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## Anthrax

### Overview <sup>(1,2)</sup>

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in wild and domestic mammalian species (cattle, sheep, goats, camels, antelopes, and other herbivores), but it can also occur in humans when they are exposed to infected animals or to tissue from infected animals or when anthrax spores are used as a bioterrorist weapon.<sup>5</sup>

***Anthrax is a potential bioterrorism weapon. The key identifying sign for anthrax is a widened mediastinum (present in about 80% of patients). A widened mediastinum, if present, will be visible on x-ray 2-3 days after onset of symptoms. If you suspect that you are dealing with a bioterrorism situation, contact your Senior Epidemiology Specialist for the District, or the Department of Health and Senior Service's Situation Room (DSR) at 800-392-0272.***

For a more complete description of anthrax, refer to the following texts:


- *Control of Communicable Diseases Manual*. (CCDM), American Public Health Association. 19th ed. 2008.
- American Academy of Pediatrics. *Red Book: 2009 Report of the Committee on Infectious Diseases*. 28th ed. 2009.

### Case Definition <sup>(3)</sup>

#### ***Clinical description***

An illness with acute onset characterized by several distinct clinical forms, including the following:

- **Cutaneous Anthrax:** An acute illness, or post-mortem examination revealing a painless skin lesion developing over 2 to 6 days from a papular through a vesicular stage into a depressed black eschar with surrounding edema. Fever, malaise and lymphadenopathy may accompany the lesion.
- **Inhalation Anthrax:** An acute illness, or post-mortem examination revealing a prodrome resembling a viral respiratory illness, followed by hypoxia, dyspnea or acute respiratory distress with resulting cyanosis and shock. Radiological evidence of mediastinal widening or pleural effusion is common.
- **Gastrointestinal Anthrax:** An acute illness, or post-mortem examination revealing severe abdominal pain and tenderness, nausea, vomiting, hematemesis, bloody diarrhea, anorexia, fever, abdominal swelling and septicemia.
- **Oropharyngeal Anthrax:** An acute illness, or post-mortem examination revealing a painless mucosal lesion in the oral cavity or oropharynx, with cervical adenopathy, edema, pharyngitis, fever, and possibly septicemia.

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- Meningeal Anthrax: An acute illness, or post-mortem examination revealing fever, convulsions, coma, or meningeal signs. Signs of another form will likely be evident as this syndrome is usually secondary to the above syndromes.

***Laboratory criteria for diagnosis***

- Isolation of *Bacillus anthracis* from a clinical specimen, or
- Anthrax electrophoretic immunotransblot (EITB) reaction to the protective antigen and/or lethal factor bands in one or more serum samples obtained after onset of symptoms, or
- Demonstration of *B. anthracis* in a clinical specimen by immunofluorescence.

***Case classification***

*Confirmed:* A clinically compatible illness with one of the following:

- Culture and identification of *B. anthracis* from clinical specimens by the 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 Centers for Disease Control and Prevention (CDC) quantitative anti-PA IgG ELISA testing.
- Documented anthrax environmental exposure AND evidence of *B. anthracis* DNA (for example, by LRN-validated polymerase chain reaction) 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).


*Probable:* A clinically compatible illness that does not meet the confirmed case definition, but with one of the following:

- Epidemiological link to a documented anthrax environmental exposure.
- Evidence of *B. anthracis* DNA (for example, by LRN-validated polymerase chain reaction) 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);
- Positive result on testing of clinical serum specimens using the Quick ELISA Anthrax-PA kit.
- Detection of Lethal Factor (LF) in clinical serum specimens by LF mass spectrometry.
- Positive result on testing of culture from clinical specimens with the RedLine Alert test.<sup>(4)</sup>

**Information Needed for Investigation**

**Verify the diagnosis.** What laboratory tests were conducted? What were the results? What are the patient’s clinical symptoms?

**Establish the extent of illness.** Determine if household or other close contacts are, or have been, ill by contacting the health care provider, patient or family members.

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## **Notification And Control Measures**

### **If terrorist activity is suspected:**

- Contact appropriate law enforcement authorities.
- Contact the Senior Epidemiology Specialist for the District, or the Department of Health and Senior Services' Situation Room (DSR) at 800-392-0272 (24/7) immediately upon learning of a suspected case. Complete the "[Suspicious Substance Data Collection Questionnaire](#)" for an incident with a known source of exposure (e.g., white powder in an envelope).
- Complete the "Missouri Department of Health and Senior Services, [Anthrax Case Investigation Form](#)" for an incident with an unknown source of exposure (e.g., people coming into an emergency room with symptoms consistent with anthrax exposure).

### **General follow-up:**

- Determine the source of infection to prevent other cases:
  - Does the case work with animals, especially sheep, cattle, goats, or their products?
  - Has the case been exposed to recent excavation sites or to places where animal products are handled?
  - Has the case traveled out of the country, especially to places where anthrax is currently known to be occurring? Contact your District Communicable Disease Coordinator for a list of countries.
  - Does the case or his/her close associates know of any other similar cases?


**NOTE:** If the case has no remarkable travel history and is not employed in an occupation that is prone to exposure, a bioterrorism event *must* be considered. Determine **all** activities of the case within the previous six days, particularly attendance at events with large numbers of people. Notify the Senior Epidemiology Specialist for your District or the DSR at 800-392-0272.

### **Control Measures:**

See the *Control of Communicable Diseases Manual*. (CCDM), American Public Health Association. 19th ed. 2008, Anthrax, "Methods of control."

See the American Academy of Pediatrics. *Red Book: 2009 Report of the Committee on Infectious Diseases*. 28th ed. 2009. Anthrax, "Control Measures."

Naturally occurring anthrax stems from animal origins. Although this disease is rarely transmitted person-to-person, body substance precautions for the duration of illness are indicated for cases. Identification and control of contaminated exposure sites is paramount.

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## **Laboratory Procedures**

The State Public Health Laboratory (SPHL) currently conducts the following tests for *Bacillus anthracis*:

### **Testing available/ estimated turnaround times:**

- **Presumptive results:**
  - Real-time PCR (polymerase chain reaction): 4 hours
  - TRF (time-resolved fluorescence): 4 hours
- **Confirming test:**
  - Culture: Turn-around time on culturing specimens is 24-hours minimum for a “presumptive,” complete identification and positive confirmation would depend on how quickly the organisms grew and other variables. Usually, identification is complete in 48 hours, but it can take up to three to four days.

Additional information on laboratory procedures can be obtained from the District Communicable Disease Coordinator or from staff at the SPHL. The SPHL web site is: <http://www.dhss.mo.gov/Lab/index.html>. (February 3, 2011)


## **Reporting Requirements**

Anthrax is a Category IA disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services immediately upon first knowledge or suspicion by telephone (800-392-0272), facsimile or other rapid communication.

1. For confirmed and probable cases, complete a “Disease Case Report” (CD-1).
2. For confirmed and probable cases, complete a “Record of Investigation of Communicable Disease” (CD-2) for non-bioterrorism exposures only.
3. Entry of the completed CD-1 into WebSurv negates the need for the paper CD-1 to be forwarded to the District Health Office.
4. Send the completed secondary investigation form to the District Health Office. All outbreaks or “suspected” outbreaks must be reported as soon as possible (by phone, fax, or e-mail) to the District Communicable Disease Coordinator. This can be accomplished by completing the Missouri Outbreak Surveillance Report (CD-51).
5. Within 90 days from the conclusion of an outbreak, submit the final outbreak report to the District Communicable Disease Coordinator.

## **DHSS Health Alerts and Related Information**

Current health alerts related to Anthrax or other Bioterror information is available on the DHSS website at: <http://www.dhss.mo.gov/emergencies/ert/alertsadvisories/archive.php> (February 3, 2011)

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1. *Control of Communicable Diseases Manual*. Anthrax. In: Heymann, DL, ed. 19<sup>th</sup>ed. Washington, D.C.: American Public Health Association, 2008: 22-30.
2. American Academy of Pediatrics. Anthrax. In: Pickering, LK, ed. *Red Book: 2009 Report of the Committee on Infectious Diseases*. 28<sup>th</sup> ed. Elk Grove Village, IL.: 211-214.
3. CDC. *Nationally Notifiable Infectious Conditions (2010)*  
[http://www.cdc.gov/ncphi/disss/nndss/casedef/antrax\\_current\\_1.htm](http://www.cdc.gov/ncphi/disss/nndss/casedef/antrax_current_1.htm) (February 3, 2011)
4. Missouri Department of Health and Senior Services, Bureau of Communicable Disease Control and Prevention, surveillance case definition.
5. CDC. *Questions and Answers About Anthrax*  
<http://emergency.cdc.gov/agent/anthrax/faq/> (February 3, 2011)

## **Other Sources of Information**

1. Martin Gregory, Friedlander Arthur “*Bacillus anthracis* (Anthrax)” Eds. Gerald L. Mandell, John E. Bennett, & Raphael Dolin, Mandell, Douglas and Bennett’s Principles and Practice of Infectious Diseases, 7<sup>th</sup> ed. New York: Elsevier, 2010: 2715 – 2725.
2. Brachman, Phillip S and Arnold F Kaufmann. “Anthrax”.. Bacterial Infections of Humans: Epidemiology and Control. 3<sup>rd</sup> ed. Eds Alfred S Evans and Phillip S Brachman. New York: Plenum, 1998: 95-107.
3. The Merck Veterinary Manual. 8<sup>th</sup> Ed. Ed. Susan E. Aiello. Whitehouse Station, NJ: Merck & Co., Inc., 1998: 432, 2162. <http://www.merckvetmanual.com/mvm/index.jsp> (search “anthrax”). (February 3, 2011)
4. U.S. Army Medical Research Institute of Infectious Diseases. *Medical Management of Biologic Casualties Handbook*. 6<sup>th</sup> ed. April, 2005: 17-24. [PDF](#) (February 3, 2011)

## **Web Resources and Information**

1. World Health Organization Emerging and other Communicable Diseases Surveillance and Control, “Guidelines for the Surveillance and Control of Anthrax in Humans and Animals.  
[http://www.who.int/csr/resources/publications/anthrax/WHO EMC\\_ZDI\\_98\\_6/en/](http://www.who.int/csr/resources/publications/anthrax/WHO EMC_ZDI_98_6/en/) (February 3, 2011)
2. Todar, Kenneth, Todar’s Online Textbook of Bacteriology.  
<http://www.textbookofbacteriology.net/> (Search “Anthrax”) (February 3, 2011)
3. Cranmer, Hilarie and Mauricio Martinez. “CBRNE – Anthrax Infection” eMedicine Journal, October 26, 2009, Vol 8, No 2 <http://www.emedicine.com/emerg/topic864.htm> (February 3, 2011)
4. Department of Defense. Anthrax Vaccine Immunization Program.  
<http://www.anthrax.osd.mil> (February 3, 2011)
5. Center for Infectious Disease Research & Policy Academic Health Center. University of Minnesota. “Anthrax: Current, comprehensive information on pathogenesis, microbiology, epidemiology, diagnosis, treatment, and prophylaxis.”  
<http://www.cidrap.umn.edu/cidrap/content/bt/anthrax/biofacts/anthraxfactsheet.html> (February 3, 2011)