Avian botulism

Any wetland supporting *Clostridium botulinum* and susceptible animals

Wildlife ✓
Livestock ✓
Human ✓

Synonyms: Alkali poisoning, duck disease, limberneck, Western duck sickness

KEY FACTS

What is avian botulism?

A paralytic and often fatal disease of birds caused by ingestion of a toxin produced by the bacterium *Clostridium botulinum*. Bacterial spores are widely distributed in wetland sediments and can be found in the tissues of most wetland inhabitants, including aquatic insects, molluscs and crustacea and many vertebrates, including healthy birds. Spores may survive for years but only give rise to the bacteria that produce the toxins under certain environmental conditions. These conditions include lack of oxygen, high temperature (noting that the disease may still occur in cold winters), and an organic nutrient source. These ecological factors largely control botulism outbreaks in birds. Illness in humans is rare and associated only with specific toxins.

Causal agent

Toxins produced by the bacterium *Clostridium botulinum.* There are seven types of toxin; A, B, C, D, E, F and G. Types C, D and E cause botulism in mammals, birds and fish. Types A, B, E and rarely F, cause illness in humans. Humans are reported as being resistant to the other toxins but this may be relative resistance and dose related.

Species affected

Many species of birds, particularly waterfowl, pheasants and poultry, and some mammals, including cattle, mink, sheep and horses. Illness in humans is rare.

Geographic distribution

Occurs worldwide.

Environment

Any environment supporting *Clostridium botulinum* and its animal hosts. Conditions needed for toxin production include lack of oxygen, high temperature, and an organic nutrient source, often in the form of dead invertebrates or vertebrates and decomposing vegetation, plus the presence of a bacteriophage - a bacteria-targeted virus. These conditions are produced during, for example, hot weather when water levels drop and create a layer of dead and decaying matter at the edges of water bodies. Salinity (up to 3 parts per thousand) can increase the likelihood of toxin production.

TRANSMISSION AND SPREAD

Vector(s)

Spread by infected invertebrates (*e.g.* maggots) and birds (see below for details of carcase/maggot cycle) and by transfer of infected carcases by predators/scavengers.

How is the disease transmitted to animals?

Through direct ingestion of the toxin or through ingestion of contaminated food and water. Birds commonly acquire bacteria through feeding on infected invertebrates. A cycle develops where the presence of dead animals and high ambient temperatures attract flies which lay eggs and produce maggots. Maggots feeding on a bird that has died of botulism concentrate the toxin and birds eating these maggots may die. This carcase/maggot cycle may then amplify the disease. Birds can develop botulism after consuming

only a few larvae. Cattle may ingest toxin through chewing infected bones and carrion in phosphorous-deficient areas, and ingesting rotting organic matter and other contaminated food.

How does the disease spread between groups of animals?

Spreads from one animal group to another through the methods detailed above. Transfer of infected carcases by predators may also indirectly spread the bacteria. Avian botulism is not directly transmissible or communicable by casual contact but, in some cases, tissues from dead animals can be toxic if ingested by other animals.

How is the disease transmitted to humans?

Most commonly transmitted through ingesting contaminated food, particularly fish, wildfowl, marine mammals and processed animal products. It can also be transmitted through wound infections or intestinal infection in infants. Occasionally, humans can be exposed to the toxin by an aerosol. Person to person transmission of botulism does not occur.

IDENTIFICATION AND RESPONSE

Field signs

Appearance of lines of bird carcases coinciding with receding water levels may signal an outbreak. Healthy, sick and dead birds are often found together during an outbreak with carcases in various stages of decay. Affected birds may be unable to use their wings and legs normally or unable to control the third eyelid (may not be visible), neck muscles and other muscles and may therefore be seen propelling themselves using weak wings across water and mudflats. Birds with paralysed neck and leg muscles cannot hold their heads up and may therefore drown. Death is frequently caused by respiratory failure caused by the toxin paralysing muscles used for breathing. A fish die-off may also indicate an outbreak, particularly with botulism E toxin.

Affected cattle and horses tend to have a stiff gait and are often found recumbent with laboured breathing. Saliva **may** drool from their mouth.

In humans, symptoms include blurred vision, dry mouth, difficulty in swallowing or speaking, general weakness, and shortness of breath. The illness may progress to complete paralysis and respiratory failure, but, if treated, rarely death.

The disease often affects the same wetlands, and the same spots within a wetland, each year.

Recommended action if suspected

Contact and seek assistance from animal and human health professionals immediately if there is any illness in birds and/or people. Report suspected cases to local or national authorities.

Diagnosis

Avian botulism can be tentatively diagnosed by the clinical signs and the exclusion of other neurological diseases. Detection of the toxin by health professionals is needed for a definitive diagnosis. Diagnosis in animals relies on identifying the toxin in faeces, blood, vomit, gastric aspirates, respiratory secretions or food samples. Serum is required for diagnosis in sick birds and tissue samples such as clotted heart blood, stomach contents, or liver are required for diagnosis in dead birds. Laboratory diagnostic tests have poor sensitivity and specificity. In wild birds clinical diagnosis is most frequently made - flaccid paralysis being very characteristic.

Food and water samples associated with suspect cases should be obtained immediately, stored in sealed containers, and sent to reference laboratories for diagnosis.

PREVENTION AND CONTROL IN WETLANDS

Overall

It is not currently feasible to eliminate botulism spores from wetlands as they are so widespread and resilient. Some actions can be taken to mitigate environmental conditions that increase the likelihood of outbreaks.

Habitat management

- **Reduce organic inputs** (*e.g.* sewage, pollutants) into wetlands, particularly in warm weather. Inputs will introduce large amounts of decaying matter and may cause death of aquatic life (which forms a nutrient source for the bacteria).
- **Oxygenate water** if possible with pumps, or by improving water flow.
- **Keep water levels stable**, particularly in warm weather.
- In areas managed primarily for migratory waterbirds, avoid flooding land that has been dry for a long time and avoid lowering water levels when warm. Both could result in die-offs of fish and aquatic invertebrates whose carcases could then become substrates for bacterial growth.
- In areas managed for shorebirds, lowering water levels provides essential habitat. Avian botulism control must therefore focus on **quickly removing any carcases**.
- Waterfowl can be redistributed to lower risk areas by draining contaminated areas whilst creating/enhancing other habitats.
- *Take care to ensure these measures do not cause the dispersal of infected birds out of the area.*

Quick and careful collection of carcases and their disposal by burial or burning, especially during outbreaks, removes nutrient sources for bacteria.

- Immediately place carcases into two plastic bags to prevent leakage of fluids. Bags should always be securely closed before they are removed from the area.
- Submit carcases to disease diagnostic laboratories before being incinerated.
- Take care to avoid contaminating new areas whilst carcases are being transported to the laboratory and disposal site.
- Wear gloves and thoroughly wash exposed skin surfaces after any contact with contaminated birds.
- Disinfect field equipment used in infected areas.

Avoid locating power lines across marshes used by large concentrations of waterbirds. Carcases from collisions provide substrates for toxin production.

Sick waterfowl are easily caught and can recover if provided with freshwater and shade, or injected with antitoxin.

Monitoring and surveillance

Regular monitoring of live and dead birds, particularly in endemic areas and areas where migratory birds are concentrated, and during warm periods, can help identify early stages of an outbreak and allows disease control activities to be activated before any outbreaks develop further.

- Document environmental conditions, outbreak sites and dates of outbreak occurrence and cessation.

- Plan for, and implement, intensive surveillance and vertebrate carcase collection.
- Where possible, monitor and modify environmental conditions to prevent the pH and salinity of wetlands from reaching or being maintained within high hazard levels.

Livestock

- Vaccination
- Prevent stock from having access to animal carcases.
- Control vermin and pest animals to reduce the risk of spread of rotting material.
- Providing nutritional supplements of protein and phosphorus to reduce bone chewing among cattle.
- Take care with the harvesting and storage of feeds to reduce the possibility of small animals contaminating feeds.
- Check water sources for organic matter contamination.

Wildlife

►Section above: Prevention and control in wetlands – overall
►Case study 3-2. Managing avian botulism at wildlife reserves in the UK (Section 3.1.3).

Humans

- **Thoroughly cook fish or waterfowl** to an internal temperature of at least 180°F to destroy the toxin.
- Anglers and hunters should **never harvest fish or waterfowl** that appear sick or dying in areas where avian botulism is known to be present.
- **Refrigeration** temperatures combined with **salt** content and/or **acidic** conditions will prevent the growth of bacteria or the formation of toxin.
- **Good personal hygiene.** Wash hands thoroughly with soap and warm water, particularly before and after preparing food and after contact with animals.
- If exposure to the toxin *via* an aerosol is suspected, remove any clothing and store in plastic bags until it can be washed with soap and water. Shower thoroughly.
- **Antitoxin** may be used to treat the disease. Severe cases require supportive treatment, especially mechanical ventilation, which may be required for weeks or months. Antibiotics are not required (except in the case of wound botulism).
- There is no fully tested vaccine against botulism.

IMPORTANCE

Effect on wildlife

It causes *significant* mass mortality of birds, particularly waterfowl, where a million or more may die in a single outbreak. Waterbirds on fresh and salt (sea) water may be affected. Some affected birds may recover without treatment. Impacts vary between species. Impacts on wild bird populations are currently unknown. The disease can result in negative perception and therefore unnecessary destruction of wildlife.

Avian botulism is probably one of the most important diseases of migratory waterbirds worldwide, and without intervention, great numbers of birds can die over a short period of time.

Effect on livestock

Causes morbidity and mortality in chickens, cattle, sheep and horses. Relatively uncommon in domestic mammals although up to 65% of affected cattle herds may fall ill and up to 40% of affected chicken flocks may die. Livestock mortality associated with dead poultry and poultry waste can be a relatively frequent occurrence.

Effect on humans

Causes morbidity, and less frequently, mortality. The death rate is high if left untreated but vastly decreases with supportive care. Recovery may take several months or longer.

Economic importance

There is potential for economic losses to the livestock industry, due to illness and death of infected animals, with cattle and poultry particularly affected, and likely trade restrictions imposed during and after an outbreak.

Illness in humans can result in significant economic losses due to the time lost from normal activities.

FURTHER INFORMATION

Useful publications and websites

- Friend, M. & Franson, J.C. (2001). **Avian botulism**. In: Field manual of wildlife diseases: general field procedures and diseases of birds. E. A. Ciganovich (ed.). pp. 271-281. U.S. Department of the Interior and U.S. Geological Survey, Washington, DC. www.nwhc.usgs.gov/publications/field_manual/chapter_38.pdf [Accessed March 2012].
- World Organisation for Animal Health (OIE). **Botulism factsheet**. www.cfsph.iastate.edu/Factsheets/pdfs/botulism.pdf [Accessed March 2012].
- World Health Organization (WHO). **Botulism factsheet**. www.who.int/mediacentre/factsheets/fs270/en/ [Accessed March 2012].
- Prairie Habitat Joint Venture. **Ecology and management of avian botulism on the Canadian prairies**. http://www.phjv.ca/pdf/BotulismReport_FINAL_FullReport_Aug2011.pdf [Accessed March 2012].
- U.S Geological Survey (USGS) National Wildlife Health Center. **Avian botulism**. www.nwhc.usgs.gov/disease_information/avian_botulism/index.jsp [Accessed March 2012].
- Wildpro. **Avian botulism**. http://wildpro.twycrosszoo.org/S/00dis/toxic/Biotoxin/botulism.htm [Accessed March 2012].

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FAO Animal Production and Health Division
www.fao.org/ag/againfo/home/en/who.htm [Accessed March 2012].