A REVIEW
MARIN MAMMALS TUBERCULOSIS CAUSED BY MYCOBACTERIUM PINNIPEDII

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Abstract
Tuberculosis in marine mammals caused by M. pinnipedii which has been reported in species of fur seals and sea lions in different countries as well as in terrestrial animals and human. In marine mammals, M. pinnipedii causes granulomatous lesions in internal organs and may be presence of acid-fast organisms in the granulomatous lesions. Disease transmission mainly by aerosols, direct contact or indirect. the disease transmitted from marine animals to human so, is a public health concern and precautions should be taken when dealing with these animals.

Keywords: Tuberculosis; M. pinnipedii; marine mammals; fur seal; sea lion

Introduction
Mammals that live in marine including two main mammal group, cetaceans group consisting of two suborders: baleen whales (Mysticeti) suborder and toothed whales (Odontoceti) suborder which contains dolphins and porpoises; pinnipeds includes true seals, eared sea lions and polar bear (Ursus maritimus) and several species of otters (Born et al., 1997; Stirling, 2009). Ocean health depends on the presence of marine mammals in the littorals and seas; Cetaceans have great environmental and commercial importance, and consider as essential source of protein and fat for human; in addition are regarded as an important tourist attraction (Endo et al., 2005; Antonioli and Reveley, 2005; Llret and Riera, 2008).

Marine mammals can be infected with many bacterial zoonotic pathogenic microorganisms such as Brucella, Leptospira, Erysipelothrix and Mycobacteria (Hunt et al., 2008; Colegrove et al., 2005; Nymo et al., 2011; Kriz et al., 2011). Tuberculosis is a disease caused by microorganism belonging to the Mycobacterium tuberculosis complex (MTBC) group which characterized by the development of tuberculous granulomas lesions in the body. It is described as the first time in pinnipeds in1913 (Blair et al., 1913). Tuberculosis was described in New Zealand fur seals (Arctocephalus forsteri), an Australian fur seal (Arctocephalus pusillus doriferus), initially, the causative agent attributed to MTBC group (Cousins, 1993; Woods et al., 1995). Another researcher and between 1989–2000, MTBC were described in captive southern sea lions, wild South American fur seals and a wild Subantarctic fur seal (Otaria flavescens, Arctocephalus australis, Arctocephalus tropicalis) respectively (Bernardelli et al., 1996; Castro Ramos et al., 1998; Bastida et al., 1999).

Many studies discovered that these isolates shared biochemical and phenotypically characteristics, but differed in their genotypic features with M. bovis and thereafter were named as “seal bacillus”. After that, causative bacteria found different from other members of the MTBC and it is a separate species, so the name “M. pinnipedii” was suggested (Cousins, 1990; Cousins et al., 1993; Bernardelli et al., 1996; Bastida et al., 1999; Cousins et al., 2003).

Description of M. pinnipedii
M. pinnipedii it is a slowly growing microorganism, acid-fast bacilli, non sporulated, non motile. Growth occurs within 6 weeks of incubation on Mycobacterium media at 36–37°C, and the growth enhanced by sodium pyruvate. Colonies are non-photchromogenic, flat, dysgonic and rough. Microscopic features, M. pinnipedii are red bacilli and have a cords of mycobacterial cells. M. pinnipedii susceptible to rifampicin, pyrazinamide, paraminosalicyclic acid, streptomycin, isoniazid, ethambutol which are used as antituberculosis (Cousins et al., 2003; Kriz et al., 2011).

Epidemolgy of marine tuberculosis in marine animals
The incidence of marine tuberculosis caused has increased since the causative agent was discovered. An outbreak occurred in 13/28 (46.4%) in zoo sea lions in the Netherlands using the tuberculin skin test (TST) and necropsied (Kiers et al., 2008). Also in 2008, tuberculosis infections reported in sea lion (Otaria byronia) in South American (Mores et al., 2008). In France, M. pinnipedii was discovered in a Patagonian Sea Lion (Otaria flavescens) by molecular characterization (Lacave et al., 2009). In the Czech Republic, the first case of tuberculosis detected in a kept Southern sea lion (Otaria flavescens) in a zoo (Kriz et al., 2011). marine tuberculosis infections a wild sea lion (Otaria flavescens) in southern Brazil and in South American sea lion were reported by (Derek et al., 2014; Martins et al., 2019). The first case of tuberculosis in South Australia, M.
pinnipedii infection recorded in a fur seal (Arctocephalus pusillus doriferus) (Wayen et al., 2014).

Symptoms of tuberculosis in marine

Clinical signs in pinnipeds affected with tuberculosis, predominantly nonspecific that include: lethargy, anorexia, weight loss and pulmonary signs. Classic chronic coughing is not a differentiate signs of active disease in affected marine mammals as in human tuberculosis (Forshaw and Phelps, 1991; Kiers et al., 2008). Emaciation and severe dyspnea and died within hours were reported in sea lion (Martins et al., 2019).

Pathology and histology characterizations

On necropsy, typically granulomas or nodular granulomatous lesions vary in sizes were found in the internal organs of body and enlarged mesenteric lymph nodes (Kiers et al., 2008; Lacave et al., 2009; Kriz et al., 2011). Multifocal or coalescing region caseous necrosis, milky lesions in pulmonary parenchyma, mucoid and purulent exudate full the airways, turbid greyish or blood tinged diffusion consist of clots of fibrin was observed in pleural (Derek et al., 2014 Roe et al., 2019; Martins et al., 2019).

Histologically, lesions associated with M. pinnipedii involve granulomas, another study revealed diffuse neoplastic proliferation or diffuse tumoral proliferation in the ovaries (Kiers et al., 2008; Lacave et al., 2009). Severe pyogranulomatous pleuropneumonia and intra histocytic acid-fast beaded filamentous bacilli was seen. In a study, tuberculous infected pinnipeds shown multifocal or coalescing granulomas in lung, pericardium and the mediastinum. Some of these granulomas were characterized by a combination of epithelioid macrophages, plasma cells, few numbers of lymphocytes and plump fibroblasts, other were present of zones of necrosis in the centre of granulomas and enclosed by macrophages, lymphocytes, plasma cells, and various amounts of fibrous tissue within or surrounding the granulomatous inflammation (Wayen et al., 2014; Roe et al., 2019).

Marine tuberculosis in other animals

Marine tuberculosis has been detected in different terrestrial animal species, in a zoo in Great Britain marine tuberculosis described in lama lowland gorillas (Gorilla and Brazilian tapir due to contact with infected South American fur seals (Cousins et al., 2003; Cousins, 2006). Marine tuberculosis infections were investigated in Camelus, crested porcupine and malayan tapirs transmitted from infected Sea Lion (Mores et al., 2008; Urzcynski et al., 2011). Seven cases of marine tuberculosis infection were recorded in beef cattle which was attributed to sharing the beach grazing area with seals and also due to the direct contact of the waterways with the ocean. At necropsy, infected cattle developed caseous necrotic lesions in a lymph node, other lesions are the same those reported in M. bovis infections. Histologically, developed granulomatous lesions with center of mineralization and caseation, the necrotic tissue was surrounded by lymphoid, epithelioid, and langhans giant cells (Loeffler et al., 2014).

Marin tuberculosis in human

Marin tuberculosis caused by M. pinnipedii has an important role on public health as a potential zoonotic pathogen, few cases were recorded in humans. The first time of M. pinnipedii infection in human was transmitted from sea lion (Thompson et al., 1993). M. pinnipedii infection has been reported in people (Bastida et al., 1999). And also, marine tuberculosis has been recorded in nine out of twenty five sea lion keepers were in close contact with these infected animals (Kiers et al., 2008). Studies have not indicated signs in humans, Australian seal trainer case due to close contact with infected seals developed pulmonary tuberculosis signs (M. tuberculosis complex), the signs involved, chronic productive cough, fatigue, night sweats and weight loss (Thompson et al., 1993). other cases were diagnosed by TST and interferon-gamma release assay (Kiers et al., 2008)

Transmission

Aerosols is the main route of infection. In human, persons, especially, zokeepers and trainers transmission occurs through direct contact with infected animals or during the cleaning of these animals, indirectly through contamination of the environment or materials with M. pinnipedii. Marine animals infected by direct contact with diseased marine animals or by contaminated materials and environment. Other animals may infect directly when contact with diseased sea animals or with contaminated water when When grazing near the beach or ocean (Thompson et al., 1993; Kiers et al., 2008; Moser et al., 2008; Loeffler et al., 2014).

Diagnosis

Diagnosis in animals depends on clinical signs, isolating and identified by M. pinnipedii, pathological and historgical features, and by skin test using tuberculin (TST) which is purified protein derivative (PPD) (Kiers et al., 2008; Lacave et al., 2009; Kiers et al., 2011; Roe et al., 2019). Molecular characterization (PCR-RFLP gyrB) (Lacave et al., 2009). In human, diagnosed by clinical signs, TST, interferon-gamma release assay (IGRA) (Kiers et al., 2008). Detected the infection using ELISA and the serological rapid test was developed (Moser et al., 2008).

References


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