Cetacean morbilliviruses in Australian whales and dolphins

Fact sheet

Introductory statement

Morbillivirus is a pathogen of great significance to cetaceans (dolphins, porpoises and whales) around the world. In 2011, an offshore bottlenose dolphin (*Tursiops truncatus*) found stranded on the Queensland coastline died as a result of morbillivirus infection. This was an important discovery, as it was the first recorded case of morbillivirus-associated death of a cetacean in the southern hemisphere (Stone et al. 2011). Since 2011, more dolphin deaths have been attributed to morbillivirus, including as recently as early 2013 in South Australia (Stone et al. 2012; Gago 2013). Studies conducted in the wake of these findings indicate that morbilliviruses have been present in Australian cetaceans, without causing significant mortality events, since at least 1985 (Stone et al. 2012). Morbillivirus should be included as a differential diagnosis for diseased cetaceans in Australia, especially if found stranded (live or dead) and/or if they display neurological signs (Stone et al. 2011 and 2012).

Aetiology

Cetacean morbillivirus (CMV) refers to a group of three single-stranded RNA morbillivirus strains originating from the same virus species (the CMV complex) (Kennedy 1998; Stone et al. 2011). The CMV complex includes dolphin morbillivirus, porpoise morbillivirus and pilot whale morbillivirus (Stone et al. 2011; Van Bressem et al. 2009). CMV is a member of the genus *Morbillivirus*, in the family *Paramyxoviridae*, which also includes canine and phocine distemper and measles virus (Stone et al. 2011). CMV is, however, more closely related to rinderpest and peste des petits than to these viruses (Stone et al. 2011; Kennedy 1998).

Natural hosts

Due to the nature of CMV as a ‘catch-all’ classification for three similar morbilliviruses affecting cetaceans, it has a very wide host range. Serological studies have identified morbillivirus infection in many cetacean species around the world, including common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*), fin whales (*Balaenoptera physalus*) and false killer whales (*Pseudorca crassidens*), to name just a
few (see Kennedy 1998). Limited studies have been conducted regarding the host range of CMV in the Australian region. However, recent work indicates that in Australian waters, the potential host range should include (but is not necessarily limited to):

- offshore bottlenose dolphin (Tursiops truncatus)
- inshore bottlenose dolphin (Tursiops aduncus)
- melon-headed whales (Peponocephala electra)
- pilot whales (Globicephala melos)
- Fraser’s dolphins (Lagenodelphis hosei) (Stone et al. 2012).

Stone et al. (2012) did not identify any age or sex predilection for CMV in their Australian study.

**World distribution**

CMV has a worldwide distribution (Stone et al. 2011). It is endemic in several cetacean species, including pilot whales and Fraser’s dolphins (Stone et al. 2012; Stone et al. 2011; Van Bressem et al. 2001). Around the world, CMV has been responsible for at least 8 mass strandings (Stone et al. 2011), including bottlenose dolphins in the north-western Atlantic (1987-88 and 1993-94), harbour porpoises in Ireland and The Netherlands (1988-1990) and striped dolphins in the Mediterranean Sea (1990-92) (Van Bressem et al. 2001).

**Occurrences in Australia**

The first record for seropositive evidence of CMV in Australia is from a standing event involving an offshore bottlenose dolphin at Marion Bay in Tasmania in 1997 (Van Bressem et al 2001). Since then evidence of exposure has been found in a variety of cetacean species from WA, SA, NSW and QLD (see “Statistics”). The majority of positive test results are from individual stranded animals. CMV has, however, been associated with mass mortality events in Australia in WA (inshore bottlenose dolphin, Swan River, 2009, n = 2) (River Guardians 2011) and SA (inshore and offshore bottlenose dolphins, various location, 2013, n = 6) (Government of South Australia 2013). Retrospective studies conducted after the death of an offshore bottlenose dolphin in 2011 concluded that CMV has probably been present in Australian cetaceans since at least 1985 (Stone et al. 2012).

CMV is not an OIE notifiable disease (OIE 2013).

**Epidemiology**

Morbilliviruses are highly transmissible, especially in naïve populations, or those with low immunity (Stone et al. 2012; Van Bressem et al. 2009; Kennedy 1998). Species in which CMV is endemic, such as pilot whales, are thought to act as reservoirs of infection for other species (Stone et al. 2011; Van Bressem et al. 2001). A high seroprevalence within melon-headed whales suggests that CMV may be endemic within this population in Australian waters (Stone et al. 2012). Transmission is thought to occur via aerosol during close contact.

---

1 The Swan river dolphin Technical Report (WA) contains a useful summary on morbilliviruses in cetaceans – Part 2 p37 (and mention that this was considered in the Swan River investigation) and p47 presents summary information on these viruses: [visit website](http://www.swanrivertrust.wa.gov.au/the-river-system/tackling-the-issues/understanding-dolphins-health-and-ecology) to download Part 2 – link on the right hand side.
(Stone et al. 2011). Efficient horizontal transmission is achieved between cetaceans due to their social nature and ‘synchronous breathing and explosive respiration’ (Stone et al. 2011).

Infection with CMV is believed to induce long-lasting immunity and no carrier state in cetaceans (Duignan 2011; Stone et al. 2012). Morbilliviruses are unable to survive outside their hosts in the environment (Duignan 2011).

Clinical signs

Common clinical signs include:

- neurological signs;
- behavioural signs;
- respiratory compromise;
- poor body condition;
- skin lesions, and;

Signs reported in the literature (but not common):

- tachycardia;
- abnormal respiratory rate;
- muscle fasciculations, and;
- poor vocalisation (Kennedy 1998).

Diagnosis

Diagnosis is often made by serology (serum neutralisation test - SNT), with titres greater than or equal to 8 considered positive (Stone et al. 2011). SNT is considered a highly sensitive and specific test in marine mammals (Stone et al. 2011). However, definitive diagnosis requires:

- virus isolation;
- detection of viral antigens using immunohistological staining (IHC), or;
- detection of viral DNA (Stone et al. 2011).

The presence of ‘’Warthin-Finkeldey’ type syncytia is considered pathognomic for cetacean CMV infection (Stone et al. 2011)

Clinical pathology

Leucopaenia, characterised by severe lymphopaenia (Kennedy 1998; Stone et al. 2011.;

Haemoconcentration (Kennedy 1998).

Pathology

Gross lesions that may be observed on post mortem examination of animals clinically affected by CMV include:

- failure of lungs to collapse on post mortem;
areas of atelectasis;
enlarged/oedematous bronchial lymph nodes;
ulceration of the skin and buccal mucosa;
oedema of internal organs, and;
serosanguinous fluid in pleural and peritoneal cavities (Kennedy 1998).

Histopathological changes include:

- non-suppurative bronchointerstitial pneumonia (Kennedy 1998; Stone et al. 2012)
- fibroplasia of alveolar septa (Kennedy 1998)
- non-suppurative encephalitis, malacia, astrocytosis and perivascular cuffing (Duignan 2011; Stone et al. 2012)
- viral inclusions and multinucleated syncytia (Stone et al. 2012). The presence of “Warthin-Finkeldey” type syncytia is considered pathognomonic for cetacean CMV infection (Stone et al. 2011)
- lymphoid depletion and lymphcytolyis (Kennedy 1998).

As CMV causes immunosuppression, infection with CMV may also lead to gross and histological changes associated with co-infection of other pathogens or parasites (Kennedy 1998). These are often super-infections (Duignan 2011).

Differential diagnoses

As described in AWHN Fact Sheet ‘Australian Seals and morbilliviruses’² and:

- Toxoplasmosis
- Leptospirosis
- Brucellosis

Laboratory diagnostic specimens

As described in WHA Fact Sheet ‘Australian Seals and morbilliviruses’³ and:

- Fresh and fixed tissues (especially brain and lung) should be submitted (Stone et al. 2012).

Laboratory procedures

- Histology
- Electron microscopy (EM)
- Serology (e.g. SNT)
- Detection of viral antigen via immunohistochemistry
- RT-PCR to detect viral RNA (Saliki et al. 2002).

EM, CMV immunohistochemistry and PCR are all available at CSIRO AAHL. To our knowledge, serology is not available in Australia.⁴

---

⁴
Treatment

There is no effective treatment for CMV (Stone et al. 2011).

Prevention and control

Strict quarantine of affected cetaceans must be implemented where rehabilitation is attempted (eg. in marine parks and zoos) (Stone et al. 2011).

As an aid to prevention and control, Stone et al. (2011) suggest that further investigation into the efficacy of vaccination programs in captive populations should be carried out in the future.

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. 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.

There are currently no formal programs directed towards morbilliviruses surveillance in Australian cetaceans.

There is no AUSVETPLAN for CMV. However, any cases of CMV in cetaceans would fit within the general surveillance category of ‘Interesting or unusual cases’ and should therefore be captured by WHA wildlife coordinators as part of Australia’s general wildlife surveillance system (www.wildlifehealthaustralia.com.au).

Statistics

There are currently 15 events involving cetaceans in which detection of morbillivirus is reported in the National Wildlife Health Information System database. Events have been reported from TAS, WA, SA, QLD and NSW. Species affected include melon-headed and Bryde’s whales (Balaenoptera edeni) and offshore and Indian Ocean (inshore) bottlenose and Fraser’s dolphins. Diagnoses were by positive serology, EM/IHC and/or histology.

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

Further research is required on the following areas:

4 Samples for serology for VNT from Australian cetaceans have been sent to Athen’s Veterinary Diagnostic Laboratory, University of Georgia (Stone pers comm.). There are a number of requirements in Australia for sending samples overseas for wildlife diagnostic work. It is important to check with your local government diagnostic laboratory before sending samples overseas. The jurisdiction’s CVO must also be informed and included in discussions prior to submission. See SCAHLS Website for the “Policy for the transfer of biological specimens to overseas laboratories”
• the ‘epidemiology, geographical distribution and serological prevalence of CMV infection’ in the Australian region (Stone et al. 2011)
• the epidemiological role played by CMV endemic populations to investigate their role as reservoirs of infection (Stone et al. 2011)
• the extent to which Australian captive populations been exposed to CMV, so that the potential for CMV to cause clinical disease in these population if introduced can be ascertained
• the efficacy of vaccination programs in captive populations.

Human health implications

Advice regarding human health implications of CMV should be sought from your local public health department. There have been no reported cases of CMV in humans (Van Bressem et al. 2009). CMV is not considered zoonotic (Van Bressem et al. 2009). It is considered unlikely that terrestrial species, such as carnivores and ruminants, could be infected by CMV under natural conditions (Stone et al. 2011). However, these species were found to be susceptible under experimental conditions (Visser et al. 1993).

Conclusions

CMV has been the cause of several major mortality events in the northern hemisphere. Many of the species affected by these mortality events are also present in Australian waters. Little is known about the occurrence of CMV in Australian cetaceans. More research is needed in relation to the epidemiology of CMV in Australia, so that an understanding can be gained of the factors relevant to its occurrence, impact and potential spread in Australian waters.

Attempts to treat and rehabilitate stranded, ill and injured cetaceans are commonly made in Australian wildlife parks and hospitals that also house captive cetacean populations. It is important to ensure that proper quarantine of wild cetaceans entering these facilities is in place. CMV needs to be ruled out in all cases of strandings in Australian cetaceans.

References and other information


River Guardians (2011) Trust confirms reduced immune function in 2009 dolphin deaths  


**Acknowledgements**

We are grateful to the many people who had input into this fact sheet. Kate Drew produced the first draft, which was reviewed by David Blyde and Brett Stone. Without their ongoing support production of these fact sheets would not be possible.

Updated: 12 September 2013

**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**

This fact sheet is managed by Wildlife Health Australia for information purposes only. Information contained in it is drawn from a variety of sources external to Wildlife Health Australia. Although reasonable care was taken in its preparation, Wildlife Health Australia does not guarantee or warrant the accuracy, reliability, completeness, or currency of the information or its usefulness in achieving any purpose. It should not be relied on in place of professional veterinary consultation. It should not be relied on in place of professional veterinary consultation. To the fullest extent permitted by law, Wildlife Health Australia will not be liable for any loss, damage, cost or expense incurred in or arising by reason of any person relying on information in this fact sheet. Persons should accordingly make and rely on their own assessments and enquiries to verify the accuracy of the information provided.