



A Monthly e Magazine  
ISSN:2583-2212

April 2024 Vol.4(4), 1280-1284

Popular Article

## Anthrax: A Historical Paradigm

Dr. Neharika Saxena<sup>1\*</sup>, Dr. Subhash Chand Meena<sup>2</sup>, Dr. Surendra Singh Shekhawat<sup>3</sup>, Dr. Vipin Chand Bairwa<sup>4</sup>

<sup>1</sup>Teaching Associate, PGIVER, Jaipur, Rajasthan, Pin: 302031, India

<sup>2</sup>Teaching Associate, PGIVER, Jaipur, Rajasthan, Pin: 302031, India

<sup>3</sup>Assistant Professor, PGIVER, Jaipur, Rajasthan, Pin: 302031, India

<sup>4</sup>PhD scholar, PGIVER, Jaipur, Rajasthan, Pin : 302031, India

<https://doi.org/10.5281/zenodo.10913242>

### Abstract

Bioterrorism has piqued the interest of many people in the first decade of the century. Because biological substances are easy to obtain, relatively inexpensive to manufacture, and more likely to instill widespread fear and panic than genuine physical harm, they are regarded as enticing weapons for bioterrorism. *Bacillus anthracis*, the agent that causes the outbreak of anthrax, is a not mobile, Gram-positive bacteria that produces spores. This is regarded to be one of the most potent BW agents since its spores may survive for decades in the environment and are extremely resistant to natural conditions. The vegetative form of the bacteria Anthrax develops when disease spores germinate or enter the body via an injury on the outside of the body (cutaneous anthrax), the respiratory tract (respiratory the anthrax), and the gut. Public health concerns concerning Anthrax exist in many countries, including India, where agriculture is the predominant industry. *B. anthracis* has been closely associated with human history, and it resurfaced during the September 11 attacks in the US. This review article discusses the background, biology, and potential use of *Bacillus anthracis* as a weapon of mass destruction.

**Key Words:** Anthrax, *Bacillus anthracis*, Biological warfare, Epidemiology, Infection, Public health

### Introduction

The bacillus responsible for anthrax, *Bacillus anthracis*, is a Gram-positive spore-forming bacillus that is typically present in the soil in endemic locations. The zoonotic illness anthrax is primarily linked to domestic animals and herbivores. When widespread livestock immunization is not done, the disease frequently breaks out in those nations. Less frequently, human anthrax is introduced to human populations by intimate work contact with sick livestock, such as cattle and goats, or through touching infected domestic animals or their byproducts, such as skin, flesh, skins, and bones. Humans can contract this bacterium through the skin, gastrointestinal tract, or respiratory system (Dixon *et*

1280

*al.*,1999). There are two kinds of *B. anthracis*: spores that remain in the soil or surroundings and vegetative cells that reside inside the host (Santelli *et al.*,2004). *B. anthracis* is typically found in the soil as endospores, which can sustain life for many years.

It has been widely believed that *B. anthracis* could be used as a biological warfare agent because it produces spores that might be dispersed and spray to spread disease. Nonetheless, the events of 2001 have demonstrated that bioterrorism is a reality rather than a threat (Jernigan *et al.*,2001). Because of its great pathogenicity and ability to generate spores, *Bacillus anthracis* is regarded as one of the most significant biological warfare agents. *B. anthracis* possesses two main virulence factors: a tripartite toxin and a poly- $\gamma$ -D-glutamic acid capsule (Collier & Young,2003). By hiding from macrophages, the pathogenic *Bacillus anthracis* bacteria create a capsule that resembles the host's immune system(Ezzell& Welkos,1999). The three separately secreted proteins that make up the tripartite anthrax toxin are the edema factor (EF), lethal factor (LF), and protective antigen (PA)(Mock & Mignot, 2003; Turk,2007). The the anthrax toxic substance is a binary A-B toxin; deadly toxin (LTx) and edoema toxin (ETx) are the binary toxins formed by PA acting as its binding (B) motif and Hf and EF acting as separate active (A) domains (Singh *et al.*,1999). Bacteria proliferate after being ingested or coming into contact with skin sores, and within a matter of days or weeks they kill either the human or the animal host.

## Review

Anthrax does not pose a severe health risk in developed countries because there have been few cases reported. In underdeveloped countries where agriculture remains the mainstay of revenue, anthrax upon the skin is still a serious health threat. India leads the world in terms of livestock population. As a result, animal anthrax is prevalent in many parts of India. However, only a few isolated instances of human anthrax have been documented in the southern states (Rao *et al.*,2009). Human skin anthrax is a public health hazard in several states, including Orissa & Andhra Pradesh (Kumar *et al.*,2000). Anthrax, caused by *B. anthracis*, is highly contagious and fatal. Anthrax has a long history with humans and was known in Europe (1190-1491 BC) and China (3000 BC). Anthrax was described in early Greek, Roman, and Hindu literature.

Anthrax was named after the Greek word "anthrakis," which means coal, because coal black lesions of the skin appear in the superficial form of anthrax. The book of Genesis (1491 BC) describes the fifth plague of Egypt, an illness that eliminated Egyptian livestock including as cattle, sheep, goats, camels, horses, and donkeys, without impacting Israeli livestock, the cause might be anthrax. The disease described by Virgil (29 BC) in his third Georgics (a collection of poetry on agriculture and



animal husbandry) appears to be anthrax in domestic and wild animals, as it was an economically important agricultural disease in Europe from the 16th to the 18th centuries(Dirckx,1981). In the nineteenth century, study on anthrax resulted in numerous medicinal advances. In 1850, Pierre Rayer described filiform bodies (tiny rods roughly half the length of a red blood corpuscle) in the blood of sheep that had perished from anthrax. In 1876, The late Robert Koch employed his postulates for the first time during his experiments in Wolstein, Germany, which was to definitively demonstrate that *Bacillus anthracis* was the underlying cause of anthrax (Koch,1876). Thus, anthrax constituted the first disease whose aetiology was identified as a microbiological agent. When an animal dies of anthrax infection, the contaminated blood and bodily fluids leak into the soil through the animal's natural orifices. When exposed to air, the bacteria in the blood go from vegetative to spore form. Recently, in 2001, packages with the *B. anthracis* bacterium were mailed to several dignitaries in the United States, affecting 22 individuals. This was deemed an act of biological warfare (Jernigan *et al.*, 2001).

### Conclusion

Anthrax, produced by *B. anthracis*, remains a significant endemic illness with public health implications in various Asian, African, and European nations. Although bacillus of Anthrax can be treated with quick antibiotic therapy, it is lethal in many cases due to a failure to diagnose the disease early on. Rapid, user-friendly, and economical serology tests can be valuable tools for anthrax surveillance, and continual monitoring can help to reduce agriculture or occupation-related anthrax cases.

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