Bioterrorism: A New Challenge to Emergency Physicians

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Abstract

The possibility of an attack by terrorists using nuclear, biologic, or chemical weapons is a new challenge to the practice of emergency physicians. The severity of this problem is unclear and unpredictable, and its risk assessment is limitedly analyzed. Although conventional explosives remain the most common weapon used by terrorists, the possibilities from nuclear, biologic, and chemical attacks will increase over time. According to the military terminology, the acronym CBRNE (chemical, biologic, radiologic, nuclear, explosive) have been provided. Among them, biologic agents are usually preferred by terrorist because of their impacts on physiological and psychological threatening. We therein introduce the concepts of bioterrorism here and provide some guidelines for its preparedness and response. *(Ann Disaster Med 2002;1 Suppl 1:S1-S8)*

Key words: Bioterrorism; Preparedness; Response; Emergency Physician

Introduction

Since the 911 terrorist attacks in the United States, the threatening of biological warfare has become a new worldwide concern. The devastating effects of anthrax dissemination caused not only physiological insults of the civilians but also the psychological problems. The impacts on national security and socioeconomic develop-pment have been well documented. Although Taiwan seems to be devoid of bioterrorism at present, it becomes evident that all societies need to be prepared for potential attacks. The plan of preparedness and response for bioterrorism still should be developed and evaluated in our society.

Because of improving disease surveillance and control in Taiwan, most of previous notorious infectious diseases such as small pox have already disappeared.[1] Other common pathogens used in bioterrorism such as the microorganisms of anthrax, botulism, tularemia and hemorrhagic fever are rarely or even never seen in Taiwan. This may incur a new challenge to the healthcare providers, especially the emergency physicians,

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because most of them are not familiar with the clinical spectrum of these diseases. However, discerning the nature of the threat of biological weapons as well as appropriate responses to them requires greater attention to the biological characteristics of these instruments of war and terror. Strengthening the public health and infectious disease infrastructure is an effective step toward averting the sufferings brought by the terrorist's use of a biological agent.

Basic Concepts of Bioterrorism

How the Pathogens can be used in Bioterrorism?

Pathogens used in bioterrorism are defined by Spencer et al.[2] as "living organisms, whatever their nature, or infected material derived from them, which are used for hostile purposes and intended to cause disease or death in man, animals and plants, and which depend for their efforts on the ability to multiply in the person, animal or plant attacked." Most of these available agents are zoonotic that ever caused agricultural damage. Because of low costs and availability, biological warfare agents instead of nuclear bomb and chemical agents are favorably utilized by terrorists to undergo so-called "asymmetric methods" of attack.[2]

To fulfill the criteria of biological warfare agents, the pathogens must be enough to cause high morbidity and mortality after appropriate dispersion of only a small volume.[1,4] The early clinical manifestations are usually non-specific and make more difficult to recognize or diagnose. In fact, many western countries[5-7] including the United Kingdom, the United States, the Soviet, and even Canada never give up studying both offensive and defensive biological warfare agents. In addition, the agents are always highly contagious and infective in low doses and have short incubation time. They may be stable during dissemination and low persistent during delivery.

As an emergency physician, we have to realize the possible ways of delivering bioweapons and thus can take essential steps in preparedness and response. Most of biological warfare agents are likely to be delivered by aerosol. The optimum particle size is almost 0.3-5.0 μm in diameter and can thereafter reach the alveoli when being inhaled.[1,8] Spread of pathogen-contained aerosols in the open air may be of little effects because many climatic factors such as wind and humidity can affect the efficiency. Normal bacteria flora that existed in the nature may also inhibit growth of such pathogens. In the military settings, a cruise missile may be utilized to cover a large enough area and produce casualties equivalent to that due to fallout from a nuclear device.[9] However, the terrorists may spread

aerosols thru ventilation or air conditioning systems.[10,11] Suicide attacks would be extremely effective for disseminating diseases such as smallpox.[12] Food and water is another possible route for local delivery of pathogens.

In the United States, the Centers for Disease Control (CDC) have identified certain agents as "Category A," or the ones most likely to be used in a biological attack.[13] They have the highest potential for a major public health crisis, as they typically cause public panic and social disruption. Among them, anthrax, botulism, plaque, smallpox, tularemia, and hemorrhagic fever are notorious candidates. Complete descriptions of these biological agents will be presented in this supplement.

How and When Terrorist Attack with Biological Weapons Should be Suspected?

Emergency physicians should pay at- tention to clinical manifestations and diagnostic clues indicating an unusual infectious disease outbreak associated with intentional release of a biologic agent. Once suspected, we should report any endemic or epidemic events to their supervising health departments. The covert release of a biologic agent may not have an immediate impact because of the delay between exposure and illness onset, and outbreaks associated with intentional releases might closely resemble naturally occurring outbreaks. Accordingly, the clues of intentional release of biologic agents include[14] 1) an unusual temporal gathering of illness; 2) an unusual geographic clustering (e.g., persons who attended the same public event or gathering); 3) patients presenting with clinical signs and symptoms that suggest an infectious disease outbreak (e.g., $\geq$2 patients presenting with an unexplained febrile illness associated with sepsis, pneumonia, respiratory failure, or rash or a botulism-like syndrome with flaccid muscle paralysis, especially if occurring in otherwise healthy persons); 4) an unusual age distribution for common diseases (e.g., an increase in what appears to be a chickenpox-like illness among adult patients, but which might be smallpox); and 5) a large number of cases of acute flaccid paralysis with prominent bulbar palsies, suggestive of a release of *botulinum* toxin.

Preparedness and Response

In view of the events over the past 10 years, the possibility of biological warfare, especially bioterrorism, has been taken into consideration by the countries worldwide. Some analyses and thrills revealed that deliberate aerosol release of agents such as smallpox or anthrax in urban settings would rapidly paralyzed local medical facilities.[15,16] In spite of extreme efforts

provided by Federal Emergency Management Agency, the experience of the Atlantic suffering both genuine release episodes and many hoaxes has revealed logistic weaknesses and false assumptions in preparedness and response.[17] Horizontal and vertical interactions and assistances between medical providers, public health, and veterinary agencies are more encouraging. Interagency and even international cooperation are also essential. It is very urgent for us to prepare adequate and plentiful vaccines / antimicrobials and to transport them rapidly if the attacks occur. For example, the vaccines of anthrax are lacking in most countries including Taiwan. Table drills and real exercises should also be reviewed frequently. The establishment of an evaluation model is also essential.

It requires a continued monitoring of abnormal disease patterns in humans, animals, and plants to recognize covert release of biological warfare agents. Clinicians, microbiologists, and public health personnel's should cooperate together to detect unusual pathogens for unusual patterns of febrile illness, unusual features of septicemia or dermatological, respiratory, or gastrointestinal manifestations. Any evidences of high mortality or clustering of cases may be suspected to be involved in bioterrorist attacks. Immediate notification of suspect cases or outbreaks should prompt rapid epidemiological investigation with a level of laboratory investigation and empirical prevention measures appropriate to the determined risk. The instructions of early prevention measures and the risk-benefit comparisons of off-license use of antimicrobial drugs and vaccines are increasingly available in the public domains in the United Kingdom[19,20] as well as in the United States.[21]

For example, in the United States, the CDC has more recently embarked on the National Electronic Disease Surveillance System (NEDSS) project. The program provides an integrated standard-based approach to disease surveillance and links public health surveillance to the clinical information systems infrastructure. With the funding, many states have been engaged in establishing the NEDSS base system, including an integrated data repository and a system able to receive data from various Web-based modules.

The Information Management Work Group recommended strategies for the application of electronic data systems in emergency medicine. The four primary recommendations were as follows: [22] 1) The evolution of standards and uniform data sets should be funded and promoted; 2) Health care information systems should be integrated to meet clinical, management, and research needs; 3) Health care professionals should be trained to

use information technologies to transform data into information; 4) Future trends, opportunities, and risks regarding information technologies should be systematically studied.

Using the above system, we can reutilize the data that has already been collected to undergo further clinical and public health research, management of patient population, development of health care guidelines and policies, and education of emergency healthcare providers.

Educational resources

Many websites provide useful resources and clinical information about bioterrorism. The following are some examples.

- Centers for Disease Control (USA) (http://www.bt.cdc.gov)
- World Health Organization (http://www.who.int/emc/deliberate_epi.html)
- Center for the Study of Bioterrorism and Emerging Infections, Saint Louis University School of Public Health (http://www.bioterrorism.slu.edu)
- American Society for Microbiology (http://www.asmusa. org/pcsrc/bioprep.htm)
- Centers for Disease Control, Taiwan, ROC (http://203.65.72.83/En/dqia/ Publications.ASP)

Summary

Appropriate dispersion of even a small volume of biological warfare agent may cause high morbidity and mortality, which may be exacerbated by public panic and social disruption. Early symptoms of disease induced by a biological warfare agent may be non-specific or difficult to recognize. Healthcare workers should be alert for unusual single cases or clusters of illness, especially in otherwise healthy adults. Unusual illness should be notified immediately to public health authorities. Strategic responses to the deliberate release of biological warfare agents must be rehearsed locally and nationally with multiple agencies. Healthcare professionals should familiarize themselves with national and local sources of advice on deliberate release.

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生物恐怖主義：急診醫師的新挑戰

王宗倫

摘要

恐怖主義分子使用核生化武器的攻擊，對於急診科醫師而言，是一項新的挑戰。這個問題的嚴重性是模糊不清且無法預期的，而它的風險評估相關研究極為有限。雖然傳統的爆炸方式仍舊是恐怖主義最常使用的武器，但是核生化攻擊的可能性也與時俱增。依據軍事用語，化學、生物、放射性、核子，及爆裂物等合稱為 CBRNE 武器。其中，生物戰劑之所以常為恐怖主義所偏好使用，是因為它們對生理及心理上的威脅，會產生極大的衝擊。我們在此將簡介生物恐怖主義的觀念，並提供對其準備及應變的準則。*(Ann Disaster Med 2002;1 Suppl 1:S1-S8)*

關鍵詞：生物恐怖主義；準備；應變；急診醫師

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