Anthrax

Wetlands in primarily arid regions supporting *Bacillus anthracis*

Wildlife ✓
Livestock ✓
Human ✓

Synonyms: *Bacillus anthracis*, charbon, inhalation anthrax, Ragsorter's disease, Woolsorter's disease, Woolsorter's pneumonia

KEY FACTS

What is anthrax?

A highly infectious disease caused by the aerobic spore-forming bacterium *Bacillus anthracis*. Spores may remain dormant and viable for decades, surviving adverse environmental conditions then germinating during favourable conditions. An acute infectious disease, anthrax can affect almost all species of mammal, including humans.

Animal anthrax primarily affects herbivores which most likely consume the bacteria whilst grazing or browsing, the disease usually results in sudden death.

Causal agent

Bacillus anthracis, a bacterium that forms spores in the presence of air.

Species affected

A wide range of mammal species, including humans. A disease of domestic herbivorous mammals such as cattle, sheep, goats, horses, donkeys but also pigs and dogs.

Susceptible wild animals include rhinoceros, zebra, elephants, antelope, wild bovids (*e.g.* Bison *Bison bison*), cervids, carnivores and omnivores (*e.g.* primates). Although cases have been recorded in ostriches *Struthio camelus* and vultures, birds are considered to be relatively resistant to anthrax.

Anthrax rarely infects humans in the developed world but is a threat to those who work with affected animals and their by-products. Some forms of the disease (*e.g.* cutaneous) are relatively common in some pastoral livestock communities in the developing world.

Geographic distribution

Occurs worldwide and is endemic in southern Europe, parts of Africa, Australia, Asia and North and South America. It persists in arid deserts of the Middle East, Asia, Africa, Australia and South America with most cases reported from Iran, Turkey, Pakistan and Sudan.

Environment

Alkaline or neutral calcareous soils provide favourable conditions in which spores can persist and the bacteria can multiply. Outbreaks occur primarily in warmer seasons, or in drier seasons following previous wet seasons of unusually high rainfall.

TRANSMISSION AND SPREAD

Vector(s)

The bacterium is not vector-borne but may be spread mechanically *via* insects, carnivorous and scavenging animals. In Africa, blowflies are an important means of transferring infection to browsing herbivores.

How is the disease transmitted to animals?

The principal mode of transmission is ingestion of infective bacteria from the environment.

How does the disease spread between groups of animals?

Following the death of an infected animal the carcase decays and bacteria are exposed to oxygen. The vegetative form of the bacteria then turns back into the spores that contaminate the soil. Grazing animals spread the bacteria by eating/picking up contaminated dirt or food sources. Spores have also been found in the guts of insects, although the importance of their role is not yet known. During droughts, when animals graze closer to the ground, more dirt is consumed and the incidence of anthrax appears to increase.

Outbreaks have been reported in some domestic animals (mainly pigs) after consuming feeds containing meat and bone meal originating from carcases contaminated with anthrax bacterial spores.

Wild carnivores and scavengers become infected through the consumption of infected meat.

After feeding on an infected carcase, non-biting blowflies may contaminate vegetation by depositing vomit droplets and subsequently animals feeding on such vegetation then become infected. Although a minor mode of transmission, biting flies may transmit the disease from one animal to another during severe outbreaks.

How is the disease transmitted to humans?

Humans can become infected with anthrax by breathing in anthrax spores from infected animal products (*e.g.*wool) or cutaneous anthrax may be aquired through contact with broken skin following handling of hides, hair, fur, bone, meat or wool from infected animals. Consumption of undercooked meat from infected animals may cause gastrointestinal anthrax.

Anthrax is not known to spread from one person to another.

IDENTIFICATION AND RESPONSE

Field signs

Animals in apparently good condition die suddenly. Acute cases in cattle, sheep and wild herbivores are characterised by fever, depression, difficulty in breathing and convulsions, and, if untreated, animals may die within two or three days. In pigs, anthrax is characterised by swelling of the throat, causing difficulties in breathing and similar characteristics are seen in dogs, cats and wild carnivores. The incubation period of anthrax is typically 3 to 7 days (ranging from 1 to 14 days).

Anthrax in animals can take three forms: apoplectic, acute/subacute, and chronic.

- **Apoplectic** – occurs most frequently at the beginning of an outbreak, where animals (mostly cattle, sheep, goats and wild herbivores) show signs of loss of conciousness and sudden death.
- **Acute** and **subacute** – common in cattle, horses, sheep and wild herbivores. Signs include fever, ruminal stasis, excitement followed by depression, difficulty in breathing, uncoordinated movements, convulsions and death. Unclotted blood issuing from body orifices, rapid decomposition of the carcase and incomplete *rigor mortis* are often observed.
- **Chronic** anthrax – can be seen in cattle, horses and dogs but occurs mainly in less susceptible species such as pigs and wild carnivores. Characterised by swelling of the throat and tongue and a foamy discharge from the mouth.

Sporadic wildlife cases occur in high risk locations associated with spore accumulation from historic infections and die-offs.

Recommended action if suspected

Contact and seek assistance from appropriate animal health professionals. Anthrax is a notifiable disease and suspected cases must be reported immediately to local and national authorities and the OIE.

Diagnosis

In animals, anthrax is diagnosed using samples taken from superficial blood vessels or natural openings of dead animals and by examining blood smears on a microscope slide. Artificial media can be used to grow the micro-organism from a dead animal, hides, skin, wool or soil. For rapid diagnosis of anthrax, polymerase chain reaction (PCR) is used.

In humans, anthrax is diagnosed by isolating *B. anthracis* from respiratory secretions, the blood, skin lesions, or in persons with suspected cases, measuring specific antibodies in the blood.

PREVENTION AND CONTROL IN WETLANDS

Environment

There is no easy method of disinfecting the environment and therefore anthrax is difficult to eliminate due to long-lived spores in soil. Burning of low vegetation can help to decontaminate an area.

Livestock

In areas prone to anthrax a preventive strategy should be adopted involving thorough surveillance and annual vaccination of susceptible animals (usually cattle, sheep and goats).

Vaccination is normally carried out 2-4 weeks before the onset of the known period of outbreaks. Following vaccination, a ten day quarantine ensues for the herd and premises in countries following OIE recommendations. Any animals showing signs of anthrax must be treated and not used for food until several months after the completion of treatment. The live Sterne vaccine is effective but there is some concern over its ecological effect and possible pathogenicity in some species. Antibiotic treatment (penicillin or tetracycline) can be an option if animals show clinical signs of anthrax but often it is not a practical or feasible method of control.

Culling of infected animals and removal of diseased carcases reduces contamination sources. Burn all anthrax-infected carcases or bury in deep lime pits. When this is not possible, place the unopened carcases in heavy duty black plastic bags which are sealed and leave in the heat. This destroys the vegetative bacteria and prevents spore contamination. After several hours the carcase is effectively sterilised under these conditions. Carcases infected with anthrax should not be moved, instead they should be disposed of using appropriate methods on site to prevent further environmental contamination.

Other control measures include **autoclaving** (*i.e.* high heat and high pressure) animal products (hides, bristles, hair) to destroy spores, prompt disposal of bedding and contaminated materials, control of scavengers, and observation of general hygiene by people who have come in contact with diseased or dead animals.

Wildlife

Prevention involves recognising the risk factors associated with anthrax which include:

- History of previous outbreaks in the region.
- Topography, in particular alkaline and calcium-rich soil.
- Rain and drought patterns associated with outbreaks *e.g.* long dry periods following previous heavy rainfall.
- High densities or overabundance of susceptible species *e.g.* near and around watering holes.
- Drainage areas where spores accumulate.
- Contemporaneous outbreaks in livestock.
- Changes in vaccination programmes in livestock.

Above all, be alert, vigilant and maintain surveillance particularly during high risk times. Anthrax is a seasonal disease which may reoccur the following year and being prepared for potential outbreaks is vital. This includes early carcase detection along with minimising environmental contamination through proper carcase disposal and decontamination

Wildlife species should be monitored for any interaction with livestock (*e.g.* at water sources and grazing areas).

Control measures include:

- Rapid diagnosis of the disease.
- Rapid disposal of carcases by *e.g.* burning on site.
- Scavengers should be kept away from carcases by reducing access to carcases *e.g.* by covering them, or providing decoy uncontaminated meat elsewhere.
- Controlling blowflies in the area.
- Burning surrounding areas of bush to kill spores and disperse unaffected wildlife.
- Ring vaccination of susceptible hosts.

Trained personnel and advisory information are required to effectively manage the control of an outbreak and attempts should be made to identify the source and mode of transmission in order to inform the response team.

Zebra *Equus quagga* in an arid area surrounding a wetland. Prevention of anthrax in wildlife depends on recognising risk factors such as seasonality, density of susceptible hosts, rainfall patterns, history, soil type and so on (*Sally MacKenzie*).

Humans

Protection measures:

- Vaccination is available for humans who are at particular risk (veterinarians, animal handlers, persons working with animal carcases or products, *etc.*).
- Use personal protective equipment (PPE) when handling infected animals and their by-products.
- Wash hands with soap and water to remove the vast majority of spores and keep fingers away from the mouth and nose.
- Treat wounds or scratches as soon as possible to reduce cutaneous infection by spore contamination.
- In the presence of acute respiratory infections or other debilitation, be on alert for "flu-like" symptoms as pulmonary infections are most likely.
- In the unlikely event of contracting anthrax, treatment is highly effective with simple penicillin, erythromycin G, tetracycline and a variety of other antibiotics.

IMPORTANCE

Effect on wildlife

- Recurring outbreaks have occurred in some regions and the disease is considered endemic and 'normal' in some large wildlife areas.
- The impacts can be greater where protected areas are smaller and where losses are proportionally greater.
- Outbreaks can put endangered species at risk of mass die-offs and rapid population decline.
- A number of significant, high mortality anthrax epidemics in wildlife have occurred in Africa over the last decades. It is suggestive of re-emergence but the cause of this is not always clear. These have included: thousands of hippopotamuses on the Zambesi; in Queen Elizabeth National Park, Uganda; and affecting a variety of species in Zimbabwe, Ethiopia, Tanzania; and endangered Grevy's zebra *Equus grevyi* in Kenya.
- Some protected areas and other environments have recurrent infection where the epidemiology is now well understood, *e.g.* in Kruger and Etosha National Parks in South Africa and Botswana. Some of these outbreaks are a result of spillover of infection from livestock epidemics especially where there is a breakdown in livestock vaccination.
- Other disease control measures such as foot and mouth disease fences have had an impact on the incidence of anthrax, keeping population densities high in some susceptible regions allowing the disease to become endemic and causing regular outbreaks.

Effect on livestock

Livestock anthrax is declining in many regions of the world due to good prevention and control measures. That said, the disease can still cause heavy losses and will remain a particular problem where the disease is present in wildlife areas and there is contact between wild and domestic populations.

Effect on humans

A potentially fatal zoonotic infection and thus a risk to human health when dealing with infected animals or their products. Livestock losses impact food security and livelihoods particularly in regions where disease is endemic.

Economic importance

Economic losses may be significant as a result of anthrax outbreaks especially for livestock traders.

FURTHER INFORMATION

Useful publications and websites

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