitic and bacterial causes of epidermal/mucosal hyperplasia) should also be ruled out.

**Clinical pathology**

There are no specific haematologic, biochemical, or urine changes associated with bandicoot papillomatosis and carcinomatosis syndromes. Metastatic squamous cell carcinoma associated with BPCV1 infection has been associated with a marked hypercalcaemia in 1 case. This hypercalcaemia may have been a paraneoplastic syndrome.

**Pathology**

Smaller lesions were usually classified as papillomatous epithelial hyperplasia (warts), but larger lesions were most commonly classified as carcinomas *in situ* and squamous cell carcinomas \(^3,4\). Distant metastases of squamous cell carcinomas have been observed in lymph nodes, lungs and the liver \(^4\). *In situ* hybridization tests were able to demonstrate BPCV nucleic acids within affected epidermis, mucous membranes and mucocutaneous junctions \(^1,2\).

**Laboratory diagnostic specimens**

Superficial skin swabs: sterile saline moistened cotton-tip swab rubbed firmly over the papillomatous lesion and immersed in 1 mL sterile saline in an Eppendorf tube will enable PCR-based detection of BPCVs.

Formalin-fixed papilloma biopsies: tissue samples collected into 10% neutral buffered formalin can be processed for histopathology and *in situ* hybridization.

Fresh/frozen biopsies: tissue collected into RNAlater®, frozen or refrigerated can be processed to extract total DNA. Molecular biology techniques (e.g. PCR) can then be used to detect BPCV DNA.

Novel BPCVs: If a novel BPCV isolate is suspected (e.g. collected from a host species other than *P. bougainville* or *I. obesulus*), all 3 diagnostic specimens described above should be collected. Please contact Mark Bennett...
Treatment

An experimental topical antiviral therapy is currently in progress. Surgical resection of papillomas leads to prompt local recurrence (K. Warren, pers. comm., 2005).

Prevention and control

The debilitating effects of BPCV infection can be prevented in captive breeding programs if only animals that are known to be BPCV-free are included. Prevention and control in the wild is unlikely to be feasible.

Surveillance and management

Surveillance is currently being conducted on an ad hoc basis. Please contact Mark Bennett (m.bennett@murdoch.edu.au; 08 9360 2479) if you have found a case of papillomatosis and/or carcinomatosis in an Australian native animal (especially bandicoots) for advice.

Statistics

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. 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.

Research

1. Safe and effective treatment for warts (currently in progress).
2. Surveillance of wart-like lesions in other Australian native animals.
3. Genomic characterisation of other “papillomaviruses” from Australian native animals.
4. Safe and effective prophylactic vaccine.

Human health implications

There are no known human health implications.

Conclusions

The BPCVs are associated with papillomas and carcinomas in *Perameles bougainville* and *Isoodon obesulus* in Western Australia. However, monitoring of other bandicoot species in other geographic locations is likely to reveal a much wider host and geographic distribution. Furthermore, BPCV-like viruses may not be limited to peramelid hosts: other marsupials, birds, reptiles, amphibians and eutherians from Australia and New Guinea with papillomas and carcinomas should be tested for BPCV infections.
References and other information


Acknowledgments

This fact sheet was produced by Mark Bennett BVSc(Hons), Resident, Veterinary Clinical Pathology, Murdoch University m.bennett@murdoch.edu.au (08) 9360 2479. Mark is very interested in any reports of warts in any Australian animals - reptiles, amphibians, birds, marsupials – and would be keen to get as many samples as possible for molecular testing. There are instructions given in the fact sheet regarding the collection of samples for further diagnostic work.

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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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