

## Review of Public Health Significance of Anthrax

Zerihun Fikru

University of Gondar College of Medicine and health science, Department of public health, Gondar, Ethiopia P.O. Box 196

Email: [zerihunfikru@gmail.com](mailto:zerihunfikru@gmail.com)

**Abstract:** Anthrax is a disease caused by the spore-forming bacteria *Bacillus anthracis*. It occurs on all the continents, causes acute mortality in ruminants and is a zoonosis (a disease which primarily affects animals, but causes disease in humans). Anthrax is a disease caused by the bacterium *Bacillus anthracis*. This bacterium exists in nature in two forms: as an active growing cell (called the vegetative form) or as a dormant spore. It does typically not spread from animal to animal nor from person to person. The bacteria produce spores on contact with oxygen. Anthrax occurs infrequently and sporadically, mainly as an occupational hazard among veterinarians, agricultural workers, and workers who process hides, hair, wool and bone products. In humans anthrax manifests itself in three distinct patterns. The most common is a skin infection, where people become infected handling animals or animal products that contain spores. In addition to antibiotic therapy and immunization, specific control procedures are necessary to contain the disease and prevent its spread.

[Zerihun Fikru. **Review of Public Health Significance of Anthrax.** *Rep Opinion* 2017;9(12):53-56]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). <http://www.sciencepub.net/report>. 9. doi:[10.7537/marsroj091217.09](https://doi.org/10.7537/marsroj091217.09).

**Key word:** Anthrax, public health

### Introduction

Anthrax is a disease caused by the spore-forming bacteria *Bacillus anthracis*. The name of the bacteria derives from the Greek word for coal, because of the ulcers with dark centers that develop on the skin of affected people. (Anthrax, The Merck Manuals): Anthrax occurs on all the continents, causes acute mortality in ruminants and is a zoonosis (a disease which primarily affects animals, but causes disease in humans). (Wilson, K. 2014): The bacteria produce extremely potent toxins which are responsible for the ill effects, causing a high mortality rate. While most mammals are susceptible, anthrax is typically a disease of ruminants and humans. (Grey, MR. et al., 2014).

### Causative Agent

Anthrax is a disease caused by the bacterium *Bacillus anthracis*. This bacterium exists in nature in 2 forms: as an active growing cell (called the vegetative form) or as a dormant spore. (CDC/ASM/APHL. May 2010): The spores are very hardy and tolerant to extremes of temperature, humidity, and ultraviolet light. They can survive for long periods of time (even decades) in the environment without nutrients or water. (Wilson, K. 2014): When a spore enters a mammal host, the internal environment of the host rich in water, sugars, and amino acids induces that spore to germinate in-to a vegetative cell that leads to disease. (OIE. 2012).

### Forms of naturally occurring human anthrax infection:

- **Cutaneous anthrax** is the result of spores entering the body through small breaks in the skin. This form of the disease is characterized by a sore at the point of infection that develops into a pain-less ulcer covered by a black scab (eschar). Cutaneous anthrax accounts for approximately 95% of all reported human anthrax cases. Cutaneous anthrax could also occur as a result of an aerosol attack. (Anthrax, The Merck Manuals).

- **Gastrointestinal anthrax** typically occurs as a result of eating the meat of animals infected with *B. anthracis*. The intestinal tract, mouth, or throat (oropharyngeal anthrax) may be infected. GI anthrax is normally thought to occur as a result of ingestion of vegetative bacteria rather than spores; therefore, GI anthrax is not expected to result from exposure to aerosolized spores. (Anthrax, The Merck Manuals).

- **Inhalational anthrax** is the result of breathing *B. anthracis* spores into the lungs. Inhalational infection is the form of anthrax that would be of most concern following an intentional aerosol attack with *B. anthracis*. (Griffith J, Blaney D, Shadomy S, Lehman M, Pesik N, Tostenson S, Delaney L, Tiller R, DeVries A, Gomez T, Sullivan M, Blackmore C, Stanek D, Lynfield, R., 2014).

- **Injection related anthrax** is a newly recognized entity. A number of cases have occurred recently in Europe in intravenous drug users. This is believed to be caused by injecting heroin that is contaminated with material containing *B.anthraxis*

spores. (Meaney-Delman D, Rasmussen SA, Beigi RH, Zotti ME, Hutchings Y, Bower WA, Treadwell TA, Jamieson DJ).

### **Transmitted and spread Modes of Anthrax**

Anthrax does typically not spread from animal to animal nor from person to person. The bacteria produce spores on contact with oxygen. (OIE. 2012): These spores are extremely resistant and survive for years in soil, or on wool or hair of infected animals. Then, if ingested or inhaled by an animal, or on entering through cuts in the skin, they can germinate and cause disease. (Meaney-Delman D, Rasmussen SA, Beigi RH, Zotti ME, Hutchings Y, Bower WA, Treadwell TA, Jamieson DJ): Because the blood of infected animals sometimes fails to clot and may leak from body orifices, insects can spread the bacteria to other animals. Carnivores and humans can become infected by eating meat from an infected animal. But typically animals become infected by ingesting spores, which are in the soil or in feed. (Grey MR,, et al.,).

### **Morbidity and Mortality**

Anthrax is still a significant risk in some countries, and outbreaks occasionally occur in humans. In Africa, estimates suggest that each cow with anthrax can result in up to ten human cases. (<http://www.cdc.gov/vaccines/hcp/vis/vis-statements/anthrax.html>. Accessed Feb. 25, 2014). However, the incidence of anthrax has declined sharply in developed nations. In the U.S., approximately 130 human cases occurred annually during the early 1900's, but only one or two cases of cutaneous anthrax are now generally seen in a year.

(Griffith J, Blaney D, Shadomy S, Lehman M, Pesik N, Tostenson S, Delaney L, Tiller R, DeVries A, Gomez T, Sullivan M, Blackmore C, Stanek D, Lynfield R, 2014). In many countries, cases of anthrax occur infrequently and sporadically, mainly as an occupational hazard among veterinarians, agricultural workers, and workers who process hides, hair, wool and bone products. (Wilson K. 2014 ).

The cutaneous form accounts for at least 90-95% of natural anthrax infections. The gastrointestinal form seems to be uncommon, but can occur in outbreaks associated with contaminated meat. Natural cases of inhalational anthrax are rare; however, aerosolized biological weapons would be expected to produce a high percentage of this form. In 2001, 11 cases of inhalational anthrax and 11 cases of cutaneous anthrax were associated with a bioterrorist attack via anthrax-contaminated mail. ( Anthrax, The Merck Manuals).

The mortality rate varies with the form of the disease. Cutaneous anthrax is thought to be fatal in 5-20% of untreated cases, and less than 1% of patients treated with antibiotics. ( Anthrax, The Merck

Manuals): In contrast, the mortality rate is high for inhalational anthrax, even when treated appropriately. Earlier estimates suggested that the case-fatality rate for this form approached 90-100% but newer, more intensive treatment regimens may decrease the mortality rate. In the 2001 mail-associated bioterrorist attack, six of eleven patients with inhalational anthrax recovered with treatment (case fatality rate of 45%). However, once a patient reaches the fulminant stage, one study suggests that the mortality rate is 97% regardless of treatment. Anthrax meningo-encephalitis is also deadly, with an estimated case fatality rate of 95-100%. ( Griffith J, Blaney D, Shadomy S, Lehman M, Pesik N, Tostenson S, Delaney L, Tiller R, DeVries A, Gomez T, Sullivan M, Blackmore C, Stanek D, Lynfield, R., 2014).

### **Human Infection**

People become incidental hosts through contact with infected animals or contaminated animal products. They can become ill if they:

- Get spores in a cut or scrape of the skin
- Eat food or drink water that is contaminated with spores
- Breathe in spores
- Inject spore-contaminated illicit drugs (e.g. heroin)

The type of anthrax infection (cutaneous, gastrointestinal, inhalation, or injection) depends on how anthrax enters the body—while some types of infection are more severe than others, all forms can cause systemic illness and result in death if untreated. Incubation period in people ranges from 1 day to more than 2 months. (OIE/WHO/FAO. 2008).

### **Public health risk of Anthrax**

In humans anthrax manifests itself in three distinct patterns. The most common is a skin infection, where people become infected handling animals or animal products that contain spores. (<http://www.cdc.gov/vaccines/hcp/vis/vis-statements/anthrax.html>. Accessed Feb. 25, 2014): This can happen to livestock producers or butchers dealing with sick animals, or when the infection has been spread by wool or hides. The spores enter the body through cut-sour scratches in the skin and cause a local infection that if not controlled may spread throughout the body. ( Bradley JS, Peacock G, Krug SE, Bower WA, Cohn AC, Meaney-Delman D, Pavia AT): The digestive form occurs when the spores are eaten. Tragically, people who lose their animals may also lose their lives trying to salvage something and consuming the meat from an animal that died. Potentially the most deadly form is by inhalation. This has been called ‘wool sorters disease’ since spores on hides or hair could be inhaled. While inhalation anthrax is rare in nature, anthrax spores have been

developed and used as a biological weapon. Clearly, preventing the disease in animals will protect human public health. (<http://www.niaid.nih.gov/topics/anthrax/Pages/default.aspx#>. Accessed Feb. 25, 2014).

### Prevention and control

Anthrax is a disease listed in the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code* and must be reported to the OIE (OIE *Terrestrial Animal Health Code*). In addition to antibiotic therapy and immunization, specific control procedures are necessary to contain the disease and prevent its spread. In particular: (Wilson, K. 2014).

❖ The proper disposal of dead animals is critical;

❖ The carcass should not be opened, since exposure to oxygen will allow the bacteria to form spores

❖ Premises are to be quarantined until all susceptible animals are vaccinated and all carcasses disposed of preferably by incineration or alternatively by deep burial with quick lime.

❖ Cleaning and disinfection are important as is control of insects and rodents.

Vaccination in endemic areas is very important. In fact effective vaccination against anthrax was first demonstrated by Louis Pasteur in 1881. The OIE spells out the requirements for the manufacture and quality control of animal vaccines, in the OIE *Manual of Diagnostic Tests and Vaccines*. (<http://www.cdc.gov/vaccines/hcp/vis/vis-statements/anthrax.html>. Accessed,2014). Although vaccination will prevent outbreaks veterinary services sometimes fail to vaccinate when the disease has not appeared for several years. But because the spores survive for such lengthy periods, the risk is always present. Though anthrax is quite susceptible to antibiotic therapy, the clinical course is often so rapid that there may not be the opportunity to treat affected animals. Early detection of outbreaks, quarantine of affected premises, destruction of diseased animals and fomites, and implementation of appropriate procedures at abattoirs and dairy factories will ensure the safety of products of animal origin intended for human consumption. ( Wilson, K.201).

### Author:

Zerihun Fikru  
University of Gondar College of Medicine and health science, Department of public health, Gondar, Ethiopia P.O. Box 196  
Email: [zerihunfikru@gmail.com](mailto:zerihunfikru@gmail.com)

### References

1. Anthrax. National Institute of Allergy and Infectious Diseases. <http://www.niaid.nih.gov/topics/anthrax/Pages/default.aspx#>. Accessed Feb. 25, 2014.
2. Anthrax vaccine: What you need to know. Centers for Disease Control and Prevention. <http://www.cdc.gov/vaccines/hcp/vis/vis-statements/anthrax.html>. Accessed Feb. 25, 2014.
3. Anthrax. The Merck Manuals: The Merck Manual for Health Care Professionals. [http://www.merckmanuals.com/professional/infectious\\_diseases/gram-positive\\_bacilli/anthrax.html](http://www.merckmanuals.com/professional/infectious_diseases/gram-positive_bacilli/anthrax.html). Accessed Feb. 25, 2014.
4. Bradley JS, Peacock G, Krug SE, Bower WA, Cohn AC, Meaney-Delman D, Pavia AT; AAP Committee on Infectious Diseases and Disaster Preparedness Advisory Council. Pediatric anthrax clinical management. *Pediatrics*. 2014 May;133(5):e1411–36. <http://pediatrics.aappublications.org/content/early/2014/04/22/peds.2014-0563>.
5. CDC/ASM/APHL. May 2010. Sentinel level clinical microbiology laboratory guidelines for suspected agents of bioterrorism and emerging infectious diseases: *Bacillus anthracis*. <http://www.asm.org/images/pdf/Clinical/Protocols/anthrax.pdf>.
6. Grey MR, et al., eds. The Bioterrorism Sourcebook. New York, N.Y.: The McGraw-Hill Companies; 2006. <http://accessmedicine.mhmedical.com/content.aspx?bookid=366 & Sectionid=39825485>. Accessed Feb. 26, 2014.
7. Griffith J, Blaney D, Shadomy S, Lehman M, Pesik N, Tostenson S, Delaney L, Tiller R, DeVries A, Gomez T, Sullivan M, Blackmore C, Stanek D, Lynfield R; Anthrax Investigation Team. Investigation of inhalation anthrax case, United States. *Emerg Infect Dis*. 2014 Feb;20(2):280–3. [http://wwwnc.cdc.gov/eid/article/20/2/13-0021\\_article](http://wwwnc.cdc.gov/eid/article/20/2/13-0021_article).
8. Meaney-Delman D, Rasmussen SA, Beigi RH, Zotti ME, Hutchings Y, Bower WA, Treadwell TA, Jamieson DJ. Prophylaxis and treatment of anthrax in pregnant women. *Obstet Gynecol*. 2013 Oct;122(4):885-900. <http://www.ncbi.nlm.nih.gov/pubmed/24084549>.
9. OIE. 2012. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals 2016, chapter 2.1.1: Anthrax [http://www.oie.int/fileadmin/Home/eng/Health\\_standards/tahm/2.01.01\\_ANTHRAX.pdf](http://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.01.01_ANTHRAX.pdf).
10. OIE/WHO/FAO. 2008. Anthrax in Humans and Animals, 4th edition. <http://www.who.int/csr/>

[resources/publications/AnthraxGuidelines2008/en/](#)

11. Wilson K. Microbiology, pathogenesis, and epidemiology of

anthrax.<http://www.uptodate.com/home>. Accessed Feb. 25, 2014.

12. Wilson K. Prevention of anthrax. <http://www.uptodate.com/home>. Accessed Feb. 26, 2014.

12/25/2017