ANTHRAX

(Malignant Edema, Malignant Pustule, Woolsorter's Disease, Charbon, Ragpicker's Disease)

REPORTING INFORMATION

- **Class A:** ***Report immediately via telephone*** the case or suspected case and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report immediately via telephone to the local public health department in which the reporting health care provider or laboratory is located. Local public health departments should report immediately via telephone the case or suspected case and/or a positive laboratory result to the Ohio Department of Health (ODH).
- Reporting Form(s) and/or Mechanism:
  - *Immediate telephone reporting* is required.
  - The local health department should enter the case into the Ohio Disease Reporting System (ODRS) within 24 hours after the telephone report
  - The Centers for Disease Control and Prevention (CDC) Anthrax Case Investigation Form is available for use to assist in local disease investigation. Information collected from the form should be entered into ODRS and the form should be uploaded under the administration module in ODRS
- Key fields for ODRS reporting include: import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset, and all the fields in the Epidemiology module.

AGENT

Bacillus anthracis, a Gram-positive, encapsulated, spore-forming, non-motile rod. This organism is found in a vegetative state in humans and animals. When exposed to air, it forms spores which are highly resistant to physical and chemical agents. The spores live for years in contaminated soils.

CASE DEFINITION

Clinical Description

An illness or post-mortem examination characterized into several clinical types, including:

Cutaneous anthrax: It usually begins as a small, painless, pruritic papule on an exposed surface, which progresses through a vesicular stage into a depressed black eschar; the eschar is often surrounded by edema or erythema and may be accompanied by lymphadenopathy. Fever is also common.

Ingestion anthrax: presents as two sub-types:

- Oropharyngeal: When anthrax spores germinate in the oropharynx, a mucosal lesion may be observed in the oral cavity or oropharynx. Symptoms include sore throat, difficulty swallowing, and swelling of the neck. Less specific symptoms include fever, fatigue, shortness of breath, abdominal pain, and nausea/vomiting; the symptoms may resemble a viral respiratory illness. Cervical lymphadenopathy, ascites, and altered mental status may be observed.
- Gastrointestinal: When anthrax spores germinate in the lower gastrointestinal tract, symptoms include abdominal pain, nausea, vomiting or diarrhea (either of which may contain blood), and abdominal swelling. Less specific symptoms

such as fever, fatigue, and headache are also common. Altered mental status and ascites may be observed.

Inhalation anthrax: Often described as a biphasic illness. Early nonspecific symptoms of inhalation anthrax include fever and fatigue. Localized thoracic symptoms such as cough, chest pain, and shortness of breath follow, as may non-thoracic symptoms such as nausea, vomiting, abdominal pain, headache, diaphoresis, and altered mental status. Lung sounds are often abnormal and imaging often shows pleural effusion or mediastinal widening.

Injection anthrax: Usually presents as a severe soft tissue infection manifested as significant edema or bruising after an injection. No eschar is apparent, and pain is often not described. Nonspecific symptoms such as fever, shortness of breath, or nausea are sometimes the first indication of illness. Occasionally patients present with meningeal or abdominal involvement. A coagulopathy is not unusual.

Additional considerations:

1. Signs of systemic involvement from the dissemination of either the bacteria and / or its toxins can occur with all types of anthrax and include fever or hypothermia, tachycardia, tachypnea, hypotension, and leukocytosis. One or more of these signs are usually present in patients with ingestion anthrax, inhalation anthrax, and injection anthrax and may be present in up to a third of patients with cutaneous anthrax.
2. Anthrax meningitis may complicate any form of anthrax, and may also be a primary manifestation. Primary symptoms include fever, headache (which is often described as severe), nausea, vomiting, and fatigue. Meningeal signs (e.g., meningismus), altered mental status, and other neurological signs such as seizures or focal signs are usually present. Most patients with anthrax meningitis have cerebral spinal fluid (CSF) abnormalities consistent with bacterial meningitis, and the CSF is often described as hemorrhagic.

Clinical Criteria

- For surveillance purposes, an illness with at least one specific **OR** two non-specific symptoms and signs that are compatible with cutaneous, ingestion, inhalation, or injection anthrax; systemic involvement; or anthrax meningitis; **OR**
- A death of unknown cause **AND** organ involvement consistent with anthrax.

Laboratory Criteria for Diagnosis

Presumptive laboratory criteria for *Bacillus anthracis* or *Bacillus cereus* expressing anthrax toxins:

- Gram stain demonstrating Gram-positive rods, square-ended, in pairs or short chains;
- Positive result on a test with established performance in a CLIA-accredited laboratory.

Confirmatory laboratory criteria for *Bacillus anthracis* or *Bacillus cereus* expressing anthrax toxins:

- Culture and identification from clinical specimens by Laboratory Response Network (LRN);
- Demonstration of *B. anthracis* antigens in tissues by immunohistochemical staining using both *B. anthracis* cell wall and capsule monoclonal antibodies;

- Evidence of a four-fold rise in antibodies to protective antigen between acute and convalescent sera or a fourfold change in antibodies to protective antigen in paired convalescent sera using CDC quantitative anti-PA immunoglobulin G (IgG) ELISA testing in an unvaccinated person;
- Detection of *B. anthracis* or anthrax toxin genes by the LRN-validated polymerase chain reaction and/or sequencing in clinical specimens collected from a normally sterile site (such as blood or CSF) or lesion of other affected tissue (skin, pulmonary, reticuloendothelial, or gastrointestinal);
- Detection of lethal factor (LF) in clinical serum specimens by LF mass spectrometry.

Case Classification

Suspected: A case that meets the clinical criteria **AND** for whom an anthrax test was ordered, but with no epidemiologic evidence relating it to anthrax.

Probable:

- A case that meets the clinical criteria **AND** has presumptive laboratory test results, **OR**
- A case that meets the clinical criteria **AND** has an epidemiologic evidence relating it to anthrax.

Confirmed: A case that meets the laboratory criteria **AND** has confirmatory laboratory test results.

Comments

Epidemiologic Linkage

- Exposure to environment, food, animal, materials, or objects that are suspected or confirmed to be contaminated with *B. anthracis*;
- Exposure to the same environment, food, animal, materials, or objects as another person who has laboratory-confirmed anthrax;
- Consumption of the same food as another person who has laboratory-confirmed anthrax.

Criteria to Distinguish a New Case from an Existing Case

Case not previously reported to public health authorities.

SIGNS AND SYMPTOMS

See case definition. Cutaneous anthrax is the most common form. The mortality rate is 5%-20% in untreated patients. Inhalation anthrax can present as respiratory distress with fever and shock. The mortality rate in inhalation anthrax is 85%-100%. Ingestion anthrax rarely occurs. The gastrointestinal sub-type of ingestion anthrax tends to occur in outbreaks following consumption of contaminated meat from anthrax-infected animals. The mortality rate is estimated to be 40%. The oropharyngeal sub-type of ingestion anthrax is characterized by edematous lesions, necrotic ulcers and swelling in the oropharynx and neck. Patients with injection anthrax most commonly have serious localized soft tissue infections accompanied by significant soft tissue edema. The mortality rate 21%. Injection anthrax symptoms are similar to those of cutaneous anthrax but can spread through the body faster and be harder to recognize and treat than cutaneous anthrax.

DIAGNOSIS

All specimens are sent to the ODH Laboratory, which will then forward them to the Centers for Disease Control and Prevention (CDC), as necessary. Specimens should be

collected before starting antimicrobial therapy. Culture will likely be negative if clinical specimens are collected after initiating antimicrobial therapy, regardless of the form of disease (cutaneous, ingestion, inhalation, injection anthrax). However, other tests not requiring viable organism may be positive after antimicrobial use.

Serology

Serology testing will only be conducted in paired serum samples submitted at the same time, including an acute (≤7 days after symptom onset) and a convalescent-phase (14–35 days after symptom onset) specimen. It is recommended that the convalescent-phase specimen be taken 2 weeks after the acute specimen. Five ml of serum is needed for serology testing.

Culture and Isolation

Isolation of the organism from lesions, blood or discharges. Organism isolation and polymerase chain reaction (PCR) testing can be done at ODH Laboratory. Immunofluorescence studies are done at CDC. For blood isolation, collect 10 cc of blood in a sterile Vacutainer serum separator tube. For cutaneous lesions use two dry sterile swabs. Soak both swabs in the clear serous fluid of the lesion or ring of lesions. If the lesion has a black eschar, slightly moisten both swabs in sterile saline or broth and rotate carefully under the edge of the eschar to avoid its detachment from the skin.

Swab 1 - Immediately prepare a smear for gram stain and another for DFA. Air-dry both smears and gently heat-fix both.

Swab 2 - Place in a dry sterile tube or silica gel pack (as is used for strep).

Transport all specimens by messenger at ambient temperatures to ODHL.

For further details, in the Infectious Disease Control Manual, see Microbiology Client Services Manual, Section 4 (see - Select Agent/Biothreat Agent (Clinical specimens), and Appendix N: Biothreat Agent Submission Information for Clinical Samples).

EPIDEMIOLOGY

Source

Infected animals, contaminated animal products or environmental contamination by spores from these sources. Also, eating raw or undercooked meat from infected animals. Anthrax associated with heroin injection has occurred in Europe; this has not been reported in the US.

Occurrence

Worldwide, but primarily in enzootic areas in developing countries among those individuals who work with livestock, eat insufficiently cooked meat from infected animals, or work in establishments where wool, goatskins and pelts are processed. In the United States, human anthrax is rare, with only one to two human cases reported annually. The last case in Ohio was reported in 1964. In 2001, an intentional release of anthrax spores through the U.S. postal system resulted in 11 cutaneous and 11 inhalational cases.

Mode of Transmission

Cutaneous anthrax is contracted by direct contact with contaminated animal tissues, pelts, wool or fur. Inhalation anthrax results from inhalation of spores from contaminated wool or pelts and the intestinal form is acquired from eating contaminated meat or animal byproducts. Transmission between humans is unusual. Insects can act as mechanical vectors. In Europe, cases have occurred among persons injecting heroin. *Bacillus anthracis* is a biologic warfare agent and potential terrorist weapon, as it can be aerosolized to expose large groups of people via

inhalation.

Period of Communicability
Articles and soil contaminated with spores can remain infective for decades.

Incubation Period
From 1-7 days; incubation period of up to 60 days is possible.

PUBLIC HEALTH MANAGEMENT

Case

Investigation
Search for history of exposure to infected animals, contact or employment in industry working with hides, pelts, bone meal or other animal products, or heroin injection. If there are multiple cases, consider terrorist activity.

Treatment
Ciprofloxacin is recommended. If the isolate is susceptible, doxycycline and amoxicillin are acceptable alternatives.

From the: Use of Anthrax Vaccine in the United States: Recommendations of the Advisory Committee on Immunization Practices, 2019— Recommendations and Reports / December 13, 2019 / 68(4);1–14:
The U.S. Food and Drug Administration (FDA) has approved three antitoxin treatments for inhalation anthrax: anthrax immune globulin intravenous (AIGIV) obiltoxaximab (Anthim), and raxibacumab (ABthrax) . These therapeutics are held in the Strategic National Stockpile, and requests for use must be made to CDC. All three antitoxins are indicated in all adults and children for the treatment of inhalation anthrax due to *B. anthracis,* in combination with appropriate antimicrobial drugs. In addition, anthrax vaccine adsorbed (AVA) (i.e., BioThrax) is FDA-approved as a 3-dose post-exposure prophylaxis (PEP) series, along with antimicrobials, to prevent anthrax in adults exposed to *Bacillus anthracis*. PEP and treatment recommendations exist for multiple populations, including children, pregnant women and nursing mothers, and adults for conventional and mass casualty settings.

Consult the CDC anthrax website for up-to-date information on treatment protocols.

Isolation and Follow-up Specimens
There is no isolation requirement. The convalescent serum specimen should be drawn 14 -35 days after the acute specimen.

Public Health Significance
Person-to-person transmission is not common. Important to identify source, if possible, as others may have similar contact (work or home) and may also contract disease. Spores remain viable for decades in soil. If bioterrorism is suspected, post-exposure prophylaxis may be recommended for persons who may have been exposed to the spores. Post-exposure prophylaxis would include antimicrobials (such as ciprofloxacin or doxycycline) and possibly anthrax vaccine. Please note that there is an existing standing medical order issued by the Director of the Ohio Department of Health for Ohio local health departments in an emergency situation to dispense prophylactic antibiotics and to provide anthrax vaccine to persons with known or suspected exposure to *Bacillus anthracis*. For further details, refer to standing orders for public health emergencies.

Contacts
Depending on the type of anthrax case (cutaneous, inhalation, ingestion, or injection) and case history, look for others with similar exposure in family, co-workers, or community.

Prevention and Control
Educate workers handling potentially contaminated materials. Control dust in hazardous industries. Disinfect wool, bonemeal, and other animal products before processing. Consult state public health officials for advice on disposal of contaminated carcasses.

Source Investigation
In animal product manufacturing plants, follow-up testing may be done. If an animal is involved, contact the Ohio Department of Agriculture, Division of Animal Health, 8995 East Main Street, Reynoldsburg, Ohio 43068, 614-728-6220 or 800-300-9755.

Vaccination
Anthrax vaccine adsorbed (AVA) protects against anthrax. It does **not** contain any anthrax bacteria and **cannot** give people anthrax. It is not typically available to the general public. The vaccine is approved by the Food and Drug Administration (FDA) for two different situations.

1. Routine Occupational Use (Before Possible Exposure)
Anthrax vaccine is approved for use in three groups of adults 18 to 65 years of age who may be at risk of coming in contact with anthrax because of their job. These at risk adults will receive the vaccine before exposure:
- Certain laboratory workers who work with anthrax.
- Some people who handle animals or animal products, such as some veterinarians.
- Some members of the United States military.

To build up protection against anthrax, these groups should get **5 shots** of anthrax vaccine over 18 months. To stay protected, they should get annual boosters. The shots are injected into a muscle (intramuscular).

People who should **not** get the anthrax vaccine for routine occupational use include:
- Pregnant women.
- Anyone who has had a serious allergic reaction to a previous dose of anthrax vaccine.
- Anyone who has a severe allergy to any component of the anthrax vaccine. Anyone with severe allergies, including allergy to latex, should tell their doctor.

For anyone with a moderate or severe illness, their doctor might ask them to wait until they recover to get the vaccine. People with mild illness can usually be vaccinated.

2. Post-Event Emergency Use (After Possible Exposure)
In November 2015, FDA also approved the vaccine for use **after** exposure to anthrax for people 18 through 65 years of age. In certain situations, such as a bioterrorist attack involving anthrax, anthrax vaccine might be recommended to prevent the disease in people after they have been exposed to the anthrax germs. If this were

to happen, people who were exposed would get **3 shots** of anthrax vaccine over 4 weeks plus a 60-day course of antibiotics.

During an emergency, the **only** people who should **not** get the anthrax vaccine after possible exposure are those who have had a serious allergic reaction to a previous dose of anthrax vaccine. These people would receive the 60-day course of antibiotics only.

What is anthrax?
Anthrax is an infection caused by a bacterial organism called *Bacillus anthracis*. The disease can be spread between animals and humans, but most people and animals become ill from exposure to soil containing spores where animals with anthrax have died. The recent use of anthrax by terrorists and the possibility of spreading anthrax for the purpose of warfare have increased the public's awareness of this disease.

Although anthrax can be found anywhere in the world, it is most common in the developing countries of South and Central America, Eastern Europe, Asia, Africa, the Caribbean and the Middle East. Anthrax is also present in the Western United States which is where human cases of anthrax typically occur. Ohio is not endemic for Anthrax.

Who can get anthrax?
Anthrax is typically a disease of sheep, cattle, horses, goats, and swine; but humans and other mammals can also become infected.

How is anthrax transmitted?
The bacterium exists in the soil in the form of spores. Spores are inactive forms of the bacteria that can survive for decades. Humans and other animals can become infected through contact with infectious spores from animals, animal hide, or contaminated environments. It cannot spread from person to person.

There are four types of anthrax in humans caused by different routes of infection.
- Cutaneous anthrax is caused by touching the spores (soil, animal fur, etc)
- Inhalation anthrax is caused by breathing in airborne spores
- Ingestion anthrax is caused by eating undercooked animal meat or other animal byproducts containing anthrax spores
- Injection anthrax has been seen in northern Europe in people injecting heroin.

How long after exposure before symptoms appear?
The first symptoms usually occur within seven days, but typically within 48 hours.

What are the symptoms of anthrax?
Symptoms of disease vary depending on how the disease was contracted.

Cutaneous: Most anthrax infections occur when the bacterium enters a cut or abrasion. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a small blister and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black area in the center. Lymph glands in the adjacent area may swell. Five to 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy. Cutaneous anthrax symptoms can include**:**
- A group of small blisters or bumps that may itch
- Swelling can occur around the sore
- A painless skin sore (ulcer) with a black center that appears after the small blisters or bumps
- Most often the sore will be on the face, neck, arms, or hands

Inhalation: Initial symptoms may resemble a common cold. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax is usually fatal. Inhalation anthrax symptoms can include:

- Fever and chills
- Chest Discomfort
- Shortness of breath
- Confusion or dizziness
- Cough
- Nausea, vomiting, or stomach pains
- Headache
- Sweats (often drenching)
- Extreme tiredness
- Body aches

Ingestion: The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases. Gastrointestinal anthrax symptoms can include:

- Fever and chills
- Swelling of neck or neck glands
- Sore throat
- Painful swallowing
- Hoarseness
- Nausea and vomiting, especially bloody vomiting
- Diarrhea or bloody diarrhea
- Headache
- Flushing (red face) and red eyes
- Stomach pain
- Fainting
- Swelling of abdomen (stomach)

Injection: Symptoms may be similar to cutaneous anthrax, however, there may be infection deep under the skin or in the muscle where the drug was injected. Injection anthrax results in death in 21% of cases. Injection anthrax symptoms can include:

- Fever and chills
- A group of small blisters or bumps that may itch, appearing where the drug was injected
- A painless skin sore with a black center that appears after the blisters or bumps
- Swelling around the sore
- Abscesses deep under the skin or in the muscle where the drug was injected

How is anthrax diagnosed?

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

How is anthrax treated?

Anthrax can be treated with antibiotics. The earlier anthrax is treated, the higher the chances of recovery. If left untreated, anthrax can be fatal.

Is there a vaccine for anthrax?
There are effective vaccines for both animals and humans. The anthrax vaccine is currently provided only to people who are at increased risk of coming in contact with anthrax spores, such as members of the U.S. military, certain laboratory workers, and some people who handle animals or animal products (farmers, veterinarians, and livestock handlers). The vaccine is not licensed for use in children under age 18, adults over 65 or pregnant or nursing women.

How can I prevent anthrax?

- When visiting countries where anthrax is common, humans should avoid contact with livestock and animal products.
- Avoid eating meat that has not been properly slaughtered and cooked.
- Do not open suspicious looking mail or packages

For more information visit these websites.
CDC Anthrax website: http://www.cdc.gov/anthrax/index.html