

Anthrax in Australian wildlife

Fact sheet

Introduction

In Australia, anthrax is primarily considered a disease of livestock. There is no evidence of anthrax infection of wild or free-ranging animals in Australia. However, given its host range, anthrax should be considered when investigating mortalities in wildlife when there are signs consistent with anthrax.

Aetiology

Anthrax is caused by *Bacillus anthracis*, a large, gram-positive, rod-shaped bacterium that can form infectious and resistant spores and produces a toxic complex (Animal Health Australia 2012). The disease is characterised by rapidly fatal septicaemia.

Natural hosts

Anthrax affects many species of domestic and wild animals, humans and some species of birds. Ruminants are considered most susceptible. In pigs, there is a subacute and chronic form, with some pigs recovering to remain carriers. Other species such as dogs, cats, horses, other ungulates and wildlife may also be affected, although less commonly. Carnivores may recover and remain chronic carriers (Animal Health Australia 2012).

World distribution

Anthrax occurs in most countries worldwide and is common in tropical Africa, the Middle East, and neighbouring countries of the former Soviet Union, parts of Central and South America and parts of Asia. When uncontrolled, anthrax can cause serious epidemics with high fatalities in humans and animal deaths (Animal Health Australia 2012; OIE 2012).

Occurrences in Australia

There is no evidence of anthrax infection of wild or free-ranging animals in Australia and anthrax is occasionally investigated and ruled out in unexplained mortalities in macropods (Animal Health Australia

2015). There are no records of anthrax in wildlife in over 4000 mammalian records in the Wildlife Health Australia national wildlife information system www.wildlifehealthaustralia.com.au (Wildlife Health Australia 2015). There is a single brief report from an Indian zoo of two kangaroos of undetermined species succumbing to the disease. Diagnosis was based on blood smears (Sen Gupta 1974). Dingoes (*Canis lupus dingo*) in zoos in the Czech Republic and Italy were unaffected during anthrax outbreaks, caused by consuming contaminated meat, which caused deaths in multiple other carnivore species (Konrad 1967; Hugh-Jones and de Vos 2002).

Anthrax occurs sporadically in Australia in livestock, most frequently in an area known as the “Anthrax belt” which extends from northern to southern New South Wales: from Bourke and Moree to Deniliquin and Albury (Robinson and Moloney 2008) and in areas in neighbouring Victoria (Durrheim et al. 2009). The suggested “Anthrax belt” was redefined by Barro et al. (2016), to include a wider geographic region of eastern Australia, and suggested inclusion of areas in south-west Western Australian and South Australia, although traditionally other states and territories are considered free of anthrax (Animal Health Australia 2012). Recent outbreaks have occurred in the Goulburn Valley in Vic; in the Hunter Valley, NSW; in Queensland; and an isolated case north of Albany in WA. Sheep are the main species affected, with some cattle, a few pigs and rarely, goats and horses also affected (Animal Health Australia 2012).



Figure 1. Area of “Anthrax belt” in New South Wales [from Durrheim et al. (2009)]

Epidemiology

The vegetative form is fragile but on exposure to air above 22°C and, when nutrients become limited, it forms highly resistant spores which survive for years, even centuries, in the environment. These spores survive best in alkaline soils that are rich in calcium and have a relatively high moisture and organic content. If the carcass is not opened after death *B. anthracis* will not form spores and will be rapidly destroyed by putrefactive bacteria.

Spores deposited in the soil deeper than 15 cm can survive for many years. If spores are on, or just below, the soil surface they are subject to wind, rain, sunlight (including ultraviolet light), acidity, dryness and the activities of other microorganisms, all of which affect viability, resulting in a loss of infective capacity over about three years (Gates et al. 2001; Animal Health Australia 2012; Bengis 2012).

Anthrax epidemics are commonly associated with low lying depressions and generally occur during dry summer months following periods of heavy rain. Deep ploughing of pastures contaminated by effluent or carcasses or unearthing old graves have been identifiable sources of infection but many outbreaks have occult sources. No hard scientific supportive data exists to predict the risk given the combination of environmental parameters, vegetation, and host condition, behaviour or population density (Animal Health Australia 2012). Epidemics are therefore difficult to predict.

Animals are only infectious after they die and release the bacteria. Natural infection usually occurs by ingestion or inhalation of spores, although in Australia humans have developed the cutaneous form of anthrax from direct contact with spores (see Human health implications). Flies and scavenging animals may also play a role in disseminating anthrax spores and biting flies can transmit the bacteria directly by feeding on an infected host during the terminal stage of the disease (Gates et al. 2001; Bengis 2012).

Clinical signs

Herbivores develop clinical signs 4-10 days post-exposure. In cattle, sheep and goats, the disease is usually rapidly fatal before clinical signs are observed and animals are usually found dead in the paddock. Blood fails to clot and there may be blood stained discharges at external orifices. Non-specific signs such as changes in temperament, colic and oedema may be present prior to death. Pigs are usually visibly ill with fevers commonly above 41°C, blood stained froth at the mouth, neck or facial swelling with laboured breathing and dysentery or constipation. Dogs, cats and other carnivores are generally resistant and can recover spontaneously. Ingestion of a large quantity of infected meat is necessary to establish infection in these species. Clinical signs in dogs include a high temperature and sudden death with swollen throat lymph nodes (Animal Health Australia 2012).

Diagnosis

Diagnosis is usually made by finding encapsulated *B. anthracis* in infected blood or tissue specimens using relatively uncomplicated laboratory procedures. Important factors to consider are the anthrax history of the area, vaccination history of the animals and the possibility of introduction of animals or spores from other areas (Animal Health Australia 2012).

Clinical pathology

In ante-mortem cases, blood, oedematous fluids or throat lymph node aspirates may be collected for detection of the bacterium (see Laboratory diagnostic specimens). Haematological and other changes are expected to be variable and would depend on the state of the disease.

Pathology

Post-mortem examination of suspected cases of anthrax is strongly discouraged as the bacilli only sporulate and contaminate the environment if the carcass is opened. Signs in inadvertently opened carcasses may include dark unclotted blood; petechial haemorrhages; enlarged and haemorrhagic spleen; thickened, oedematous mesentery; increased pericardial, peritoneal or pleural fluid; dark red and oedematous intestinal mucosa and the absence of rigor mortis.

Differential diagnoses

Differential diagnoses for anthrax include blackleg (*Clostridium chauvoei*), black disease (*C. novyi*), malignant oedema (*C. septicum*), enterotoxaemia (*C. perfringens* type D), trauma, lightning strike, bracken fern poisoning, yersiniosis and malignant catarrhal fever (Gates et al. 2001).

Laboratory diagnostic specimens

Deaths suspicious of anthrax should have air-dried smears made from blood collected from a peripheral blood vessel into a vacuum tube by the attending veterinarian. These smears and the blood sample should be submitted to the appropriate laboratory for testing. If blood is unavailable, the dependant ear could be cut off, double bagged and labelled for submission. Horses, dogs and pigs do not have large numbers of bacteria in their blood so smears or samples for culture from oedematous fluid should also be submitted (Animal Health Australia 2012).

Specimens should be transported in watertight containers in case of breakage or spillage, on ice and clearly marked 'Suspected Anthrax Specimens'. Special packaging and labelling conditions apply and the receiving laboratory must be notified pre-shipment.

Laboratory procedures

B. anthracis is easily identified from smears and grows readily (1 - 2 days) on blood agar plates. It should be cultured under physical containment level 3 (PC3) conditions. Inoculation of guinea pigs or mice may be required for degenerated samples. PCR assays are also available.

A hand-held immunochromatographic test (ICT) assay for diagnosis in the field is available from the national Anthrax Reference Laboratory (AgrioBio, Department of Economic Development, Jobs, Transport and Resources, Latrobe University, 5 Ring Road, Bundoora, Victoria 3086; telephone 03 9217 4200). This test detects the protective antigen expressed in the bloodstream of an animal, and is an excellent screening test. Only blood samples collected within 48 hours after death should be tested. The ICT can be read within 15 minutes, requires very basic training in its use and can be performed at point-of-care. Positive results should be confirmed, for at least the first case on a premises, at an approved laboratory and subsequently provided to the Anthrax Reference Laboratory (Animal Health Australia 2012). The Ascoli test is unreliable and not approved for use in Australia (Animal Health Australia 2012).

Further information can be found in the OIE (World Animal Health Organisation) Manual of Diagnostic Tests and Vaccines for Terrestrial Animals <http://www.oie.int/en/international-standard-setting/terrestrial-manual/access-online/> (OIE 2012).

Treatment

Personnel who have handled suspected or confirmed anthrax carcasses should seek immediate medical advice. Treatment may be considered for valuable infected or exposed animals. Penicillin is the antibiotic of choice and, if given early in the course of the disease, should lead to complete recovery. Such treatment prevents effective vaccination for at least 10 days (Animal Health Australia 2012).

Prevention and control

Feral pigs and other wild animals should be prevented from coming into contact with, or feeding on, carcasses to avoid both the potential for infection and mechanical spread of infective material. Anthrax is considered unlikely to become established in wild animals in Australia due to the nature of its transmission (Animal Health Australia 2012).

If a case is suspect or confirmed all associated biological and disposable material should be destroyed immediately and the area disinfected (Animal Health Australia 2012). Anthrax spores can be destroyed by applying dry heat (140°C) for three hours, autoclaving at 120°C for ten minutes or exposure to 10% bleach for two hours. Surfaces contaminated with spores can also be disinfected with 10% formaldehyde, 2% glutaraldehyde, 3% hydrogen peroxide or 0.3% peracetic acid (Animal Health Australia 2012).

Anthrax in Australia is considered to be well-controlled. Primary producer awareness campaigns and regular vaccination of livestock in known risk areas are used to assist control. There is a rapid, rigorous and coordinated response to incidents which includes prompt identification of the source of infection, movement tracing, quarantine, decontamination and safe disposal of carcasses, vaccination and/or treatment of potentially exposed animals including potential use of a vaccination zone and prevention of processing of potentially infected livestock or their product.

Surveillance and management

There is an AUSVETPLAN Disease Strategy for anthrax (Animal Health Australia 2012). Anthrax is in Emergency Animal Disease Response Category 3 (50% of costs borne by government and 50% by the relevant industry) (Animal Health Australia 2012) and is an OIE listed disease (OIE 2016).

In Australia, anthrax is a notifiable disease in both humans and animals (Department of Agriculture 2014; Department of Health 2015). Recording systems and public awareness campaigns are used in surveillance and management of the disease. Active surveillance is initiated in disease incidents as part of the response (Animal Health Australia 2012). If you suspect a case of anthrax, please notify your state/ territory department of primary industry.

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. There are no reports of anthrax in Australian wildlife in eWHIS (Wildlife Health Australia 2015). Wildlife Health Australia is, however, keen to include any cases of anthrax diagnosed in Australian wildlife in eWHIS. Please contact us at admin@wildlifehealthaustralia.com.au.

NOTE: access to the eWHIS dataset is restricted. If you would like access, please contact admin@wildlifehealthaustralia.com.au.

Agricultural animal reports of anthrax are available at http://www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/Diseasehome (global) and via state

agricultural department websites, or through “Animal Health in Australia”, published annually by Animal Health Australia.

Research

No specific research for anthrax and Australian wildlife was identified. The risk of anthrax establishment or adverse effects in free-ranging livestock in Australia’s north, feral animals or Australian wildlife appears to be unquantified. However, it is expected to be low, but with a risk of delayed detection. In a review of anthrax in African and North American wildlife, research needs for genotypic grouping, improved field diagnostic techniques, oral vaccines, spore survival in soil and the natural ecology of the disease were highlighted (Hugh-Jones and de Vos 2002).

Human health implications

Anthrax is a significant zoonosis and medical practitioners should be consulted immediately if exposure or the disease is suspected in humans. Australia has never recorded an inhalational or gastrointestinal case of anthrax in a human and only the cutaneous form has been reported in humans in Australia, with low numbers of cases, mostly acquired from contact with infected animals or material, although other sporadic cases have occurred (Animal Health Australia 2012).

In humans in Australia anthrax has been a nationally notifiable disease since 1 January 2001 and has a low notification rate (NNDSS 2015). Further information is available at

<http://www.health.gov.au/internet/publications/publishing.nsf/Content/ohp-anthrax-toc>

Conclusions

Anthrax transmission is more akin to that of an obligate parasite rather than an infectious disease so ongoing infective exposure of wild or free-ranging animals to spores or carcasses would be required for anthrax to become established in such populations – a risk considered to be low in Australia. Feral pigs and other wild animals should, however, be prevented from coming into contact with, or feeding on, carcasses to avoid both the potential for infection and mechanical spread of potentially infective material.

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Acknowledgements

WHA is extremely grateful to Peter Holz and Shan Siah who provided the initial drafts of this fact sheet and to those individuals, agencies and organisations that provided comment and external review. Without their ongoing support production of these fact sheets would not be possible.

Updated: September 2016

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. Negative data are also valuable. 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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