

# Anthrax



## Case Definition

**Confirmed Case:** Clinically compatible illness (see below) with one of the following:

- Isolation of *Bacillus anthracis* from a clinical specimen; or
- Demonstration of *Bacillus anthracis* in a clinical specimen by immunofluorescence; or
- Detection of antibodies to *Bacillus anthracis* (see below).

**Clinical Case:** Clinically compatible illness, epidemiologically linked to a confirmed human or animal case.

## Reporting Requirements

- All positive laboratory tests are reportable by laboratory.
- All clinical cases are reportable by attending health care professional.

## Clinical Presentation/Natural History

This is a zoonotic disease caused by a sporulating gram-positive bacteria. It usually presents as one of four distinct clinical syndromes in humans.

### Cutaneous Form

This form begins with a pruritic papule followed by formation of a blister-like, fluid-filled vesicle within one or two days. The lesion is usually 1-3 cm in diameter and usually remains round and regular. The vesicle typically dries and forms a coal-black scab or depressed eschar. It occurs most frequently on the hands and forearms, and less commonly on the face and neck of persons working with infected livestock. It was described as “the malignant pustule” in the past. There may be regional lymphangitis and lymphadenopathy, and some systemic symptoms such as fever, malaise and headache.

### Inhalational Form

This form is also known as Woolsorters’ disease. It usually presents with non-specific illness consisting of fever, malaise, fatigue, cough and mild chest discomfort. It may resemble a mild upper respiratory tract infection or influenza. This initial illness is followed by severe respiratory distress with dyspnea, diaphoresis, stridor and cyanosis. Shock and death occur within 24 to 36 hours after onset of severe symptoms. Radiographic examination of the chest may reveal widening of the mediastinum and pleural effusion. Inhalational anthrax is very difficult to diagnose early and is almost always fatal.

### Intestinal Form

Symptoms of the intestinal form are initially non-specific and include nausea, vomiting, anorexia and fever. Lesions are frequently described in the cecum and adjacent areas of the bowel, rarely in the duodenum. Abdominal pain, hematemesis and bloody diarrhea develop with progression of the disease. With further progression toxemia develops, with shock, cyanosis and death. The time from onset of symptoms to death varies from two to five days.

### Oropharyngeal Form

In this form, edema and tissue necrosis occur in the cervical area. Inflammatory lesions resembling cutaneous lesions may be seen in the oral cavity involving the posterior wall, the hard palate or the tonsils. The main clinical features are sore throat, dysphagia, fever, regional lymphadenopathy in the neck and toxemia. Most persons die of toxemia and sepsis.

### Meningitis

Meningitis is seen in less than 5% of anthrax cases. It may be a complication of any of the four forms of primary anthrax infection.

## Etiology

*Bacillus anthracis*, a gram-positive, encapsulated, spore-forming, nonmotile rod.

## Epidemiology

**Reservoir:** Animals, normally herbivores, both livestock and wildlife, are the reservoir. These animals may shed *B. anthracis* in terminal hemorrhages or spit blood just before death, exposing the vegetative form of bacilli to air. Upon exposure to air, the vegetative form sporulates and the spores, which are very resistant to adverse environmental conditions and disinfection, may remain viable in contaminated soil for many years after the source-animal infection has terminated. Dried or otherwise processed skins and hides of infected animals may harbour the spores for years and are the fomites by which the disease is spread worldwide.

**Transmission:** Cutaneous infection is transmitted by contact with tissues of animals (cattle, sheep, goats, horses, pigs and others) dying of the disease. Biting flies that have partially fed on such animals may also transmit the disease. Contact with contaminated hair, wool, hides or products made from them, such as drums or brushes, or contact with soil associated with infected animals or contaminated bonemeal used in gardening may also transmit the organism.

Inhalation anthrax results from inhalation of spores in risky, industrial processes such as tanning of hides, or wool or bone processing, where aerosols of *B. anthracis* spores may be produced. Intestinal and oropharyngeal anthrax arise from ingestion of contaminated meat; there is no evidence that milk from infected animals transmits anthrax. Accidental infections may occur among laboratory workers.

The disease spreads among grazing animals through contaminated soil and feed, and among omnivorous and carnivorous animals through contaminated meat, bonemeal or other feeds, and among wildlife from feeding on carcasses of animals that have had anthrax. Vultures have been reported to spread the organism from one area to another. Human-to-human transmission has not been documented.

## Occurrence:

**General:** Primarily a disease of herbivores; humans and carnivores are incidental hosts. Human anthrax is endemic in agricultural regions of the world where anthrax in animals is common, including countries in South and Central America, southern and eastern Europe, Asia and Africa. However, human infection is infrequent and sporadic in most industrialized countries. New areas of infection in livestock may develop through introduction of animal feed containing contaminated bonemeal. Environmental events such as floods may provoke epizootics.

**Manitoba:** No cases of human anthrax have been diagnosed in the last two decades. In 1998, two laboratory-confirmed cases (one bison and one deer) and two suspected cases of animal anthrax were reported. All were zoo animals. In 1994, one bison from a commercial farm in Manitoba was reported to have died from anthrax infection.

**Incubation Period:** A few hours to seven days; most cases occur within two to five days of exposure.

**Susceptibility and Resistance:** All persons are probably susceptible, but there is some evidence of inapparent infection among people in frequent contact with the infectious agent. Second attacks can occur but are probably rare.

**Period of Communicability:** Articles and soil contaminated with spores may remain infective for decades.

## Diagnosis

Diagnosis is based on clinical illness coupled with laboratory confirmation. Laboratory confirmation is made by demonstration of *B. anthracis* in clinical specimens by culture.

Acceptable clinical specimens include swabs or pustular fluid from a skin lesion, sputum, and blood. All clinical specimens should be clearly

labeled and forwarded to the Cadham Provincial Laboratory (CPL). CPL should also be telephoned ahead of time.

An enzyme-linked immunosorbent assay (ELISA) has been developed that measures antibodies to anthrax toxins (lethal and edema toxins). The diagnosis may be confirmed serologically by demonstrating a four-fold change in titre in acute and convalescent phase serum specimens collected four weeks apart, or by a single titre of greater than 1:32.

## Key Investigations

- Identify the source of infection.
- Identify contacts of the source of infection.
- Close liaison is recommended with other agencies such as the Canadian Food Inspection Agency, the Provincial Veterinarian, Manitoba Health, and Workplace Safety and Health as appropriate.

## Control

### Management of Cases:

- It is estimated that approximately 20% of untreated cases of cutaneous anthrax will result in death, whereas inhalational anthrax is almost always fatal. Death is rare after antimicrobial treatment of the cutaneous form.
- In the cutaneous form, intravenous penicillin G is the preferred drug, with a dose of approximately four million units every four to six hours. Cutaneous lesions become culture negative in a few hours, but therapy should be continued for seven to 10 days. For the penicillin-allergic patient, use erythromycin, ciprofloxacin, tetracycline or chloramphenicol. Antibiotic treatment does not prevent the formation of eschar. Excision of the lesion is contraindicated. Topical therapy is not effective.
- Although the vast majority of naturally occurring anthrax strains are sensitive *in vitro* to penicillin, resistant strains exist naturally. Therefore, in the absence of information concerning antibiotic

sensitivity, treatment with other antibiotics such as ciprofloxacin or doxycycline should be considered.

- For inhalational anthrax, the United States Army recommends intravenous penicillin two million units every two hours for penicillin sensitive organisms, and intravenous ciprofloxacin 400 mg every eight to 12 hours or doxycycline 200 mg initially, followed by 100 mg every 12 hours for penicillin-resistant organisms.
- Routine infection control precautions should be practised. After an invasive procedure or autopsy, the instruments and area used should be thoroughly disinfected with a sporicidal agent. Chlorine in the form of sodium or calcium hypochlorite can be used, or glutaraldehyde, stabilized hydrogen peroxide, paracetic acid or chlorine dioxide.
- Dressings with drainage from the lesions should be incinerated, autoclaved, or otherwise disposed of as biohazardous waste.
- Persons with draining lesions should be cared for using routine precautions.

### Management of Contacts:

- The source of infection must be identified. Any person who has come into contact with the source of infection is defined as a contact. This may include physical contact with either a human or animal case or a contaminated product, ingestion of contaminated food, and possible inhalation of spores. However, person-to-person transmission has not been documented.
- The United States Army recommends as chemoprophylaxis ciprofloxacin 500 mg po bid, levofloxacin 500 mg po od, ofloxacin 400 mg po bid, or doxycycline 100 mg po bid for four weeks.

### Management of Outbreaks:

- All cases and contacts should be managed as per this protocol.
- **Potential as a biological warfare agent**  
The anthrax bacterium is easy to cultivate and spore production is readily induced. Spores are

highly resistant to sunlight, heat and disinfectants and therefore, can be used as a biological weapon. The spores could be delivered as an aerosol cloud by a spray device in a highly populated area infecting many people at the same time. There have been a series of bio-terrorist threats of anthrax in the United States.

In case of bio-terrorist threats, the following resources may be contacted:

- Police and Emergency Medical Services:  
911 (24 hours)
- Public Health: During office hours: Local Public Health Office  
After office hours: (204) 945-0183
- Office of Special Health Initiatives, Health Canada:  
During office hours: 1-613-954-8505  
After office hours: 1-800-545-7661

## Preventive Measures:

- Anthrax Vaccine  
Currently, a vaccine derived from sterile culture fluid supernatant, taken from an attenuated strain, has been used in both United States and Canadian Armed Forces. It is not licensed for civilian use in Canada. However, it can be made available through the special access program from Health Canada (telephone 613-941-2108 or 613-941-3061 after hours).

- Other Preventive Measures
  - Workers handling potentially contaminated articles should be educated about the modes of transmission, care of skin abrasions and personal cleanliness. Protective clothing should be worn.
  - In industries handling raw animal materials, there should be proper dust control and adequate ventilation.
  - There should be continuous medical supervision of employees who are at risk for handling contaminated articles, and prompt medical care should be provided in the event of suspicious skin lesions.
  - Appropriate rules should be established for preventing anthrax exposure in workplaces that pose a risk for such exposure, such as strict hand washing and changing clothes after work.
  - All animal materials with potential contamination must be disinfected, as described above, prior to being sold or processed.
  - If anthrax is suspected to be the cause of an animal death, the carcass should be handled with care. Necropsy is not recommended. Instead, a blood sample should be collected for culture. If a necropsy is inadvertently performed, autoclave, incinerate or chemically disinfect/fumigate all instruments or materials. Soil seeded by carcasses or discharges should be decontaminated with 5% lye, anhydrous calcium oxide (quick lime).