

Anthrax

Anthrax is a zoonotic disease caused by bacteria called Bacillus anthracis. It is transmissible to humans through handling or consumption of contaminated animal products. Infection in humans most frequently occurs on the skin, in the gastrointestinal tract and in the lungs. Like most Bacillus bacterium, B. anthracis is spore-forming which can survive in extremely harsh environments for decades, and even centuries.

Bacteriology

Bacillus anthracis is a large, gram-positive, sporeforming, rod-shaped bacterium. It ranges from 1-1.2 µm in width and 3-5 µm in length. It was the first bacteria shown to be the cause of disease by Robert Koch in 1876. It can be cultivated in regular nutrient medium in both aerobic and anaerobic settings. B. anthracis is a capsulogen and toxinogenic organism. It secretes 2 toxins which are composed of 3 different proteins: protective antigen (PA), the lethal factor (LF), and the edema factor (EF). The lethal toxin (PA + LF) provokes death in animals. The edema toxin (PA + EF) induces edema.

In spore form, B. anthracis can be used for bioterrorism; this poses a major threat due to the availability in laboratories and the environment, the ability for B. anthracis spores to be mass produced, low infectious dose and high mortality rate.

Clinical Manifestations

Skin (cutaneous) infections are the most common manifestation of B. anthracis infection, which account for approximately 95% of naturally occurring infections. Cutaneous infections show up as black boil-like skin lesions, and are typically painless. The areas of greatest exposure are the hands, arms, face or neck. Sources the organism may occupy include wool, hides, and leather or hair products of infected animals. Inhalation is the most serious case of anthrax infection. Once inhaled, the spores are consumed by macrophages and carried to the lymph nodes in the central chest cavity. In the lymph nodes is where germination occurs, and subsequently the bacteria are carried through the blood stream where they begin releasing toxins. Initial symptoms resemble a flu-like illness with fever, cough, and headache, followed by progressive shortness of breath that rapidly progresses to respiratory failure and death within hours. Gastrointestinal infection occurs with germination inside the upper and lower gastrointestinal tract. After germination, bacteria release toxins which cause abdominal pain, hematemesis (vomiting blood), severe bloody diarrhea and sepsis. Intestinal anthrax may be fatal in 25% to 60% of cases.

Epidemiology of Transmission

Bacillus anthracis is primarily transmitted through three different pathways, the skin (cutaneous), the intestines (ingestion), and lungs (inhalation). Anthrax is not known to be transmissible through human-to-human contact. A lethal infection by means of inhalation is about 10,000 to 20,000 spores, depending on the host. Gastrointestinal infection primarily occurs through the consumption of meat contaminated with spores. Cutaneous infection primarily occurs when anthrax spores enter the skin through cuts. Incubation times vary for the area infected but can occur within one day and can sometimes even last twelve days.

Basic Prevention

Anthrax infection is most common among people who work with animals or animal products. The risk of infection is very low however, treating the animal products before working on them can be an effective preventative measure. Fumigation, irradiation, tanning, chemical treatment (acid/alkaline solution) are just a few examples of techniques that can effectively kill anthrax spores and reduce the risk of infection. Additionally working in a well ventilated area, wearing appropriate personal protective equipment (PPE), basic cleanliness and hand hygiene can also prevent infection.

Prevention Measures

Routine / Standard Precautions are sufficient preventative measures to follow when providing care to patients who are suspected or confirmed to have B. anthracis infection.

- Use PPE barriers (such as gloves) when anticipating contact with blood or body fluids
- Immediately wash hands and other skin surfaces after contact with blood or body fluids
- Gloves should be worn when handling potentially infectious specimens, cultures or tissues; laboratory coats, gowns or suitable protective clothing should be worn

Environmental Control Measures

Anthrax spores and spores in general have been found to be able to remain dormant for decades and even centuries, until favourable conditions arise in which germination can occur. Hospital grade disinfectants with a sporicidal claim are sufficient in disinfecting hard, non-porous surfaces. It is imperative to allow the full (if not longer than stated) contact time to ensure full disinfection or sterilization. Contaminated materials and personal protective equipment (PPE's) are to be autoclaved or incinerated if no longer needed.

References:

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