

# **Anthrax: Facts and Nothing But the Facts**

By Katherine West, BSN, MEd, CIC

It became evident on September 11 that life has changed in the United States forever. It changed even more as a result of events that began in late September with the mailing of anthrax-tainted letters, which made our vulnerability seem even more evident. The mailing of anthrax-tainted letters was not designed to kill large numbers of people; it was designed to create fear. And create fear it did.

It also began to create confusion in the fire/EMS community regarding dealing with an exposure and/or an infected patient. Some of the many questions raised include: Is there risk for the care provider? How do we decon the vehicle? Are we exposed? How is this disease really transmitted? This article will assist in answering these questions and get EMS providers on track for understanding the risk.

## **History of Anthrax**

Anthrax is caused by a bacterium called *Bacillus anthracis* (a spore-forming Gram-positive bacillus). This organism can cause an acute infectious disease. Anthrax has been recorded for over 11,000 years. Early Egyptians provided the first well-written accounts. It also has a special place in history because it was the first human disease studied that was linked to a specific pathogen.

This disease is most commonly associated with hoofed animals such as goats, cows, sheep and pigs, which acquire anthrax by ingesting spores in contaminated soil. With onset of dry weather, the bacteria undergo "sporulation" (multiple fission). A spore is a protective coating that surrounds the bacteria and protects them from changes in the environment. Spores can survive for decades in soil and in workplaces.<sup>(1)</sup> These bacteria are found naturally in soil samples from all over the world. Anthrax is sometimes transmitted from animals to humans who eat infected meat that is not properly cooked. The bacteria are able to invade the animal host because they are resistant to host phagocytic response. Once in the body, the bacteria produce a toxin.

Anthrax occurs regularly in the United States. There are cases reported almost every year, usually in the Midwest regions of Texas, Oklahoma and the lower Mississippi Valley. Case numbers in this country are very low because we have had vaccine programs in place for many years. In the United States, the vaccine is offered to animal handlers, lab personnel working with anthrax bacteria and persons who work with animal products such as hides. In fact, in the past, anthrax was termed "wool sorter's" disease because it was found in persons who worked with infected goat hair.

In the United States, there were approximately 224 cases of anthrax reported between 1955 and 1994. Of these, 11 were inhalation anthrax; there were 20 deaths. In 2000, cases reported in Minnesota and North Dakota did not draw any attention because this disease is naturally occurring; however, the cases were published by the Centers for Disease Control and Prevention in August 2000.

The cases were related to ingestion of meat from an infected steer, discovered when several members of a farm family became ill with ingestion anthrax.(2) Although inhalation anthrax represents only about 5% of reported cases in the past, it is the primary means of transmission seen in recent cases. In 2001, there were 18 cases of anthrax—seven cutaneous and 11 inhalation—all related to tainted letters. Five deaths resulted from inhalation anthrax.(3)

### **Pathogenesis**

While spores can live for decades in the environment, they cannot multiply or grow. The presence of one or a few spores in any given area does not mean that there is risk for infection. In order for these spores to grow and multiply, they must enter a human host. Upon entry into the body, germination to the vegetative form begins. This is followed by extracellular multiplication and toxin production. Once in the body, these bacteria are virulent. The dose usually needed for infection to occur is 3,000 to greater than 10,000 spores.(4) This dose rate is based on prior history of the disease from animals to humans. The dose is not as clear when it comes to research-grade anthrax, as was present in the letter sent to Senator Tom Daschle. The dose rate of 5,000 to 10,000 spores seemed to hold in an outbreak that occurred in Russia in 1979, which was related to research-grade anthrax.(5)

### **Modes of Transmission**

Anthrax is caused by one spore-forming bacterium that has three ways in which it can be transmitted: cutaneous, inhalation and ingestion.

Cutaneous (skin) anthrax can be acquired when nonintact skin comes into *direct* contact with this bacterium. Once direct contact occurs, infection may result. The process may take 2–6 days or up to 10 days. It begins with intense itching at the site of inoculation, followed by swelling and the appearance of a pustule. Edema around the lesion is thought to be from toxin production. Pustules are most often located on forearms, hands and the head. A black area, caused by tissue death, then appears in the center of the pustule.(1) Only about 50% of patients complain of fever or malaise. If not treated, this may develop into a bacteremia.

Inhalation of the spores can result in infection. Usually, a dose of 8,000–10,000 or more spores is needed to cause infection. However, if a victim is immunocompromised, a smaller dose may cause infection, as was seen in several of the recent cases. With inhalation anthrax, signs and symptoms include: nonproductive cough, fever, chills, vomiting, fatigue/malaise, shortness of breath and chest discomfort. These symptoms can be distinguished from the flu by the absence of runny nose, rhinitis and purulent sputum.(5) If not treated, the infection can progress to tightening in the chest, chest pain and respiratory distress over a 2–10-day time frame.

The third way in which this disease can be transmitted is via ingestion of contaminated meat. Less than 1% of the reported cases have occurred by ingestion. Signs and symptoms include abdominal pain, nausea, vomiting of

blood or bloody diarrhea, followed by a high fever. The time frame from ingestion to active disease is about 2–3 days.(1,2,6)

### **Risk for Transmission from Patient to Care Provider**

Anthrax is not transmitted from an exposed or infected patient to another person. Therefore, healthcare providers are not at risk for infection from direct patient care. This is an infectious disease, *not* a communicable disease. (1,4,5)

#### *Exposed Patient:*

Following exposure to anthrax, exposed persons will not require EMS transport. The incubation time (the time in which an exposed person can come down with signs/symptoms) varies with the type of exposure. For cutaneous and ingestion exposure to anthrax, the incubation period is 1–7 days. For inhalation exposure, the incubation period is 2–60 days.

Exposed persons will be advised to remove contaminated clothing and store it in plastic bags. They should shower and wash with plain soap and water. This will be done at the site of the exposure and handled by hazmat team members as a precautionary measure. Transport to a medical facility is not indicated.(4,5)

#### *Suspect Infected/Symptomatic Patient:*

EMS personnel caring for or transporting patients who have confirmed infection or are suspect for anthrax infection need no additional personal protective equipment other than following routine body substance isolation (BSI). The use of gloves when in contact with skin lesions or nonintact skin and, as always, good handwashing technique are recommended. The anthrax organism is not airborne, even if the person has inhalation anthrax; therefore, a mask is not needed.(5,7)

#### *Decontamination Following Transport:*

Post-transport care of a patient known to be infected or suspect for infection does not require any special cleaning activities. Routine cleaning with standard cleaning agents is appropriate. Anthrax spores can be killed using a dilution of bleach and water. The proper dilution is one tablespoon of bleach per gallon of water.(7,8)

### **Treatment**

Treatment for anthrax exposure or infection is readily available. In the case of an exposure event, antibiotics will be administered prophylactically. This approach was most evident following the exposure in Senator Daschle's office. The first medication that was offered was ciprofloxacin (Cipro), 500 mg. twice daily for 60 days to those who had direct exposure. Follow-up laboratory work was conducted and, if appropriate, the drug was changed to doxycycline, 100 mg. twice daily. For persons allergic to penicillin, doxycycline or tetracycline was prescribed.

Anthrax vaccine can also be offered post-exposure. If administered, it is given in three doses: one directly after exposure, then two and four weeks after exposure. If the vaccine is given in conjunction with antibiotics, the antibiotics can be stopped after four weeks.(4) There has been some controversy over the anthrax vaccine after it was refused by military staff, who claimed it had severe side effects. The vaccine was then pulled by the FDA and sent through a process to refine it and reduce possible side effects.

## Summary

It has long been suspected that anthrax would be used in a bioterrorism attack. The fact that this did occur was alarming; however, this event can be looked at several ways. First, the mailing of anthrax-tainted letters was not designed to kill large numbers of people. It was designed to create terror, which it did. However, there were more than 10,000 people exposed and tested. There were 18 cases of the illness and five deaths. Compare this to the fact that each year in the U.S., more than 12,000 people die from the flu. That never seems to get much attention. When putting case numbers into perspective, one must always look at the numerator as well as the denominator.

Second, country and health experts have learned a great deal from this experience. Now, there is a system in place for drug stockpiling to have large amounts of drugs more readily available.

Third, more physicians and hospitals are aware of signs and symptoms for biologic agent disease, and labs have more training on rapid testing to confirm a diagnosis.

Finally, the population is more in tune to becoming educated on these issues, because this type of event is now real. Education remains the key to reducing fear and risk in any setting.

## References

1. Koltz S. Anthrax. *Infectious Diseases* 186:1291–1293. Philadelphia: W.B. Saunders & Co., 1992.
2. Human ingestion of bacillus anthracis-contaminated meat: Minnesota, August 2000. *MMWR* 49(36): 813–816, 2001.
3. CDC Update: Current case count. *MMWR*, 2001.
4. Swartz MN. Recognition and management of anthrax– an update. *JAMA* 1–5 (advance printing), 2001.
5. Anthrax: Separating fact and fiction. *ICP Report*, pp. 181–184, 2001.
6. Bioterrorism readiness plan: A template for healthcare facilities. *APIC Core Curriculum*. Association for Professionals in Infection Control and

Epidemiology, 2000.

7. West KH. *Infectious Disease Handbook for Emergency Care Personnel*, 3<sup>rd</sup> Edition. ACGIH, 2001.
8. Turnbull PC. *Bacillus*. *Medical Microbiology*, Chapter 15. Online version. [www.gsbs.utmb.edu/microbook/ch015.htm](http://www.gsbs.utmb.edu/microbook/ch015.htm).