Anthrax

CHAPTER CONTENT

The following chapter is adapted with permission from Alberta Health, for additional guidance related to the management of anthrax see: Alberta Public Health Disease Management Guidelines: Anthrax.

1. CASE DEFINITION

Confirmed Case

- Clinical illness* with laboratory confirmation of infection (pre- or post-mortem):
  - Isolation of *Bacillus anthracis* from an appropriate clinical specimen (e.g., blood, sputum, pus, lesion swab)** ***OR***
  - Detection of *B. anthracis* by immuno-fluorescence in an appropriate clinical specimen (e.g., blood)***

Probable Case

- Suspect case with detection of *B. anthracis* nucleic acid (e.g., PCR) in an appropriate clinical specimen (e.g., blood, CSF, biopsy tissue)

Suspect Case

- Clinical illness in a person who is epidemiologically linked**** to a confirmed or suspected animal case or contaminated animal product

*Clinical illness is characterized as an acute onset of symptoms characterized by several distinct clinical forms, including the following:

- Cutaneous:
  - Clinical illness is characterized by the appearance of small, painless, but often pruritic papules
  - As the papule enlarges, it becomes vesicular and, within 2 days, ulcerates to form a distinctive black eschar, with surrounding edema
- Inhalation:
  - Clinical illness is characterized by an upper respiratory flu-like syndrome that after a few days takes a fulminant course, manifested by dyspnea, cough, chills, and a high-grade bacteremia
- Intestinal:
  - Clinical illness is characterized by abdominal pain, fever, and signs of septicaemia
- Oropharyngeal:
  - Clinical illness is characterized by a painless mucosal lesion in the oral cavity, with cervical adenopathy, edema, pharyngitis, fever, and possibly septicaemia
- Meningeal:
  - Clinical illness is characterized by fever, convulsions, coma, or meningeal signs
  - Signs of another form will likely be evident as this syndrome is usually secondary to the above syndromes

**Appropriate clinical specimens for *B. anthracis* isolation requires:

- Notifying the laboratory prior to specimen collection and indicating suspected organisms on requisition
- For more information, and to find the most current specimen collection and submission information see: Alberta Public Health Laboratory

***Refer to the National Microbiology Laboratory (NML) Guide to Services for current specimen collection and submission information.

****In NWT, epidemiological link is more likely to be direct contact with an infected bison or soil or other environmental material contaminated with the carcass of an infected bison. Contact through animal products is generally rare but could occur if an individual butchers a clinically ill bison, or infected mammal meat was imported.

2. DIAGNOSIS

- Diagnosis is based on clinical illness coupled with laboratory confirmation and informed by clinical history
- Identifying the source of exposure is critical
- Primary culture from clinical specimens is done at the Provincial Laboratory for Public Health (PLPH)
- Primary identification is based on:
  - Non-motile
  - Non-haemolytic

  - Penicillin susceptibility (some strains may produce a slowly active penicillinase)
  - Susceptibility to gamma bacteriophage
  - Presence of capsule using a Giemsa stain
- PLPH has a PCR test (Roche) that can be used to confirm *B. anthracis* from culture, but not directly on a clinical specimen
- Positive specimens are sent on to the National Microbiology Laboratory (NML) in Winnipeg for additional confirmation
- Public health intervention would occur based on the testing done at the PLPH
- Enzyme-linked immunosorbent assay (ELISA) serology is not performed at the PLPH but is forwarded to either the NML or Centers for Diseases Control in Atlanta
- For more information, refer to the Public Health Laboratories (formerly ProvLab) - Laboratory Services

3. REPORTING

Health Care Professionals

- Confirmed, probable, or suspect cases are to be reported to the Office of the Chief Public Health Officer (OCPHO) by telephone (867) 920-8646 **immediately** after diagnosis is made or opinion is formed ***AND***
- Complete and fax (867) 873-0442 the Communicable Disease Reporting Form to the OCPHO within **24 hours**
- **Immediately** report all outbreaks or suspect outbreaks by telephone (867) 920-8646 to the OCPHO.

Laboratories

- Report all positive results to the OCPHO by telephone (867) 920-8646 **immediately *AND***
- Fax (867) 873-0442 all positive results to the OCPHO **within 24 hours.**

Additional Reporting Requirements

- Under federal legislation: *Health of Animals Act – Reportable Diseases Regulation* anthrax is a reportable disease
- If a case or outbreak of anthrax in an animal(s) is suspected or confirmed, this should be reported to the Chief Veterinarian Officer (CVO)/Environment and Natural Resources Wildlife Veterinarian
- The CVO will serve as the primary point of contact with key animal health organizations, including the Canadian Food Inspection Agency, provincial/territorial animal health units, and diagnostic laboratories

4. OVERVIEW

Causative Agent

- *Bacillus anthracis*, is a gram-positive, encapsulated, spore-forming, non-motile rod (bacteria)
- Anthrax spores are ubiquitous and can survive in soil and dried or processed hides for hundreds of years
- Spores are formed within a few hours if *B. anthracis* are exposed to air
- Anthrax is a zoonotic disease considered endemic in the range of the Mackenzie, Slave River Lowlands, and Wood Buffalo National Park bison populations ranging in the Northwest Territories, in which there have been repeated sporadic outbreaks
- Between 1962 and 2016, there have been 23 documented anthrax outbreaks resulting in the deaths of over 2,265 bison
- Most outbreaks have occurred in the Slave River Lowlands and adjacent Wood Buffalo National Park, with 3 outbreaks in the Mackenzie bison range

Clinical Presentation and Major Complications

For information regarding Clinical Presentation and Major Complications see Alberta Public Health disease management guidelines: Anthrax.

Transmission

- Humans become infected by skin contact, ingestion, or inhalation of spores originating from products of infected animals
- The most common method of transmission of anthrax is through direct contact with an infected animal or by contact with contaminated hair, wool, hides, or products made from them such as rugs, drums, or brushes
- *B. anthracis* may enter the body through a pre-existing skin lesion or may be inadvertently introduced through an injury
- The result of the source transmission is cutaneous anthrax
- Transmission may also occur through contact with soil associated with infected animals or contaminated bone meal used in gardening
- Transmission from person to person is very rare
- Animals ingest or inhale the spores in large numbers
  - Between 1000 and 10,000 spores are required to establish an infection in animals, and bacterial toxins can kill large herbivores rapidly, often within a few days
  - After the animal dies, the bacteria can be released back into the environment through discharges from body orifices, leaking from breaks in the skin of bloated animals, or when the carcass is opened by scavengers
  - Humans are rarely infected in this way
- Vectors such as flies and vultures may mechanically spread the organism, but vectors are not believed to be important in human infection

- Meat from infected animals can transmit *B. anthracis* if the meat from a clinically infected bison is eaten and undercooked
  - It is advised not to eat the meat from a *B. anthracis* infected animal
- *B. anthracis* can also be transmitted by inhalation of airborne or aerosolized spores
  - In nature, *B. anthracis* spores are two to six microns in diameter
  - If aerosolized by industrial processing of contaminated products, or as a result of a bioterrorist attack, particles less than five microns in diameter quickly fall from the atmosphere and bond to any surface
  - The particles are difficult to resuspend in the air and may remain in the environment for years
  - Spores 2 to 5 microns in diameter behave as a gas and move through the environment without settling
    - Spores of this size are able to pass through the pores in paper, as occurred in US mail processing facilities subsequent to the anthrax attacks in 2001
    - Particles less than 5 microns in diameter, if inhaled, are small enough to reach the lower respiratory tract and can lead to inhalation anthrax

Incubation Period

- The incubation period is determined by the route of exposure
  - **Cutaneous anthrax**: ranges from 12 hours to 12 days
  - **Inhalation anthrax**: generally, 1-7 days, but may be as long as 43 days
    - Antibiotics may also prolong the incubation period if given in sub-therapeutic dose
  - **Intestinal** and **oropharyngeal anthrax**: 1-7 days

Clinical Guidance

- For patient-specific clinical management consult your local healthcare professional, paediatrician, infectious disease specialist, or NWT Clinical Practice Guidelines

5. PUBLIC HEALTH MEASURES

- Airborne or aerosolized anthrax spores have been used as bioterrorism agents
- For more information on how to identify and handle suspicious packages, refer to Public Health Agency of Canada: Handling Suspicious Packages
- In the NWT, the most likely route of human exposure would be through direct contact with bison carcasses or hides during active anthrax outbreak

Key Investigation

- Investigate the possible source of exposure taking into consideration the incubation period, reservoir, and mode of transmission. Assessment may include:
  - Recent history of travel
  - Occupation

  - Contact with animal sources
  - Awareness of documented cases of anthrax (well reported as a reportable disease)
- Identify all individuals who may have had contact with the same source of infection
- Determine the nature of exposure

Management of Cases

- One human case is deemed a public health emergency
- Consultation with an infectious disease specialist is essential
- Important to identify other individuals who may have been in contact with source of anthrax (usually one or more bison mortalities)
- Since transmission from person to person is very rare, strict quarantine is not required
- Persons with draining lesions should be cared for using routine contact precautions
- Dressings with drainage from the lesions should be appropriately disposed of as biohazardous waste

Management of Contacts

- Person to person transmission has not been documented
- Consultation with an infectious disease specialist is essential
- Advise all persons who have accidentally handled anthrax-infected material to thoroughly scrub arms, hands and fingernails with liquid soap and hot water immediately after discovery of exposure
- These steps must be taken before the anthrax organisms have time to form spores

Prevention

- The disease is an occupational hazard of workers who process hides, hair, wool, bone, and bone products, as well as laboratory workers, veterinarians, agricultural workers, and wildlife biologists, officers, and harvesters who are at risk of handling infected animals
  - Given the integral role of animal's and their hides, bones, hair, and wool to the cultural practices of the NWT Indigenous populations, it is essential that healthcare workers recognize the potential risk to these populations, while also respecting the significance and longevity of these cultural practices
- These populations should be provided education regarding modes of transmission, signs of anthrax in bison and how to avoid contact, care of skin abrasions, and personal cleanliness
  - Protective clothing should be worn
  - There should be continuous medical supervision of employees who are at risk for handling contaminated articles
  - 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 handwashing and changing clothes after work

  - In Canada, the anthrax vaccine is not recommended for the public and is only accessible through Health Canada's Special Access Program
  - Telephone: 1 (613) 941-2108
  - Fax: 1 (613) 941-3194
  - In the NWT, anthrax vaccine is recommended for Environment and Natural Resources staff who may be involved in the diagnosis or management of anthrax outbreaks in bison, in addition to use of appropriate PPE and biosecurity measures
  - At least 6 weeks are required for immunity to develop after vaccination, so planning is required prior to the potential anthrax season for best protection
  - Chief Veterinarian may consult with OCPHO (or designate)
  - For more information see the Anthrax Emergency Response Plan
- Provide education about the modes of transmission, care of skin abrasions, and handwashing to members of the public visiting areas where anthrax is known to exist
- Educate the public regarding the importance of handwashing after touching animals
- Control disease in animals
  - Immunize at-risk livestock/domestic animals annually
    - Anthrax vaccination of free-ranging bison is currently not a viable option
    - Rapid detection, disinfection, incineration of bison carcasses and contaminated areas, and scavenger prevention are the primary tools for controlling the disease in free-ranging bison populations
  - Symptomatic livestock or domestic animals can be treated with penicillin or tetracycline
  - Treatment is not functionally feasible in free-ranging wildlife
  - Control of the disease in humans ultimately depends on control of disease in animals
- Industries handling raw animal materials should ensure proper dust control and adequate ventilation in facilities
- Autopsy and invasive procedures
  - Use routine practices
  - Instruments and areas 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
- Animal Deaths
  - The carcass and associated contaminated soil should be handled with care and follow the guidance outlined in the Anthrax Emergency Response Plan (ENR)
  - Necropsy is **not recommended**; instead, a swab for carcass-side diagnostics and laboratory culture should be collected
    - In older carcasses, turbinate bones can be collected for culture
  - If a necropsy is performed, all instruments must be autoclaved, incinerated, and/or chemically disinfected, and anyone involved must be wearing appropriate PPE

- All other materials must be treated chemically and/or incinerated and disposed
- Animal carcasses and associated soil should be treated with 10% bleach solution and subsequently incinerated
- For more information on safe handling practices, see the Environment and Natural Resources (ENR) website and the Anthrax Emergency Response Plan.
- Laboratory safety:
  - Laboratory workers who handle anthrax-contaminated specimens must observe appropriate infection control precautions
  - Biosafety level 3 practices are required
  - Refer to the current Pathogen Safety Data Sheet for anthrax

6. PUBLIC & HEALTH PROFESSIONAL EDUCATION

For more information about anthrax:

- Health Canada: Canada/Anthrax
- Centers for Disease Control and Prevention: CDC/Anthrax
- Government of the Northwest Territories Environment and Natural Resources-Anthrax Emergency Response Plan

7. EPIDEMIOLOGY

- There have been 4 documented human cases of anthrax in the NWT, including 2 in 1952 and 2 in 1963
- All 4 personnel were involved in the response and management of anthrax outbreaks in bison and involved cutaneous lesions that responded to antibiotic treatment
- Anthrax has been notifiable in Canada since 1979 with a total of 23 cases reported from 1931 to 1977
- An outbreak of anthrax was reported in the summer of 2006 in NWT and occurred in free-ranging wood bison in the eastern Slave River Lowlands (SRL)
- For more information on the epidemiology of anthrax in NWT wildlife, see: Anthrax Emergency Response Plan.
- For more information on the epidemiology of anthrax in the NWT see: Epidemiological Summary of Communicable Diseases HSS Professionals.

8. REFERENCES

Information from this chapter was adapted with permission from Alberta Health's Public Health Notifiable Disease Management Guidelines Anthrax.

Additional resources used for this chapter include:

1. Government of the Northwest Territories Environment and Natural Resources- Anthrax Emergency Response Plan: https://www.enr.gov.nt.ca/sites/enr/files/resources/anthrax_emergency_response_plan_aerp_155a.pdf