Anthrax in Australian wildlife

Fact sheet

September 2016

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 [1]. 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 [1].

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 [1, 2].

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 [3]. There are no records of anthrax in wildlife in over 4000 mammalian records in the Wildlife Health Australia national wildlife information system https://wildlifehealthaustralia.com.au/Our-Work/Surveillance/eWHIS-Wildlife-Health-Information-System [4]. 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 [5]. 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 [6, 7].

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 [8] and in areas in neighbouring Victoria [9]. The suggested "Anthrax belt" was redefined by Barro et al. 2016 [10], 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 [1]. 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 [1].

Figure 1. Area of "Anthrax belt" in New South Wales [from Durrheim et al. 2009 [9]]

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 [1, 11, 12].

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 [1]. 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 [11, 12].

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 [1].

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 [1].

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 [11].

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 [1].

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

Bacillus 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 [1]. The Ascoli test is unreliable and not approved for use in Australia [1].

Further information can be found in the WOAH (World Animal Health Organisation) Manual of Diagnostic Tests and Vaccines for Terrestrial Animals https://www.woah.org/en/international-standard-setting/terrestrial-manual/access-online [2].

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 [1].

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 [1].

If a case is suspect or confirmed all associated biological and disposable material should be destroyed immediately and the area disinfected [1]. 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 [1].

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 [1]. Anthrax is in Emergency Animal Disease Response Category 3 (50% of costs borne by government and 50% by the relevant industry) [1] and is an WOAH listed disease [13].

In Australia, anthrax is a notifiable disease in both humans and animals [14, 15]. 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 [1]. If you suspect a case of anthrax, please notify your state/ territory department of primary industry.

Statistics

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 no reports of anthrax in Australian wildlife in eWHIS [4]. Wildlife Health Australia is keen to include any cases of anthrax diagnosed in Australian wildlife in eWHIS. Please contact us at admin@wildlifehealtaustralia.com.au.

Agricultural animal reports of anthrax are available from https://www.woah.org (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 [6].

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 [1].

In humans in Australia anthrax has been a nationally notifiable disease since 1 January 2001 and has a low notification rate [16]. 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 carcases would be required for anthrax to be 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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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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Find out more at wildlifehealthaustralia.com.au

Email: admin@wildlifehealthaustralia.com.au

Or call +61 2 9960 6333