



## **Anthrax - FAQs**

### **What is anthrax?**

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in grazing animals (cattle, sheep, goats, camels, antelopes, and other herbivores). Anthrax infection of humans can occur following contact with *B. anthracis* spores present in infected animals or on contaminated animal products. Alternatively, infection can also occur following the intentional release of anthrax spores as a biological weapon.

### **What are anthrax spores?**

Typically, in normal conditions, anthrax bacteria grow in a "vegetative" form, ie. they are actively living and replicating. However, when conditions become hostile, such as in the absence of nutrition or in the presence of environmental conditions perceived as harsh, the anthrax bacteria will become spores. Thus, when an animal dies, anthrax bacteria living on that animal may turn into spores. These spores are very hardy, do not replicate, and are resistant to drying, heat, ultraviolet radiation and many disinfectants. Five percent hypochlorite (eg. Clorox® bleach) or five percent paraformaldehyde have been shown to be effective at disinfecting anthrax spores. Anthrax spores are fairly sticky and once they fall onto a surface, they do not usually rise back into the air (human manipulation can change that, see later).

### **How is anthrax transmitted?**

Natural anthrax infection can occur in three forms: cutaneous, inhalation, and gastrointestinal. Infection with anthrax almost always involves the transmission of anthrax spores.

Cutaneous anthrax is the most common naturally occurring form of anthrax infection. Humans can become infected with anthrax by handling products from infected animals containing anthrax spores. These spores are introduced into the body under the skin through a cut or abrasion. Low level germination of the spores into vegetative bacteria then occurs at the primary site leading to swelling and tissue death at the point of entry.

Gastrointestinal anthrax occurs following swallowing of anthrax spores. These spores enter via some break in the surface lining of the gastrointestinal tract (eg. small intestine). However, it is still not known where germination of spores into active bacteria occurs.

Inhalational anthrax occurs when anthrax spores are breathed into the lungs. These spores may come from contaminated animal products or from a deliberate release into the environment. Immune system cells present in the lungs carry spores into the closest lymph nodes, such as the mediastinal lymph nodes, where germinated bacteria will continue to multiply.

### **How common is anthrax and who can get infected?**

Naturally occurring anthrax is most common in agricultural regions where it occurs in animals. When anthrax affects humans, it is usually due to an occupational exposure to infected animals or their products. Workers who are exposed to dead animals and animal products from other countries where anthrax is more common may become infected with *B. anthracis* (industrial anthrax). In the United States, where anthrax in animals is uncommon, there have been 224 cases of naturally occurring cutaneous anthrax from 1944 through 1994. Gastrointestinal anthrax is rare, with the most recent US incident of human ingestion of anthrax-contaminated meat occurring in August 2000. However, this incident did not result in actual gastrointestinal anthrax disease and this form of the disease has yet to be documented in the United States. Inhalational anthrax is also rare in the United States, with only 18 documented cases between 1900 and 1978, when the last naturally occurring case in the US was diagnosed.

### **What is the average risk of contracting anthrax?**

The danger of anthrax infection is limited only to people associated with a documented exposure to anthrax. Persons who have not been associated with these exposures are not at risk. Anthrax has not been shown to be contagious and so persons who have been in contact with anthrax-infected persons are also not at risk.

The risk of any individual in this country contracting a natural anthrax infection is infinitesimal as anthrax is rare in animals in the United States. The anthrax bacteria does not survive well outside an animal or human host. On the other hand, anthrax spores are hardy and are known to survive in protected environments for decades. However, studies suggest that a fairly large number of spores (2,500 to 55,000) must be inhaled to acquire inhalational anthrax.

### **How is anthrax used as a weapon of mass destruction?**

It is possible to chemically and/or mechanically manipulate the anthrax spores to increase the likelihood that contact with them will result in infection. For example, spores can be "milled" into a size (one-three microns) that would be optimal for inhalation deep into the lungs, specifically into the alveolar sacs. Spores can also be coated with an electrostatic powder so that they do not clump easily and fall to the ground quickly; these spores would then be more easily aerosolized (dispersed into the air). It is also possible to genetically engineer the anthrax bacteria before they turn into spores to make them more resistant to antibiotics. Then when these spores germinate into active bacteria inside an infected person, it would be much harder to treat him/her.

The deliberate release of anthrax spores into the environment would be typical of the use of anthrax as a weapon of mass destruction. The primary method of dissemination would be via the aerosolized release of anthrax spores. Such an aerosol would be odorless and invisible and would have the potential to travel many miles. Thus, the use of anthrax as a weapon of mass destruction would most likely show up as cases of inhalational anthrax.

The largest experience with inhalational anthrax occurred after the accidental release of aerosolized anthrax spores in 1979 at a military biology facility in Sverdlovsk, Russia. Some 79 cases of inhalational anthrax were reported, of which 68 were fatal. One of the major problems with anthrax spores is the potentially long incubation period of subsequent infections. Exposure to an aerosol of anthrax spores could cause symptoms as soon as 2 days after exposure. However, illness could also develop as late as six weeks after exposure — in Sverdlovsk, one case developed 43 days after exposure. Typically, symptoms appear at about 7-10 days after exposure.

In the current situation of anthrax spores contained within envelopes, the situation is different from that of an aerosolized release. Here, there will be opportunity for anthrax spores to come into direct contact with the body of the person and thus, cutaneous anthrax will likely occur from such an attack. Spores contained in the envelope can also become aerosolized should the envelope be jarred or opened or mechanically manipulated. Individuals in close proximity who then inhale these spores could then develop inhalational anthrax.

### **Is anthrax contagious?**

Anthrax has not been shown to be contagious.

### **Diagnosis**

#### **What are the symptoms of anthrax?**

Symptoms of disease vary depending on how the disease was contracted, but usually occur within 7 days.

**Cutaneous (skin) anthrax** accounts for 95 percent of all anthrax infections in the United States.

Cutaneous anthrax infections occur when the anthrax spores enter a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather or hair products of infected animals, or when handling deliberately contaminated objects such as mail envelopes. Skin infection begins about three to five days after introduction of the spores under the skin as a raised itchy, but painless papule that resembles an insect bite. Within 24 to 36 hours this primary sore develops into a vesicle and then a painless ulcer, usually one to three cm in diameter, with a characteristic black dying area in the center. Immune system cells called macrophages carry germinating bacteria to closest lymph nodes, which may swell. About 10

percent-20 percent of untreated cases of cutaneous anthrax may progress to systemic disease that can result in death. Deaths are rare with appropriate treatment with antibiotics.

**Inhalational anthrax** occurs when anthrax spores are breathed into the lungs. In order for the spores to enter deep into, and stay in, the lungs, the spores must be one to two microns in size. If they are smaller, they will be exhaled and if they are too large, they will either fall to the ground too rapidly to be inhaled, or they will not make it into the lungs and get caught in the upper portions of the respiratory tract. Spores that make it that far are then taken up by immune system cells called macrophages and transported to the closest lymph nodes, with the spores germinating into active bacteria en route. Anthrax bacteria then multiply in the lymph nodes causing bleeding in the chest cavity and spread throughout the body in the blood. Inhalational anthrax has been described as a disease with two distinct symptomatic courses. The first course is marked by symptoms frequently described as "flu-like." These include muscle aches and pains, malaise, a low-grade fever, a non-productive cough. Early in the course of disease, chest x-rays show a characteristic widening of the middle of the chest cavity and liquid draining from the membrane covering the lungs. This first phase of symptoms may last from hours to a few days and in some patients may be followed by a brief period of recovery. After one to three days, the disease takes on a rapid course with shortness of breath, strident cough and chills, and culminates in death. In the Sverdlovsk exposure, the mean time from appearance of symptoms to death was three days. Inhalational anthrax is usually fatal if antibiotic treatment is not given in time.

**Gastrointestinal anthrax** follows the consumption of meat contaminated with anthrax spores. The disease is characterized by an acute inflammation of the intestinal tract. Widening of the middle of the chest cavity (as seen via x-rays) has also been reported with cases of gastrointestinal anthrax. Associated symptoms include fever and diffuse abdominal pain with tenderness when pressed. There have been reports of both constipation and diarrhea, and stools are either dark-colored due to the presence of blood, or blood-tinged. Vomited material may also be blood-tinged. Within two to four days after symptoms appear, fluid develops in the abdominal cavity with a corresponding reduction in abdominal pain. Death is due intestinal break down or toxins secreted by the anthrax bacteria entering the blood stream. If the patient survives, symptoms will subside in about 10-14 days. Gastrointestinal anthrax results in death in 25 percent to 60 percent of cases. A less common form of gastrointestinal anthrax is oropharyngeal anthrax. Initial symptoms include swelling in the throat and neck and of the lymph nodes in that area. This may cause difficulty in swallowing and breathing difficulties. This form has a more favorable diagnosis.

### **How is anthrax diagnosed?**

Anthrax is diagnosed by isolating *B. anthracis* from the blood, skin lesions, or respiratory secretions, or by looking for antibodies developed by the infected person against anthrax. Stains that identify bacteria, culturing the bacteria, or biopsies can be used by most laboratories for diagnosing anthrax.

Nasal swab tests cannot be used to establish an anthrax diagnosis, and a negative nasal swab is not proof that the person has not been exposed to anthrax. These tests are used as part of the criminal investigations associated with apparent intentional release of anthrax spores and to aid in establishing presumptive epidemiologic clues. Specifically, nasal swabs are useful in combination with environmental sampling to arrive at a risk-based decision as to whether any further follow-up treatment or decontamination is required.

### **Who should receive a test for anthrax?**

Only persons associated with a suspected/documented anthrax exposure should seek testing.

### **How do you tell the difference between inhalational anthrax and the flu?**

It is difficult to differentiate between the symptoms of inhalational anthrax and the flu. Most important is whether the person has a suspected or documented exposure prior to the onset of symptoms. However, inhalational anthrax rarely presents with a runny nose or nasal congestion and the cough is generally non-productive and dry. Chest X-rays will reveal the widening of the middle of the chest cavity at this point and this is characteristic of inhalational anthrax.

## **Vaccine**

### **Is there an effective anthrax vaccine?**

An anthrax vaccine has been licensed for use in humans. In animal studies, the vaccine is reported to be 93 percent effective in protecting against anthrax.

### **What is the anthrax vaccine?**

The anthrax vaccine is manufactured and distributed by BioPort, Corporation, Lansing, Michigan. The vaccine is a cell-free filtrate vaccine, which means it contains no dead or live bacteria in the preparation. The final product contains no more than 2.4 mg of aluminum hydroxide as adjuvant. Adjuvants help the body's immune response react to the vaccine. Anthrax vaccines intended for animals should not be used in humans.

### **Should the public be vaccinated against anthrax?**

Access to the anthrax vaccine is limited to persons who are potentially at a high risk of exposure. The public's risk of exposure is exceedingly minimal at this time. Given this low level of risk, antibiotics provide the public a more realistic treatment for preventing anthrax following an exposure. If anthrax vaccine is readily available, persons with documented exposure to anthrax may be vaccinated in addition to treatment with antibiotics. This would be to provide protection against the potential of residual retained spores.

The current anthrax vaccine does not provide instant immunity. Once a person starts the vaccination regimen, it may take up to 18 months to develop effective immunity to anthrax although it is likely that some protection will be afforded earlier.

### **Who should be vaccinated against anthrax?**

The Advisory Committee on Immunization Practices has recommend anthrax vaccination for the following groups:

- Persons who work directly with the organism in the laboratory
- Persons who work with imported animal hides or furs in areas where standards are insufficient to prevent exposure to anthrax spores.
- Persons who handle potentially infected animal products in high-incidence areas. (Incidence is low in the United States, but veterinarians who travel to work in other countries where incidence is higher should consider being vaccinated.)
- Military personnel deployed to areas with high risk for exposure to the organism (as when it is used as a biological warfare weapon).
- Pregnant women should be vaccinated only if absolutely necessary.

### **What is the protocol for anthrax vaccination?**

The immunization consists of three injections given 2 weeks apart (weeks 0, 2, and 4) followed by three additional injections given at 6, 12, and 18 months. Annual booster injections of the vaccine are recommended thereafter. Effective immunity to anthrax has been documented following administration of the sixth dose at 18 months. In one monkey study, complete protection against inhalational anthrax was achieved 8 weeks after giving the second of two doses of the vaccine.

### **Are there adverse reactions to the anthrax vaccine?**

Mild local reactions occur in 30 percent of recipients and consist of slight tenderness and redness at the injection site. Severe local reactions are infrequent and consist of extensive swelling of the forearm in addition to the local reaction. Systemic reactions occur in less than 0.2 percent of recipients.

## **Treatment**

### **Is there a treatment for anthrax?**

In comparison to other biological agents, common strains of anthrax are readily treatable with antibiotics. However, there may exist anthrax strains that have been engineered to be resistant to certain antibiotics, such as the tetracyclines and the penicillins. To be effective, treatment against all anthrax strains must be initiated early. If left untreated, the disease can be fatal.

### **Who should seek treatment?**

It is critical that all persons with low-grade fever or evidence of systemic disease in an area associated with a documented anthrax exposure be treated with antibiotics by a physician, who can in turn report suspected cases to the public health department. This ensures appropriate treatment for the individual patient, and also ensures that appropriate public health action is activated for others who may be at risk of infection.

### **Why is ciprofloxacin (Cipro®) recommended for use against anthrax?**

Actually, several antibiotics can be used to treat anthrax. Which antibiotic is most effective depends on the strain of anthrax, how the disease was contracted, and the patient's profile. Ciprofloxacin can have serious toxic side effects and may not be appropriate for special patient populations.

In the event of a deliberate release of anthrax, it must be assumed that those responsible have access to anthrax strains that are engineered to be resistant to older antibiotics, like the tetracyclines and penicillins. Until laboratory testing demonstrates the nature of the anthrax strain, ciprofloxacin is recommended as the first line of treatment because engineering resistance to ciprofloxacin is much harder to do.

Once the antibiotic susceptibility of the anthrax strain has been determined, the most widely available, efficacious, and least toxic antibiotic should be administered to persons requiring post-exposure treatment.

### **What other antibiotics can be used against anthrax?**

Antibiotics from three classes are currently recommended for use against anthrax. Which antibiotic is used depends on the strain of anthrax, how the disease was contracted, and the patient's profile.

Doxycycline is the preferred option from the tetracycline class.

Penicillin G and amoxicillin are the preferred options from the penicillin class.

Ciprofloxacin is the preferred option from the fluoroquinolone class.

## **Prevention**

### **Will gas masks prevent anthrax?**

A gas mask is not a realistic defense. To adequately protect a person from anthrax spores, the masks need to be properly fitted to the person, usually specifically for that person. Surgical masks and cloth masks are too loose and will provide no protection against aerosolized anthrax spores.

### **Should antibiotics be taken to prevent anthrax?**

No one should take an antibiotic out of fear they might be exposed to anthrax at some indefinite future time. Only people involved in a confirmed anthrax exposure should take antibiotics. Overuse of the antibiotics by people worried about anthrax may cause a second wave of health problems.

Antibiotic resistance is a real and important threat right now. Taking antibiotics without an appropriate medical indication dramatically increases the risk of antibiotic resistance - both for the individuals taking the antibiotics and for everyone else.

All antibiotics have side effects that are a reasonable risk when measured against the benefit of treating an infectious disease. In the absence of an actual infection, only the risk remains.

**Should people buy and store antibiotics?**

There's no need to buy or store antibiotics. Stockpiling antibiotics increases the risk that symptoms not related to anthrax will prompt patients to initiate unnecessary treatment.

Additionally, stockpiling of antibiotics may cause shortages of the antibiotics depriving other persons who really need the antibiotics from getting them. This could result in severe illness or even death.

Antibiotics for the prevention of anthrax during an actual bioterrorism event are stockpiled by the government in several areas around the U.S. These emergency stockpiles can be delivered anywhere in the country within hours. This system has proven to be effective following the events of September 11 and the anthrax incidents in Florida and Washington, DC.

**What should an individual do about suspicious mail?**

Most people in the U.S. should never be naturally exposed to anthrax. Recent exposures to anthrax have come from deliberative incidents containing powdered anthrax spores, but there's no cause for panic. These envelopes were directed at specific individuals of significance in the United States. Here's what to do if you receive a letter or package that you suspect of containing anthrax or any other dangerous germs:

- Do not shake or empty the envelope or package. Do not try to clean up any spilled powder or fluid.
- Put the envelope or package into a plastic bag or other container to prevent the contents from leaking out. If you can't find a container, cover the envelope or package with clothing, paper, or a trash can — and DON'T remove this cover.
- Leave the room and close the door. Keep other people from entering the room.
- Wash your hands with soap and water.
- Call the local police and report the incident. If you are at work, call your building security officer and/or your supervisor.
- Make a list of all the people who were in the room when you opened the letter or package. Give this list to the police — and to local public-health authorities.
- Remove contaminated clothing and put it into a plastic bag that can be sealed. Give the bag of contaminated clothing to the police.
- Shower with soap and water as soon as you can. Do not use bleach or disinfectant on your skin.
- Do not start taking antibiotics until told to do so by your doctor or by health authorities.