

ANTHRAX - BIOLOGICAL THREAT IN THE 21ST CENTURY

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The causative agent of the anthrax, spore-forming bacterial rod *Bacillus anthracis* was discovered by Robert Koch in the nineteenth century. The *B. anthracis* spores are highly resistant to inactivation and may be present in the soil, for decades and occasionally infecting grazing animals that ingest the spores. Hundred of years ago, anthrax was significant mainly as an economically damaging disease of domesticated animals. Once common where livestock was raised, it is now controlled through animal vaccination programs. Anthrax still occurs in countries where animals are not vaccinated, mainly in Africa and Asia. It does infrequently occur in many countries, including the United States.

Human anthrax is a disease acquired following contact with infected animals. Anthrax is not contagious; the illness cannot be transmitted from person to person. Cutaneous anthrax is the most common naturally occurring type of infection (>95%) usually occurs after skin contact with contaminated meat, wool, hides, or leather from infected animals. Gastrointestinal anthrax usually follows the consumption of raw or undercooked contaminated meat. Inhalation anthrax is the most serious and rare form of human anthrax. Breathing in airborne spores may lead to inhalation anthrax.

The bacteria secretes a toxin made up of three proteins: capsular antigen, edema factor and lethal factor. However the manifestation of anthrax infection are not solely due to the effects of the toxins as is the case with diphtheria, tetanus or botulism. Results of other work in mice imply that further non-toxin components contribute to virulence that have yet to be identified. The mortality rate for anthrax varies, depending on exposure, and are approximately 20% for cutaneous anthrax without

antibiotics and 25-75% for gastrointestinal anthrax; inhalation anthrax has a fatality rate that is 80% or higher. The only known effective prevention against anthrax is the anthrax vaccine. Antibiotics constitute the mainstay of treatment, although anti-toxins have long been considered an essential 'adjunctive' therapy, and remain so.

The odds that any one individual in the United States will contract anthrax is extremely low, one in about 300 million. The tragic events in the United States on 11 September 2001 and with the intentional release of *Bacillus anthracis* spores in some environments, has spurred a chilling HIV-like fear and anxiety throughout the world. Who could have imagined people getting anthrax from handling 'animal' mail?

Anthrax is a potential biological terrorism threat because the spores are resistant to destruction and can be easily spread by release in the air. Anthrax as a bioweapon is a science fiction in the past. A second look at the reality shows that biological weapon poses by far the greatest threat, because they can be as lethal as nuclear weapons. Anthrax is the biological weapon most likely to be encountered because it is easy to produce in large quantities, highly lethal, relatively easy to develop as a weapon, easily spread over a large area and easily stored and dangerous for a long time. Aerosol exposure to anthrax spores could cause symptoms as soon as 2 days after exposure. However, illness could also develop as late as 6-8 weeks after exposure. Further, early presentation of anthrax disease would resemble a fever or cough and would be exceedingly difficult to diagnose with a high degree of suspicion. Once symptoms begin, death follows 1-3 days later for most people. If appropriate antibiotics are not

started before development of symptoms, the mortality rate is estimated to be 90%.

Given appropriate weather and wind conditions, 50 kilograms of aerosolised anthrax spores released from an aircraft along a 2 kilometer line could create a lethal cloud of anthrax spores that would extend beyond 20 kilometers downwind. The aerosol cloud would be colorless, odorless and invisible following its release. Given the small size of the spores, people indoors would receive the same amount of exposure as on the street. There are currently no atmospheric warning systems to detect an aerosol cloud of anthrax spores. The first sign of a bioterrorist attack would most likely be patients presenting with symptoms of inhalation anthrax. A 1970 analysis by World Health Organization concluded that the release of aerosolized anthrax upwind to a population of 5,000,000 could lead to an estimated 250,000 casualties, of whom as many as 100,000 could be expected to die. A later analysis, by the Office of Technology Assessment of the U.S. Congress, estimated that 130,000 to 3 million death could occur following the release of 100 kilograms of aerosolized anthrax over Washington D.C., making such an attack as lethal as a hydrogen bomb. The Centre for Disease Control and Prevention estimated that such a bioterrorist attack would carry an economic burden of \$26.2 billion per 100,000 people exposed to the spores.

In the second half of this century, anthrax was developed as part of a larger biological weapon program by several countries, including the United States and the Soviet Union. The number of nations believed to have biological weapon programmes has steadily risen from 10 in 1989 to 17 in 1995, but the number of nations working with anthrax is unknown. The Aum Shinrikyo religious sect, infamous for releasing sarin gas in a Tokyo subway station in 1995, developed a number of biological weapons, including anthrax. The largest experience with inhalation anthrax occurred after the accidental release of aerosolized anthrax spores in 1979 at a military biology facility in Sverdlovsk, Russia. Some 79 cases of inhalation anthrax were reported, of which 68 were fatal.

Biomedical scientists should consider biological weapons as a serious 'emerging new pathogens' to be controlled and prevented for the good of humanity. New revolution in biology could be misused in offensive biological programs directed against human beings and their staple crops or livestock. Any misuse of biology is prohibited by the 1975 Biological and Toxin Weapons Convention (BTWC). Article 1 of the Convention states:

“ Each State Party to this convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain :

1. Microbiological or other biological agents, or toxins whatever their origin or method of production, *of types or in quantities that have no justification for prophylactic, protective or other peaceful purposes*”

Let us hope this so called *General Purpose Criterion* is respected by the over 140 States Party in the Convention for the good of all human kind.

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