

Anthrax: in Taiwan versus in Western World

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Abstract

After the events that began last September, the threatening of terrorism was attacked again, have heightened awareness of and concern about anthrax in the western world. The initial reports documented some cases of clinical anthrax in United States. These cases included inhalational anthrax and cutaneous anthrax, the serologic testing performed and confirmed by health officials of U.S., but newspaper reported indicate that around 28 persons in the same offices of documented cases had evidence of anthrax exposure on nasal swabs. However, some frights suffered from terrorism in Taiwan. Fortunately, there were no anthrax cases documented in humans in past 30 years in Taiwan, and only few cases occurred in animals. Comparing with western world, the dread of anthrax seems less in Taiwan, the ability of diagnosis or confirmed diagnostic tests were uncertain due to lacking real clinical and laboratory experiences. We therein make a brief review of clinical management of anthrax and provide a highlight for emergency physicians and other personnel of disaster response team. (*Ann Disaster Med 2002;1 Suppl 1:S9-S16*)

Key words: anthrax , bioterrorism, Taiwan, disaster medicine

Introduction

For centuries, anthrax has caused disease in animals and, uncommonly, serious illness in humans throughout the world.¹ There were focused research on anthrax as a biological weapon more than 80 years.² Now, it is believed that more 17 nations have offensive biological programs.³ In Taiwan, there were the similar programs to defense the biochemic nuclear war or disaster, however, it is uncertain how many are

working with anthrax. Iraq has acknowledged producing and weaponizing anthrax.⁴

Most experts concur that the manufacture of a lethal anthrax aerosol is beyond the capacity of individuals or groups without access to advanced biotechnology. However, autonomous groups with substantial funding and contacts may be able to acquired the required material for a successful attack. One terrorist group, Aum Shinrikyo,

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responsible for release of sarin in a Tokyo, Japan, subway station in 1995,⁵ dispersed aerosols of anthrax and botulism throughout Tokyo on at least 8 occasions. For unclear reasons, the attacked failed to produce illness.

In 1970, a World Health Organization (WHO) expert committee estimated that casualties following the theoretical aircraft release of 50 kg of anthrax over a developed urban population of 5 million would be 250,000, 100,000 of whom would be expected to die without treatment.⁶ At 1993 report by the US Congressional Office of Technology Assessment estimated that between 130,000 and 3 million deaths could follow the aerosolized release of 100 kg of anthrax spores upwind of the Washington, DC, area- lethality matching or exceeding that of a hydrogen bomb.⁷ A economic model developed by the centers of Disease Control and Prevention (CDC) suggested a cost of \$26.2 billion per 100,000 persons exposed.⁸

Current status in Taiwan about anthrax, there is no positive human case during the past 30 years documented. In late reported, November 1999, one sporadic infection of horse has been documented in southern Taiwan.⁹

Method

MEDLINE databases were searched from 1999 to 2002 update, using the medical subject headings

anthrax. Review of references identified by this search led to identification of relevant references published prior 1999.

The Taiwan databases were searched from web and from the issue of CDC, agricultural, or microbiologic issues.

The purpose of this paper is to outline the difference status between Taiwan and western world in anthrax.

Overview of anthrax

Pathogen

Bacillus anthracis, a very large, Gram positive, spore forming rod (1-1.5 μm *10 μm), which is readily cultivated on ordinary nutrient medium. When nutrients are exhausted, resistant spores are formed that can survive in the soil for decades.¹⁰ Spores do not form in host tissues unless the infected body fluids are exposed to ambient air. *B. anthracis* spores germinate when exposed to a nutrient-rich environment, such as the tissue or blood of an animal or human host.

Pathogenesis and Clinical Manifestations

In humans, anthrax is fairly rare; the risk of infection is about 1/100,000. The principal virulence factors of *B. anthracis* are encoded on two plasmids- one involved in the synthesis of a polyglutamyl capsule that inhibits phagocytosis of vegetative forms and the other bearing the genes for the synthesis

of the exotoxins it secretes.¹¹ The exotoxins are binary, composed of a B (binding) protein that necessary for entry into the host cell and an A (enzymatically active) protein. The B component is known as the protective antigen and is common to both toxins. The A component of the edema toxin is the edema factor, a calmodulin-dependent adenylate cyclase that is responsible for the prominent edema at site of infection, the inhibition of neutrophil function, and the hindrance of the production by monocytes of tumor necrosis factor and interleukin-6.¹² The A component of the second toxin, lethal toxin, is a zinc metalloprotease that inactivates mitogen-activated protein kinase kinase, leading to the inhibition of intracellular signaling. Lethal toxin stimulates the release by macrophages of tumor necrosis factor (alpha) and interleukin-1(beta)-a mechanism that appears to contribute to the sudden death from toxic effects that occurs in animals with high degree of bacteremia and terminally high levels of lethal toxin.

The clinical forms included (1) cutaneous anthrax (eschar with edema), from handling infected material; (2) intestinal anthrax, from eating infected meat; (3) inhalational anthrax, from inhaling spore-laden dust; (4) anthrax meningitis, result from the inhalational anthrax induced bacteremia. The most possibility of outbreak anthrax is inhalational source, the classic clinical

description of inhalational anthrax is that of a biphasic illness, in the initial phase that follows an incubation period of one to six days, it appears as a nonspecific illness characterized by mild fever (similar with common cold), malaise, a nonproductive cough, and some chest or abdominal pain. And the illness progressed to the second phase within two or three days. This phase begins abruptly and involved further fever, acute dyspnea, diaphoresis, and cyanosis. The second stage of illness is rapidly progressive, with shock, associated hypothermia, and death occurring within 24 to 36 hours; 16 of 18 cases reported in US between 1900 and 1978 were fatal.¹³ Cutaneous anthrax, more than 95 percent of naturally occurring anthrax is the cutaneous form. The primary lesion – a painless, pruritic papule – appears one to seven days after the introduction of the endospore. Within one to two days, small vesicles surround the papule, or a vesicle develops that is 1 to 2 cm in diameter and is filled with clear or serosanguineous fluid containing very rare leukocytes and numerous large, gram-positive bacilli. The vesicle enlarges, and satellite vesicles may develop. A striking, nonpitting, gelatinous edema surrounds the lesion. Low-grade fever and malaise are frequent. The vesicle ruptures, undergoes necrosis, and enlarges, forming an ulcer covered by a characteristic black eschar. The edema

may become massive, particularly when the lesions are on the face or neck, and occasionally, multiple bullae develop along with marked toxic effects. Incision or debridement of such early lesions should be avoided, since this may increase the possibility of bacteremia. The eschar dries and falls off in one to two weeks with little ultimate scarring.

Intestinal anthrax appears the symptoms in two to five days after ingestion of undercooked meat containing spores and consist of nausea, vomiting, fever, and abdominal pain. The manifestations progress rapidly to severe, bloody diarrhea and signs suggestive of an acute abdomen. The primary intestinal lesions are ulcerative and occur mainly in the terminal ileum or cecum. Gastric ulcers may be associated with hematemesis. Hemorrhagic mesenteric lymphadenitis is also a feature of gastrointestinal anthrax, and marked ascites may occur. Mortality is greater than 50 percent. Anthrax meningitis may occur as a result of bacteremia after inhalational anthrax and is less common after other forms of anthrax. The cerebrospinal fluid is hemorrhagic in most instances, and there is a high mortality (approach 100 percent), but occasionally, patients treated with antibiotics have survived.

The clinical diagnosis of anthrax is confirmed by directly visualizing or cultured the anthrax bacilli. Enzyme-linked immunosorbent assay

(ELISA) is for antigen detection. Nasal swab culture to determine whether there may have been inhalational exposure to *B. anthracis* is an investigative tool and is not known to accurately predict the risk of subsequent clinical illness.

Treatment of anthrax, penicillin has been the drug of choice for many decades, and is also susceptible to most other commonly used antimicrobial drugs, such as ciprofloxacin, tetracyclines, macrolides, aminoglycosides etc. It is resistant to cefuroxime, extended-spectrum cephalosporins such as cefotaxime and ceftazidime, aztreonam, trimethoprim, and sulfamethoxazole.¹⁴⁻¹⁸

Discussion

To against terrorism is one of the major objectives after last September, and the same effort was taken in Taiwan. Even Taiwan is a small island, stand the side with United States and against terrorism, still is the possible target of attack. As we known, of the biological agents that may be used as weapons, could cause disease and deaths in sufficient numbers to gravely impact a city or region. *Bacillus anthracis*, the bacterium that causes anthrax, is one of the most serious of these.

It is believed that some counties have the ability to defense the biochemical attacks included anthrax, the same programs were set up in Taiwan's army. However, it was

uncertain work special in inhalational anthrax. The best efficiency way to prevent the inhalational anthrax is not to touch uncertain letter or mail parcel, and re-announce the public.

In Taiwan, there was no case documented in humans in several years, the reasons might be due to poor alert to diagnosis anthrax or the poor laboratory ability to detect the pathogen or few fear of the terrorism. Comparing with the western world, there were some programs to defense biochemical attacks in Taiwan, but they were only for the army's planning and fit the real situation.

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炭疽病：台灣與西方國家的異同

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摘要

自去年 911 恐怖攻擊事件後，恐怖主義對人類的威脅再起，也引起整個西方世界重新對於炭疽病產生關切及認知。初期報導證實美國有數例炭疽病病例。這些病例包括了吸入性炭疽病及皮膚性炭疽病，而由美國官方所做的血清試驗也加以證實。但是當地報紙卻指出大約有 28 人在同一辦公室感染了炭疽病菌。在台灣也感受到恐怖主義所產生的威脅性。在過去三十年，台灣沒有任何感染炭疽病的病患，只有少數動物感染的病例。相形之下，台灣受到炭疽病的威脅，似乎較小。然而基於對於生物戰防備的觀點，在台灣缺乏臨床及實驗室對於炭疽病診斷的經驗下，不禁令人擔憂。因此我們在此對於炭疽病的臨床診斷與治療，做一個簡單的整理，以提供急診科醫師及其他從事災難應變團隊的人員，實際工作時的參考指引。(Ann Disaster Med 2002;1 Suppl 1:S9-S16)

關鍵詞：炭疽病；生物恐怖主義；台灣；災難醫學