

Control of Communicable Diseases Manual

James Chin, MD, MPH, Editor

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800 I Street, NW

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ANTHRAX ICD-9 022; ICD-10 A22

(Malignant pustule, Malignant edema, Woolorter disease, Ragpicker disease)

1. Identification—An acute bacterial disease that usually affects the skin, but which may very rarely involve the oropharynx, mediastinum or intestinal tract. In cutaneous anthrax, itching of an exposed skin surface occurs first, followed by a lesion that becomes papular, then vesicular and in 2-6 days develops into a depressed black eschar. The eschar is usually surrounded by moderate to severe and very extensive edema, sometimes with small secondary vesicles. Pain is unusual and, if present, is due to edema or secondary infection. The head, forearms and hands are common sites of infection. The lesion has been confused with human orf (see Orf virus disease). Untreated infections may spread to regional lymph nodes and to the bloodstream with an overwhelming septicemia. The meninges can become involved. Untreated cutaneous anthrax has a case-fatality rate between 5% and 20%, but with effective antibiotic therapy, few deaths occur. The lesion evolves through typical local changes even after the initiation of antibiotic therapy.

Initial symptoms of inhalation anthrax are mild and nonspecific and may include fever, malaise and mild cough or chest pain; acute symptoms of respiratory distress, x-ray evidence of mediastinal widening, fever and shock follow in 3-5 days, with death shortly thereafter. Intestinal anthrax is rare and more difficult to recognize, except that it tends to occur in explosive food poisoning outbreaks; abdominal distress is followed by fever, signs of septicemia and death in the typical case. An oropharyngeal form of primary disease has been described.

Laboratory confirmation is made by demonstration of the causative organism in blood, lesions or discharges by direct polychrome methylene blue (M'Fadyean)-stained smears or by culture or inoculation of mice, guinea pigs or rabbits. Rapid identification of the organism by using immunodiagnostic testing, ELISA and PCR may be available in certain reference laboratories.

2. Infectious agent—*Bacillus anthracis*, a Gram-positive, encapsulated, spore forming, nonmotile rod.

3. Occurrence—Primarily a disease of herbivores; humans and carnivores are incidental hosts. Anthrax is an infrequent and sporadic human infection in most industrialized countries. It is an occupational hazard primarily of workers who process hides, hair (especially from goats), bone and bone products and wool; and of veterinarians and agriculture and wildlife workers who handle infected animals. Human anthrax is endemic in those agricultural regions of the world where anthrax in animals is common; these include countries in South and Central America, southern and eastern Europe, Asia and Africa. New areas of infection in livestock may develop through introduction of animal feed containing contaminated

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bone meal. Environmental events such as floods may provoke epizootics. Anthrax is considered a leading potential agent in bioterrorism or biowarfare and, as such, could present in epidemiologically unusual circumstances.

4. Reservoir—Animals (normally herbivores, both livestock and wildlife) shed the bacilli in terminal hemorrhages or spilt blood at death. On exposure to the air, the vegetative forms sporulate, and the spores of *B. anthracis*, which are very resistant to adverse environmental conditions and disinfection, may remain viable in contaminated soil for many years. *B. anthracis* is a soil commensal in many parts of the world. Bacterial growth and spore density in soil are enhanced by flooding or other ecological conditions. Soil can also be contaminated by vultures, which spread the organism from one area to another after feeding on anthrax infected carcasses. Dried or otherwise processed skins and hides of infected animals may harbor the spores for years and are the fomites by which the disease is spread worldwide.

5. Mode of transmission—Cutaneous infection is by contact with tissues of animals (cattle, sheep, goats, horses, pigs and others) dying of the disease; possibly by biting flies that had partially fed on such animals; by contact with contaminated hair, wool, hides or products made from them, such as drums, brushes or rugs; or by contact with soil associated with infected animals or contaminated bone meal used in gardening. Inhalation anthrax results from inhalation of spores in risky industrial processes— such as tanning hides and processing wool or bone—where aerosols of *B. anthracis* spores may be produced. Intestinal and oropharyngeal anthrax arise from ingestion of contaminated undercooked meat; there is no evidence that milk from infected animals transmits anthrax. The disease spreads among grazing animals through contaminated soil and feed; among omnivorous and carnivorous animals through contaminated meat, bone meal or other feeds; and among wildlife from feeding on carcasses infected with anthrax. Accidental infections may occur among laboratory workers.

In 1979, an outbreak of largely inhalation anthrax occurred in Yekaterinburg (Sverdlovsk), Russia, in which 66 individuals were documented to have died of anthrax and 11 infected persons were known to have survived; many other cases are presumed to have occurred, investigations disclosed that the cases occurred as the result of a plume emanating from a biological research institute and led to the conclusion that the outbreak had resulted from an accidental aerosol generated in work related to biological warfare studies.

6. Incubation period—From 1 to 7 days, although incubation periods up to 60 days are possible. (In the Sverdlovsk outbreak, incubation periods extended up to 43 days.)

7. Period of communicability—Transmission from person to person is very rare. Articles and soil contaminated with spores may remain infective for decades.

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8. Susceptibility and resistance—Uncertain; there is some evidence of inapparent infection among people in frequent contact with the infectious agent; second attacks can occur, but reports are rare.

9. Methods of control—

A. Preventive measures:

1) Immunize high risk persons with a cell-free vaccine prepared from a culture filtrate containing the protective antigen (available in the USA from the Bioprot Corporation, 3500 N. Martin Luther King, Jr., Boulevard, Lansing MI 48909). **Evidence indicates that this vaccine is effective in preventing cutaneous and inhalational anthrax; it is recommended for laboratory workers who routinely work with *B. anthracis* and workers who handle potentially contaminated industrial raw materials. It may also be used to protect military personnel against potential exposure to anthrax used as a biological warfare agent. Annual booster injections are recommended if the risk of exposure continues.** [Emphasis added]

2) Educate employees who handle potentially contaminated articles about modes of anthrax transmission, care of skin abrasions and personal cleanliness.

3) Control dust and properly ventilate work areas in hazardous industries, especially those that handle raw animal materials. Maintain continuing medical supervision of employees and provide prompt medical care of all suspicious skin lesions. Workers should wear protective clothing and have adequate facilities for washing and changing clothes after work. Locate eating facilities away from places of

work. Vaporized formaldehyde has been used for terminal disinfection of textile mills contaminated with *B. anthracis*.

4) Thoroughly wash, disinfect or sterilize hair, wool and bone meal or other feed of animal origin prior to processing.

5) Do not sell the hides of animals exposed to anthrax or use their carcasses as food or feed supplements (i.e., as bone or blood meal).

6) If anthrax is suspected, do not necropsy the animal but aseptically collect a blood sample for culture. Avoid contamination of the area. If a necropsy is inadvertently performed, autoclave, incinerate or chemically disinfect/fumigate all instruments or materials.

Because the anthrax spores may survive for decades if the carcasses are buried, the preferred disposal technique is to incinerate the carcasses at the site of death or to remove them to a rendering plant, ensure no contamination en route to the plant. Should these methods be impossible, deeply bury carcasses at the site of death, if possible; do not burn them on

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open fields. Decontaminate soil seeded by carcasses or discharges with 5% lye or anhydrous calcium oxide (quicklime). Deeply buried carcasses should be covered with quicklime.

7) Control effluents and trade wastes from rendering plants that handle potentially infected animals and those from factories that manufacture products from hair, wool, bones or hides likely to be contaminated.

8) Promptly immunize and annually reimmunize all animals at risk. Treat symptomatic animals with penicillin or tetracyclines; immunize these animals after cessation of therapy. They should not be used for food until a few months have passed. Treatment in lieu of immunization may be used for animals exposed to a discrete source of infection, such as contaminated commercial feed.

B. Control of patient, contacts and the immediate environment:

1) Report to local health authority: Case report obligatory in most states and countries, Class 2A (see Communicable Disease Reporting). Also report to the appropriate livestock or agriculture authority. Even a single case of human anthrax, especially of the inhalational variety, is so unusual that it should be reported immediately to both public health and law enforcement authorities for consideration of a bioterrorist source.

2) Isolation: Standard precautions for the duration of illness for cutaneous and inhalation anthrax. Antibiotic therapy sterilizes a skin lesion within 24 hours, but the lesion progresses through its typical cycle of ulceration, sloughing and resolution.

3) Concurrent disinfection: Of discharges from lesions and articles soiled therewith. Hypochlorite is sporicidal and good when organic matter is not overwhelming and the item is not corrodable; hydrogen peroxide, peracetic acid or glutaraldehyde may be alternatives; formaldehyde, ethylene oxide and cobalt irradiation have been used. Spores require steam sterilization, autoclaving or burning to ensure complete destruction. Fumigation and chemical disinfection may be used for valuable equipment. Terminal cleaning.

4) Quarantine: None.

5) Immunization of contacts: None.

6) Investigation of contacts and source of infection: Search for history of exposure to infected animals or animal products and trace to place of origin. In a manufacturing plant, inspect for adequacy of

preventive measures as outlined in 9A, above. As mentioned in 9B1, a potential bioterrorist source may need to be ruled out for all human cases of anthrax, especially for those cases with no obvious occupational source of infection.

7) Specific treatment: Penicillin is the drug of choice for cutane-

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ous anthrax and is given for 5-7 days. Tetracyclines, erythromycin and chloramphenicol are also effective. The U.S. military recommends parenteral ciprofloxacin or doxycycline for inhalational anthrax; the duration of therapy is not well defined.

C. Epidemic measures: Outbreaks may be an occupational hazard of animal husbandry. The occasional epidemics in the USA are local industrial outbreaks among employees who work with animal products, especially goat hair. Outbreaks related to handling and consuming meat from infected cattle have occurred in Asia, Africa and the former Soviet Union.

D. Disaster implications: None, except in case of floods in previously infected areas.

E. International measures: Sterilize imported bone meal before use as animal feed. Disinfect wool, hair and other products when indicated and practical.

F. Bioterrorism measures: During 1998, more than two dozen anthrax threats were made in the USA. None of these threats was real. The general procedures in the USA for dealing with these civilian threats include the following:

- 1) Anyone who receives a threat about dissemination of anthrax organisms should notify the local office of the Federal Bureau of investigation (FBI) immediately.
- 2) In the USA, the FBI has primary responsibility for the investigation of such biological threats, and all other agencies are to cooperate and provide assistance as requested by the FBI.
- 3) Local and state health departments should be notified also and be ready to provide any public health management and follow-up that may be needed.
- 4) Persons who may have been exposed to anthrax are not contagious, so quarantine is not appropriate.
- 5) Persons who may have been exposed should be advised to await laboratory results and need not be placed on chemoprophylaxis. If they become ill before laboratory results are available, they should immediately contact their local health department and proceed to a predetermined emergency care unit, where they should inform the attending staff of their potential exposure.
- 6) If the threat of exposure to aerosolized anthrax is credible or confirmed, persons at risk should begin postexposure prophylaxis with both an appropriate antibiotic (fluoroquinolones are the drugs of choice; doxycycline is an alternative) and vaccine. Postexposure immunization with an inactivated, cell-free anthrax vaccine is indicated in conjunction with

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chemoprophylaxis following a proven biologic incident. Immunization is recommended because of the uncertainty of when or if inhaled spores may germinate. Postexposure immunization consists of three injections: as soon as possible after exposure and at 2 and 4 weeks after exposure. This vaccine has not been evaluated for safety and efficacy in children less than 18 years of age or adults 60 [sic] years of age or older.

7) All first responders should follow local protocols for incidents involving biological hazards.

8) Responders can be protected from anthrax spores by donning splash protection, gloves and a full face respirator with high-efficiency particle air (HEPA) filters (Level C) or self-contained breathing apparatus (SCBA) (Level B).

9) Persons who may have been exposed and are potentially contaminated should be decontaminated with soap and copious amounts of water in a shower. Usually no bleach solutions are required. A 1:10 dilution of household bleach (i.e., a final hypochlorite concentration of 0.5%) should be used only if there is gross contamination with the agent and an inability to remove the materials through soap and water decontamination. The use of bleach decontamination is recommended only after soap and water decontamination, and the solution should be rinsed off after 10 to 15 minutes.

10) All persons who are to be decontaminated should remove their clothing and personal effects and place all items in plastic bags, which should be labeled clearly with the owner's name, contact telephone number and inventory of the bag's contents. Personal items may be kept as evidence in a criminal trial or returned to the owner if the threat is unsubstantiated.

11) If the suspect envelope or package associated with an anthrax threat remains sealed (not opened), then first responders should not take any action other than notifying the FBI and packaging the evidence. Quarantine, evacuation, decontamination and chemoprophylaxis efforts are NOT indicated if the envelope or package remains sealed. For incidents involving possibly contaminated letters, the environment in direct contact with the letter or its contents should be decontaminated with a 0.5% hypochlorite solution following a crime scene investigation. Personal effects may be decontaminated similarly.

12) Technical assistance can be provided immediately by contacting the National Response Center at 800-424-8802 or the local Weapons of Mass Destruction Coordinator of the FBI.