Review Article

Are Saudi Arabian hospitals prepared for the threat of biological weapons?

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ABSTRACT

The use of biological weapons has been recorded repeatedly in history. Until recently, biological terrorism had been little discussed or written about. However, events over the past 12 to 18 months have made it clear that likely perpetrators already envisage every possible scenario. Nations and dissident groups exist that have both the motivation and access to utilize biological weapons. In April 1994, a Russian biological weapons expert presented the conclusions of the Russian experts as to the agents most likely to be used: smallpox, anthrax, and plague. Health care workers in the Kingdom of Saudi Arabia (physicians, nurses, and emergency medical technicians) need to be aware of the seriousness of the threat of biological weapons, and to have an approach for the early identification, triage, and management of biological weapons victims. Clues to the occurrence of a bioterrorism attack include the abrupt onset of a large number of cases of a similar disease or syndrome, the occurrence of diseases with unusual geographic or seasonal distribution, and epidemics of non-endemic diseases. Health care workers must maintain a high index of suspicion, involve the hospital epidemiologist or infectious diseases specialist, identify a clear administrative chain-of-command to minimize confusion, and rely on existing networks such as the hospital disaster-and-safety committee to ensure a multidisciplinary response. Maximum readiness can be achieved by periodic readiness drills.

Keywords: Biological terrorism, biological weapons.

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Throughout history, infectious diseases have had a major impact on military operations. However, the intentional use of infectious agents in war adds a new dimension to the threat. Early attempts at biological warfare date to antiquity and include the crude use of filth, cadavers, animals, and carcasses to contaminate wells and water sources of armies and civilians under attack. During the 14th century siege of Kaffa (now Feodossia, Ukraine), the attacking Tattar forces experienced an epidemic of plague and used the cadavers of their deceased to cause an outbreak in the city leading to its conquest. Also, smallpox was used as a biological weapon against native-Americans in the 18th century.[1]

Biological agents reportedly have been employed to a limited extent during recent military conflicts, for example, the dispersion of plague bacilli during World War II, and the use of trichothecenemycotoxins (yellow rain) in Southeast Asia.[2] Japan conducted biological weapons research in occupied Manchuria from 1932-1942, where prisoners were infected with Bacillus anthracis, Neisseria meningitidis, Shigella species, Vibrio cholerae, and Yersinia pestis; at least 10,000 prisoners died from these experimental infections. In Germany, prisoners in Nazi concentration camps were forcibly infected with Rickettsia prowazekii, hepatitis A, and Plasmodium species, and treated with investigational drugs. In England, during World Ward II, bomb experiments of weaponized spores of Bacillus anthracis were conducted on Gruinard Island near the Coast of Scotland resulting in heavy contamination. Viable spores remained present until the island was decontaminated with sea water and formaldehyde in 1986.[3]

In 1972 an international treaty called the

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"Biological Weapons and Toxin Convention" (BWC) was signed by many nations that prohibited the development, production, and stockpiling of biological weapons. Since then, several signatory nations of the 1972 BWC have participated in activities outlawed by the treaty. A notable incident was the non-intentional release of anthrax spores in Sverdlovsk in 1979 that resulted in 66 deaths and provided evidence of continuing production of BW in the former Soviet Union.[4,5] This article addresses the key biological-weapons threats to Saudi Arabia, and the need to prepare an effective response to them.

Definitions. A biological agent is defined by the World Health Organization (WHO) as an agent that produces its effect through multiplication within a target host and is intended for use in war to cause disease or death in human beings, animals, or plants. A biological weapon is a system composed of four major components: the payload (the biological agent), the munition (a container that keeps the payload intact and active), the delivery system (a missile, an artillery shell, an aircraft, etc.), and the disposal mechanism (an explosive force or spray device).[6]

Recent threats and agents. The possibility of bioterrorism has always seemed remote. But recent terrorist attacks on the World Trade Center in Manhattan in 1993, the Federal Building in Oklahoma City in 1995, and the Tokyo subway in 1995, have made the threat of bioterrorism more relevant. This has lead many countries, especially the United States, to examine its readiness to respond to a biological weapons attack.[7,8]

Many bacteria, fungi, viruses, rickettsial agents, and toxins have been mentioned in the literature as possible biological weapons. Those mentioned most often include Bacillus anthracis, botulinum toxin, Yersinia pestis (plague), ricin, staphylococcal enterotoxin B, and Venezuelan equine encephalitis virus.[9] Most of these agents are unique in their ability to infect a large number of casualties over a wide area with minimal logistical requirements. The characteristics of an ideal biological weapons agent include low visibility, high potency, substantial accessibility, and a relatively easy mode of delivery.[10]

Three major threats. In April 1994, Anatoliy Vovobyov, a Russian biological-weapons expert, presented the conclusions of the Russian experts as to the agents most likely to be used in a biological attack.[11] These agents--smallpox, anthrax, and plague--are briefly described for clinicians who are unfamiliar with their salient features.

Smallpox is caused by the virus Variola major and is transmitted from person to person by the airborne route after an incubation period of 12 to 14 days. Patients develop fever and backache followed by the

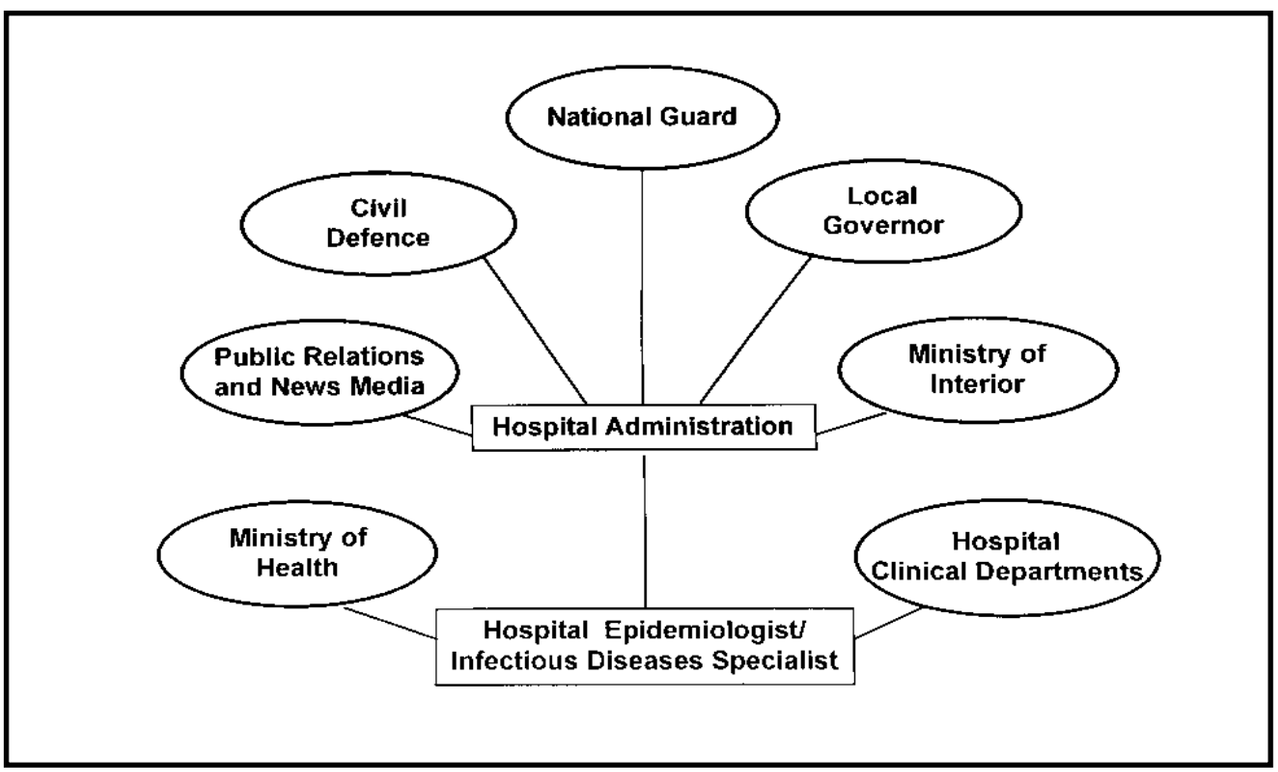

Figure 1 - Proposed scheme for communicating about bioterrorism events.

appearance of a macular rash that progresses to papules and then pustular vesicles. While the rash of smallpox resembles that of chickenpox, a notable distinguishing feature is that the smallpox rash is synchronous (all lesions reach the same stage at the same time) while the chickenpox rash is not (at any given time, there are lesions at various stages of development). There are no mild or subclinical infections, and no treatment is available. The mortality of smallpox ranges from 25% to 30% in unvaccinated persons. After the detection of the last case of smallpox in Somalia in 1977, smallpox eradication was certified by the WHO in 1980. Until that time, essentially all countries conducted vaccination programs. Currently, the United States possesses only six to seven million doses of the vaccine.[12]

Anthrax is caused by Bacillus anthracis, a spore-forming, gram-positive bacillus that is present in soil worldwide. It has three clinical presentation in human beings: cutaneous, gastrointestinal, and inhalational. Inhalational anthrax, the form likely to be associated with bioterrorism, begins with fever, malaise, and fatigue, and then progresses to severe respiratory distress, septic shock, and death within 24 to 36 hours. Once symptoms appear, the disease is usually fatal despite treatment. Anthrax is difficult to diagnose because of the nonspecific physical findings, but the chest x-ray may reveal a widened mediastinum due to lymphadenopathy, and blood cultures are positive late in the course of the disease. Treatment includes intravenous ciprofloxacin or doxycycline plus supportive care. A licensed vaccine is available and administered in six subcutaneous doses at time 0, 2 weeks, 4 weeks, 6 months, 12 months, and 18 months, followed by annual boosters. Chemoprophylaxis in the form of oral ciprofloxacin or doxycycline should be given for suspected exposure and should be continued for at least four weeks and until three doses of the vaccine have been received.

Plague is caused by the bacterial pathogen Yersinia pestis. It is transmitted by flea vectors from rodents to animals, rodents to human beings, and human beings to human beings. There are bubonic, septicemic, and pneumonic forms of presentation. When the disease is suspected, gram stain or culture of the causative pathogen can be obtained from blood, sputum, or other clinical specimens. Pneumonic plague is fatal if therapy is not initiated within 24 hours of symptom onset. While intramuscular streptomycin (30 mg/kg/d) for 10 days is the therapy of choice, gentamicin or doxycycline are also effective. A licensed killed vaccine is available for those considered at risk, but its efficacy against pneumonic plague is questionable.

Recognition of bioterrorism events. Bioterrorism acts may be covert or announced events. It is important for clinicians to be aware of the clinical syndromes produced by biological agents in order to recognize them rapidly. However, because of the nonspecific features of these syndromes, the recognition of a bioterrorism event will most likely be triggered by epidemiologic features such as a rapidly-increasing incidence of a disease in a normally healthy population; an epidemic curve that rises and falls during a short period of time; an unusual increase in the number of people seeking care for fever, respiratory complaints, or GI complaints; an endemic disease rapidly emerging at an uncharacteristic time or in an unusual location; a cluster of patients arriving from a single location; a large number of rapidly-fatal cases; or any patient presenting with a disease that is relatively uncommon.

The public health response. In the United States, the perception of vulnerability to bioterrorism has lead to a coordinated public health response involving partnership between representatives for local and state health departments, federal agencies, and medical and public health professional associations. This response is described in a national strategic plan developed by the US Centers for Disease Control and Prevention.[13] Since no similar strategic plan presently exists in the Kingdom of Saudi Arabia, what can be done at the hospital level until a national commitment and funding is made available to address this concern?

Saudi health care facilities are likely to be the initial sites of recognition and response to bioterrorism events. Therefore, these facilities should have policies in place to authorize the hospital epidemiologist or infectious diseases specialist to rapidly implement preventive and control measures, and to clarify the lines of authority and communication. A proposed scheme for the communication of a possible bioterrorism event is shown (Figure 1). In this scheme, the hospital epidemiologisit or infectious diseases specialist notifies hospital clinical departments, the Ministry of Health, and Hospital administrators. Hospital administrators will in turn notify governmental agencies and the media. In addition to establishing a communication mechanism, an existing network such as the hospital disaster-and-safety committee can be utilized as the foundation for a multidisciplinary response team with an operational readiness plan.

A readiness plan prepared by the Association for Professionals in Infection Control and Epidemiology (APIC) and the US Centers for Disease Control and Prevention can be adapted for local use, and is available free from the APIC website resource center.[14] Hospital staff should be educated about the magnitude of the threat and the clinical presentation and medical management of the likely biological agents. From an operational point-of-view, there should be an inventory of acute-care and long-term-care beds, isolation rooms (single-occupancy with

negative air pressure), decontamination units for management of chemical or toxin attacks, emergency medical service capability, and therapeutic and preventive modalities. Periodic readiness drills are essential for ensuring that all staff are familiar with all procedures. The readiness plan requires financial resources and support from hospital administration despite the fact that the exact magnitude of the threat cannot be quantified.

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