Australian marine mammals and *Brucella*

Fact sheet

March 2020

Introductory statement

Novel members of the genus *Brucella* have recently emerged as pathogens of various marine mammal species and as potential zoonoses. *Brucella* infections of terrestrial animals are a well-recognised cause of abortion and infertility and, consequently, of high economic concern to the domestic livestock industry. It is important, therefore, to define the likelihood of transmission and disease-causing potential of marine mammal *Brucella* species for humans and livestock, as well as for wildlife. This will enable public health agencies to define 'at risk' groups in the community and formulate risk management strategies aimed at preventing pathogen transfer. In addition, knowledge of the epidemiology of marine mammal brucellosis will be of interest to livestock industries, particularly those involved in export of beef products.

Aetiology

Marine strains of *Brucella* are genetically and biochemically distinct from other species in this genus and isolates from cetaceans and seals (pinnipeds) have been proposed as two new species, respectively, *B. ceti* and *B. pinnipedialis* [1, 2].

Natural hosts

Microbiological and serological evidence suggest that cetacean species are the natural hosts of *B. ceti* and pinniped species the natural hosts for *B. pinnipedialis*. While pathological syndromes associated with *B. ceti* infection are apparent in some cetacean species [3-6], *B. pinnipedialis* infections in pinnipeds are not associated with a clear pattern of pathology. Most members of the genus *Brucella* can infect mammalian species other than their natural host. While disease resulting from infection with marine *Brucella* has occurred in humans, there are no reports of natural spill-over infections occurring from marine to terrestrial mammals. Experimental infections of sheep and cattle with marine *Brucella* showed that while these strains have the potential to induce abortion, their ability to infect and cause disease was low [7, 8]. There are no reports of *Brucella* investigations in *Sirenians*.

World distribution

Marine *Brucella* species have been isolated from numerous Northern Hemisphere marine mammals [9, 10]. Outside Australia, there is serological evidence of exposure to *Brucella* in Southern Hemisphere cetaceans and pinnipeds [11-13], with detection of *Brucella* sp. only from a small number

of cetaceans. Isolates from humans with severe brucellosis, who were resident in South America and New Zealand, were characterized as marine mammal types [2, 14, 15].

Occurrences in Australia

There have been very few demonstrated cases of brucellosis in marine mammals from Australian waters. There is a report of brucellosis in a late-term foetus of an Indo-Pacific bottle-nosed dolphin (*Tursiops aduncus*) aborted in Australia. *Brucella ceti* was cultured from spleen, kidney and liver. Histopathology showed mild placentitis and encephalitis [16]. There is molecular (PCR) evidence of *Brucella* infection from one wild short-beaked common dolphin (*Delphinus delphis*) from Port Campbell, western Victoria. The animal presented dead from trauma but incidental post-mortem findings included moderate, chronic necro-suppurative pneumonia with intralesional nematode parasites (most likely *Halocercus* spp.). There was a positive PCR result for *Brucella* sp. from lung tissue. The species of *Brucella* was not able to be identified by sequencing, however is thought most likely to be *B. ceti* [17]. There is serological evidence of exposure in a number of Australian marine mammal species (see World Distribution, above, and Epidemiology below).

Epidemiology

The epidemiological parameters for *Brucella* infections in marine mammals are largely unknown, particularly for cetacean species. The relationship between antibody prevalence and the incidence of active infection and disease is not established and likely to vary between species. Australian fur seals were found to have high (>50%) antibody prevalence to *Brucella* but no microbiological or molecular evidence of infection was found in post-mortem specimens [18]. New Zealand fur seals from Kangaroo Island, SA were found to have a low (<10%) *Brucella* antibody prevalence and have not been investigated further for infection (Lynch, unpublished data). In cetacean species, however, it may be that positive antibody status is indicative of a high probability of active infection and disease [6]. The routes of transmission of marine *Brucella* have not been definitively established. Isolation of *Brucella* from the reproductive tract of cetaceans suggests that, as in terrestrial mammals, infection may be transmitted by the venereal route [19]. Parasitic carriage has also been suggested as a means of infection as *Brucella* has been isolated from lungworms from both cetaceans and pinnipeds [20, 21]. Ingestion of infected prey items may be significant [22]. Direct transmission by bites from fighting is likely as *Brucella* has been isolated from subcutaneous abscesses of marine mammals [23]. In addition, pinnipeds congregating on land would provide a situation where respiratory transmission may occur.

Clinical signs

Marine mammals carrying *Brucella* may not show any clinical signs. Stranded odontocytes and those displaying abnormal swimming patterns indicative of neurological illness have been found to be suffering from meningoencephalitis caused by *B. ceti* infection [4]. Marine mammals with active *Brucella* infection may present in poor body condition and in pinnipeds, respiratory signs can predominate due to *Brucella*-associated bronchopneumonia [24]. *Brucella* infection may be associated with stillbirth and abortion [16]

Diagnosis

Exposure to *Brucella* is indicated by the presence of antibodies using serological tests developed in cattle [25]. Definitive diagnosis of *Brucella* infection is by isolation of the organism from tissues using specific culture techniques. Isolation of the organism can be difficult in marine mammals [26]. In addition fresh or frozen tissue samples may be examined for evidence of infection by *Brucella*-specific PCR [18]. Immunohistochemistry has also been used in *Brucella* investigations in marine mammals [6]

Pathology

Brucella infection in cetaceans can cause meningoencephalitis characterised by perivascular, mononuclear infiltration of the white and grey matter of the cerebrum, cerebellum and brainstem [4]. Some cetaceans with disseminated infections may also display fibrinopurulent osteoarthritis [19], nonsuppurative interstitial pneumonia and endocarditis [6]. Reproductive tract lesions in cetaceans include placentitis characterised by necrosis and mixed inflammatory infiltrates [27], orchitis, and epididymitis [19, 23]. In seals, *Brucella* has been most commonly associated with bronchopneumonia [24] although it has been suggested as a cause of abortion [28]. In both cetaceans and pinnipeds, *Brucella* has been isolated from subcutaneous abscesses [23]. The case in the aborted dolphin foetus in Australia showed placentitis and encephalitis . The incidental finding in the dead dolphin in Victoria was associated with pneumonia, which may have been a result of parasitic infection.

Differential diagnoses

Encephalitis in cetaceans may be caused by numerous pathogens including morbilliviruses and *Toxoplasma gondii* [29, 30]. However, the histological lesions produced by *Brucella* infection are distinct and isolation of the organism provides a definitive diagnosis. Bronchopneumonia in pinnipeds often results from lungworm infection particularly in the juvenile age class. Infectious causes of abortion in pinnipeds include influenza viruses, leptospirosis and mycoplasmas [31-33].

Laboratory diagnostic specimens & procedures

Marine mammals suspected of brucellosis should have the following samples collected:

- Serum (frozen): Serological testing
- Cerebrospinal fluid: Brucella-specific culture
- Fresh tissues, brain, lung, lymph node, placenta, abscess material: Brucella-specific culture
- Impression smears: Cytology & possible immunohistochemistry
- Tissues in formalin: Histological examination
- Frozen tissues: Molecular diagnostics

Tissues should include brain, lung, mediastinal lymph node, placenta, mesenteric lymph node, heart and spleen.

Treatment

Given the lack of knowledge concerning brucellosis in marine mammals in Australasia, animals suspected of severe or disseminated brucellosis should be euthanatized and thoroughly investigated. It may be reasonable to treat Individuals presenting with subcutaneous abscessation from which *Brucella* is isolated. In these cases, drainage and flushing of the abscess site would be the foundation of treatment.

Prevention and control

Exposure to infected animals poses a risk to humans. Prevention of human infection is by identification of at risk groups and adoption of appropriate personal protection measures (see below). Cattle are unlikely to become infected with *Brucella* from marine mammal sources. Marine mammal *Brucella* has been shown to be of low infectivity for cattle and sheep [7, 8] and opportunities for interaction between cattle and potentially infected marine mammals are limited. *Brucella* may be considered as a biosecurity issue when introducing new animals to captive marine mammal collections. However, the lack of knowledge of the relationship between antibody status and active infection presents difficulty in using serological testing as a determining quarantine procedure. *Brucella* species are sensitive to most antiseptics and washing of hands with chlorhexidine gluconate and chemical sterilisation of equipment should be practiced as a minimum standard after handling free-ranging marine mammals.

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.

There are very few reports of clinical brucellosis in marine mammals in Australia in the national 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. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

Research

Work is needed to establish how widely brucellosis present in Australian cetaceans as most *Brucella*-related pathology in marine mammals has been reported from cetacean species. Diagnosis of brucellosis requires specific culture and molecular techniques. Post-mortem investigations of stranded cetaceans in Australasia should include sampling and testing for brucellosis.

There is an ongoing need to collect serological data from Australian marine mammals regarding exposure to Brucella. Serological data would provide information as to species, age, spatial and temporal differences in exposure to *Brucella* and help elicit the epidemiology of this potential pathogen.

Human health implications

Serological data suggests that marine *Brucella* species have a world-wide distribution and two cases of severe human brucellosis are known from the southern hemisphere [14, 15]. Groups at most risk of acquiring *Brucella* infection from marine mammals are those that have close contact with infected animals. Such groups include staff working in facilities holding captive marine mammals particularly those that accept wild individuals for treatment and rehabilitation. Other groups potentially at risk are research scientists, wildlife officers and members of the public and wildlife carer groups who assist at marine mammal strandings. Appropriate personal protection (gloves, protective clothing and mask) should be employed when conducting post mortem examinations on pinnipeds.

Conclusions

Marine strains of *Brucella* are recognised to have a wide-spread distribution and are important pathogens of some cetacean species in addition to being potential zoonoses. Knowledge of the exposure status of Australian marine mammals to these *Brucell*a strains is incomplete. It is known that some pinniped populations have been exposed to an unidentified strain of *Brucella* and rare cases of infection are reported in cetaceans from Australian waters. The prevalence of active infection in all Australian marine mammal species is unknown. Experimental studies and epidemiological information suggest that spill over of marine brucellosis to cattle is unlikely. Marine *Brucella* strains are capable of infecting humans so appropriate protective measures should be adopted by those at risk of infection.

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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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