

Anthrax: Disease fact sheet

Anthrax

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002301/>

Woolsorter's disease; Ragpicker's disease; Cutaneous anthrax; Gastrointestinal anthrax

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Anthrax is an infectious disease due to a type of bacteria called *Bacillus anthracis*. Infection in humans most often involves the skin, gastrointestinal tract, or lungs.

Causes, incidence, and risk factors

Anthrax commonly affects hooved animals such as sheep, cattle, and goats, but humans who come into contact with infected animals can get sick from anthrax, too. In the past, the people who were most at risk for anthrax included farm workers, veterinarians, and tannery and wool workers.

There are three main routes of anthrax infection:

Cutaneous anthrax occurs when anthrax spores touch a cut or scrape on the skin.

- It is the most common type of anthrax infection.
- The main risk is contact with animal hides or hair, bone products, and wool, or with infected animals. People most at risk for cutaneous anthrax include farm workers, veterinarians, and tannery and wool workers.

Inhalation anthrax develops when anthrax [spores](#) enter the lungs through the respiratory tract. It is most commonly contracted when workers breathe in airborne anthrax spores during processes such as tanning hides and processing wool.

Breathing in spores means a person has been exposed to anthrax, but it does not mean the person will have symptoms.

- The bacteria spores must "germinate" or sprout (the same way a seed might sprout before a plant grows) before the actual disease occurs. The process usually takes 1 to 6 days. Forty-three days is the longest known incubation period.
- Once the spores germinate, they release several toxic substances. These substances cause internal bleeding, swelling, and tissue death.

Gastrointestinal anthrax occurs when someone eats anthrax-tainted meat.

Anthrax may be used as a biological weapon or for bioterrorism. In 2001, anthrax sent through the U.S. Postal Service infected 22 people; 7 survivors had confirmed cutaneous anthrax disease.

Symptoms

Symptoms of anthrax differ depending on the type of anthrax.

Symptoms of cutaneous anthrax start 1 to 7 days after exposure:

- An itchy sore develops that is similar to an insect bite. This sore may blister and form a black ulcer (sore).
- The sore is usually painless, but it is often surrounded by swelling.
- A scab often forms, and then dries and falls off within 2 weeks. Complete healing can take longer.

Symptoms of inhalation anthrax:

- Begins with fever, [malaise](#), headache, cough, shortness of breath, and chest pain
- Fever and shock may occur later

Symptoms of gastrointestinal anthrax usually occur within 1 week and may include:

- Abdominal pain
- Bloody diarrhea
- Diarrhea
- Fever
- Mouth sores
- Nausea and vomiting (the vomit may contain blood)

Signs and tests

The tests to diagnose anthrax depend on the type of disease that is suspected.

A culture of the skin, and maybe a [biopsy](#), are done on the skin sores. The sample is looked at under a microscope to identify the anthrax germ.

Tests may include:

- Blood culture
- [Chest CT scan](#) or [chest x-ray](#)
- Spinal tap to check for infection around the spinal column (See: [CSF culture](#))
- Sputum culture

Fluid or blood samples may be sent to a special laboratory for more testing, including PCR, immunofluorescence, and immunohistochemistry.

Treatment

Most people with anthrax are treated with antibiotics. Several antibiotics are effective, including penicillin, [doxycycline](#), and [ciprofloxacin](#).

When treating inhalational anthrax, a combination of antibiotics should be used. Doctors often start treatment with [ciprofloxacin](#) plus another drug, given through a vein (intravenously). The length of treatment is about 60 days for people who have been exposed to anthrax, because it may take spores that long to germinate.

Cutaneous (skin) anthrax is treated with antibiotics taken by mouth, usually for 7 to 10 days. [Doxycycline](#) and ciprofloxacin are most often used.

Expectations (prognosis)

When treated with antibiotics, cutaneous anthrax is likely to get better. However, up to 20% of people who do not get treatment may die if anthrax spreads to the blood.

People with second-stage inhalation anthrax have a poor outlook, even with antibiotic therapy. Up to 90% of cases in the second stage are fatal.

Gastrointestinal anthrax infection can spread to the bloodstream, and may result in death.

Calling your health care provider

Call your health care provider if you have been exposed to anthrax, or if you develop symptoms of any type of anthrax.

Prevention

There are two main ways to prevent anthrax.

For people who have been exposed to anthrax (but have no symptoms of the disease), doctors may prescribe preventive antibiotics, such as [ciprofloxacin](#), penicillin, or [doxycycline](#), depending on the strain of anthrax.

An [anthrax vaccine](#) is available to military personnel and some members of the general public. It is given in a series of five doses over 18 months.

There is no known way to spread cutaneous anthrax from person to person. People who live with someone who has cutaneous anthrax do not need antibiotics unless they have also been exposed to the same source of anthrax.

References

1. Lucey DR, Anthrax. In: Goldman L, Ausiello D, eds. *Cecil Medicine*. 23rd ed. Philadelphia, Pa: Saunders Elsevier; 2007:chap 317.
2. Martin GJ, Friedlander Am. *Bacillus anthracis* (anthrax). In: Mandell GL, Bennett JE, Dolin R, eds. *Principles and Practice of Infectious Diseases*. 7th ed. Philadelphia, Pa: Elsevier Churchill Livingstone; 2009:chap 208.
3. Reissman DB, Whitney EA, Taylor TH Jr, et al. One-year health assessment of adult survivors of *Bacillus anthracis* infection. *JAMA*. 2004/291:1994-1998.

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Animal pest

http://www.daff.qld.gov.au/4790_11287.htm

General information

Anthrax is a bacterial disease of livestock, humans and dogs, often with fatal consequences. The major risk is that anthrax spores contaminate the environment and remain viable for many years, with the potential to infect further animals.

Overview

Scientific name	<i>Bacillus anthracis</i> (a large, square-ended, rod-shaped, capsulated, spore-forming bacillus).
Species affected	<ul style="list-style-type: none">• cattle and sheep (per-acute)• horses and goats (acute)• humans less than above• pigs and dogs not as susceptible.

Distribution Occurs throughout the world. Outbreaks can vary from sporadic cases to epidemic proportions depending on soil, climate and degree of contamination. In Australia, it occurs most commonly in New South Wales in what is known as the 'anthrax belt' (from Moree and Walgett down to the Victorian border from Corowa to Deniliquin). In Victoria, it occurs mainly along the Goulburn and Murray rivers. An outbreak has also occurred in West Australia. There was one isolated incident in Queensland on the Marlborough peninsula in 1994, and a further occurrence near Wandoan, originating from Dirranbandi in February 2002.

When the organism is exposed to air, spores are rapidly formed, contaminating the environment. Spores are resistant to most external influences. They can remain viable for at least 80 years but rarely persist beyond four years where soil moisture and microbial activity are high.

Epidemiology Outbreaks from contaminated soil always occur after a major climate change (i.e. rain following drought, and in warm weather when the temperature is over 15°C). Under the right conditions, anthrax spores may multiply vegetatively in the soil. Soil disturbance increases the risk of disease. Grazing abrasive forage in denuded pasture and around water points

increases the disease incidence when spores are present.

The organism can be spread within an area by dogs, wild birds, via water courses, and through faecal contamination of transports and articles by infected animals. Effluent from tanneries, run-off from infected soil, and carcasses can contaminate water. Infection can be introduced into a new area in any contaminated animal product, animal feed or an incubating infected animal. Rarely, blood-sucking insects are known to have carried the disease from an infected animal.

Infection enters the body by ingestion, inhalation or through skin injury. Ingestion does not invariably lead to disease development. Injury to the digestive tract mucous membrane will assist development but certainly disease can develop without injury. Pigs may become infected after ingesting contaminated blood and meat from carcasses, and cattle have been infected after chewing on old bones containing spores. Large outbreaks have resulted from contaminated feed additives such as bone flour and peanut meal. Inhalation is of minor importance in animals but contaminated dust can be a source. Wound contamination occasionally occurs.

In an uncontrolled outbreak, it is usual to have two series of events. The initial case, which may be by chance and involve only one animal, followed by secondary cases becoming infected from contamination by the initial case. This can be extensive if the animal is mobile until just prior to death. The incubation period is estimated as being between 2-14 days.

Cattle and sheep

Two forms of the disease occur in these species: per-acute and acute.

Per-acute:

Clinical signs

- sudden death after only 1-2 hours
- prior to death, the animal may show muscle tremor and respiratory problems
- death occurs after terminal convulsions
- after death, it is common for black, tarry-looking blood to discharge from the nostrils, anus and vulva, but this is *not* a consistent event.

Acute:

- disease course runs about 48 hours
- temperature is high - up to 42°C
- respirations are rapid and deep
- animals are severely depressed and listless
- mucous membranes are congested and haemorrhagic
- heart rate is elevated
- there is no appetite and rumen stasis is evident
- milk-yield falls dramatically - what is produced may be yellow and bloodstained

- pregnant animals may abort
- diarrhoea or dysentery is usual
- may be local oedema of tongue, throat and perineum.

Pigs

The disease may be acute or subacute.

- high fever, dullness and off food
- non-painful oedema of the throat and face
- swallowing and respiration are impaired
- petechial haemorrhages are seen on the skin
- may be dysentery without the oedema
- death occurs within 12-36 hours but some may linger a few days.

Horses

The disease is acute, with death in 2-3 days but symptoms vary with the route of infection.

- When infection is ingested, septicaemia develops with enteritis and colic.
- When insects are involved, hot painful oedematous swellings are found on the throat, neck and along the ventral abdomen.
- In both cases there is severe depression and high fever.

Rapid and massive proliferation of the organism results in the production of a specific toxin. This toxin causes disease and death through its effects on the central nervous system.

If anthrax is suspected as a cause of death, the carcass must NOT be opened. This is to prevent environmental contamination, as the organism will form resistant spores on exposure to air.

Black, tarry blood may be seen at the external orifices, but this sign is not evident in every case. There is incomplete rigor mortis. The carcass bloats and decomposes rapidly.

Autopsy

When there is less concern because of the animal's immediate history or movements, but a suspicion of anthrax still exists because of a history of sudden death and appropriate clinical signs, protective equipment must be worn before proceeding further. The carcass should be placed with the near (left) side uppermost and an incision made behind the last rib through the body wall. Lift the rib cage with a wire hook or similar tool to expose spleen, viscera and the nature of any abdominal fluid. This must be done with care if the carcass is badly bloated, to prevent infected material blowing back onto the operator.

If an autopsy is carried out in ignorance, the following signs will be seen:

- muscle will look fevered and ooze fluid

- blood fails to clot
 - ecchymotic haemorrhages are present through the body tissues
 - body cavities contain bloodstained serous fluid
 - severe enteritis
 - grossly enlarged spleen, which is soft and the structure liquefied
 - subcutaneous swellings are jelly-like and local lymph nodes enlarged.
- This particularly applies to horses and pigs.

Where anthrax is suspected, and before any samples are forwarded, the receiving laboratory must be notified. Samples must be sent in a sealed container specifically for dangerous goods (anthrax). Containers should be in every [Biosecurity Queensland](#) office.

Cattle and sheep

Laboratory samples

When the carcass has not been opened, a small incision is made at the base of the ear on the dorsal surface using a scalpel blade. At least five slide smears and sterile swabs of blood are taken. If possible, free blood should also be taken. The wound is then taped to prevent blood escaping. Gloves, mask and disposable equipment should be burnt at the site. Any contaminated item should be removed in plastic bags to be soaked in 10% formalin.

If the carcass has been opened, smears of the spleen should be made, with collection of blood and fluid, always being aware of the inherent risks to the operator.

Pigs and horses

An incision is made over the site of any enlarged lymph nodes in the throat, or any oedematous swelling. Impression smears are made after cutting through the nodes and fluid is collected for culture.

There are many causes of sudden death in animals and differentiation can pose problems.

Some causes of sudden death include:

Differential diagnosis

- clostridial diseases
- Hendra virus in horses
- acute leptospirosis
- tick fevers
- salmonellosis
- acute bloat
- hypomagnesaemic tetany
- peracute chemical poisons (lead - arsenic)
- poisonous plants (bracken - *Myoporum* sp)
- snake bite
- lightning strike.

Control Individual animals can be treated with large doses of antibiotic. Treatment

must be started quickly. It is more effective in pigs, dogs, and humans than in ruminants.

Depending on the circumstances, control measures could include some or all of the following:

- the affected property will be quarantined and neighbouring properties notified
- staff dealing with suspect animals and material must wear full personal protective clothing and equipment
- any carcasses will be totally disposed of by burning or deep burial (at least 2 m) in an identified safe area; the carcasses should be covered with quicklime
- any contaminated bedding or feed will be treated in the same manner
- stock will be isolated from any defined contaminated area
- the history of any animal movements on to the property will be detailed and back-tracing initiated
- animals moved off the property in the previous four weeks will be traced, identified and if necessary, quarantined until the disease situation resolves
- all introductions of feed materials and articles traced back to their source
- all concerned people must be notified of the potential human risk and care must be taken to prevent contamination of themselves and their environment
- concerned people must consult a medical doctor. The option to be prophylactically treated with antibiotics must be given to staff closely involved with known cases
- the Chief Veterinary Officer will decide on the vaccination of animals at risk and any other susceptible species. This may be extended to future purchases and replacement stock
- quarantine will be released 42 days after completion of vaccination or the last death whichever is later
- store beasts may be allowed to move 14 days after vaccination, but no movement will take place to slaughter, sale for slaughter or for export until quarantine is released.

These conditions may be altered, depending on the disease situation.

Decontamination of buildings, yards and articles

The extent of these procedures depends on the assessment of contamination:

- Dirt yards are sprayed with water to lay the dust.
- The top 15 cm of soil is removed and buried.
- Cracked areas in concrete yards are sealed.
- Spray yards and fences with 5% caustic soda, or gluteraldehyde.
- Articles and machinery are decontaminated with 5% formalin.
- Wash off chemicals after 24 hours.

- Flame guns can be used on appropriate surfaces.

On a dairying property

In addition to the above, rectal temperatures of every animal will be taken in a milking herd as soon as possible and then every day for 14 days after vaccination. Any animal showing an increased body temperature will be identified, isolated and treated with an appropriate antibiotic. The milk from these cows will be treated with 5% formalin before being buried. They will then be excluded from the milking herd until after the drug withholding period and during this time, when they are milked, the milk is discarded. Any surviving animals treated with antibiotics must be vaccinated or revaccinated seven days after the completion of the treatment.

Milking equipment will be cleansed and disinfected:

- warm rinse with clean water at a rate of 5 L/cluster
- alkaline detergent rinse at 40-60°C caustic soda (5%)
- acid rinse at 95-100°C (phosphoric or acetic acid) 4-6 L/cluster
- all cracked or deteriorated rubbers replaced.

Dairy infrastructure is disinfected after cleansing with 'hypochlorite' (300 ppm available chlorine) or 'iodophor' (25 ppm available iodine) or the areas of metal and concrete can be washed and then flame-gunned.

If the bulk tank is operating correctly and the milk is kept chilled, the milk can enter the normal production chain but must be pasteurised as soon as possible. Vegetative forms of *B.anthraxis* may be present in the milk just prior to death of the animal but they are destroyed by pasteurisation.

If the vat is not operating well, the milk will be mixed with formalin to a minimum of 1% and buried.

Raw milk must not be consumed by people or fed to other animals.

The management of the milk processing plant taking milk from the affected dairy, must be informed of the situation. (Sporulation of the organism occurs at temperatures greater than 21°C after some hours).

Alternatively, public reaction and risk of contamination may determine that the milk from an infected dairy will be disposed of until quarantine is lifted.

Saleyards and transports

Isolate the group of animals in proximity to the suspect case. Arrange to remove them back to the property of origin (or an approved destination). Identify any other animals in the sale from the property of origin, detain and arrange to move them back. Determine the risk of animals which may have left the sale and trace forward where necessary, especially those going to abattoirs. For treatment of carcasses, decontamination of the yard and

vehicles, follow the procedures already detailed.

Piggeries

Worldwide, outbreaks in intensive piggeries have occurred but this is not common. If it occurs, usually only a few animals are affected, however, there are a few notable exceptions. The same procedures will be followed as for grazing properties as regards removal of carcasses, isolation, treatment, monitoring for symptoms and vaccination of animals. A recording system of mortalities should be introduced and all deaths investigated. The disposal of effluent should be investigated. Any animals exposed to contaminated areas will be vaccinated.

On individual properties it depends on the severity of the outbreak and the type of enterprise:

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| Economic importance | <ul style="list-style-type: none">• cattle deaths• increased labour of intense animal observation• treatment and vaccination costs• decontamination and disposal costs of carcasses• marketing restrictions• abattoir workers' rejection• consumer rejection of animal product. |
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Zoonosis	<p>The cutaneous form is the common human disease (malignant pustule) after contact with contaminated animal products and soil. Infection can also occur by ingesting or inhaling anthrax spores (i.e. wool-sorters disease). If the disease is not treated promptly, death will occur.</p>
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State policy	<p>Anthrax is a notifiable disease and if a case is suspected or diagnosed, it must be reported to Biosecurity Queensland. The property will be quarantined under the <i>Stock Act 1915</i>. Cases will be managed according to the AUSVETPLAN for anthrax.</p>
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Animal welfare	<p>Queensland Health must be notified.</p>
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Animal welfare	<p>There are no specific animal welfare considerations except prompt action to limit the numbers of deaths.</p>
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Export protocols	<p>Importing countries can demand certification that there has been no incidence on a property or in an area or state for a given time. When the disease occurs, countries receiving animals or animal products may refuse to accept the consignment and refuse further consignments for stipulated periods.</p>
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