Quarantine after an International Biological Weapons Attack: Medical and Public Health Requirements for Containment

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Key words: bioterrorism, contingency, containment, healthcare, quarantine

Abstract

The world now faces the dreadful possibility of biological weapons attacks by terrorists. Healthcare systems would have to cope with such emergencies should all preemptive measures fail. Information gained from the Global Mercury exercise and the SARS outbreak has shown that containing an outbreak at the start is more effective than reacting to it once it has spread and that containment should be treated both nationally and internationally. On the national level this entails developing rapid and effective methods to detect and identify infected cases, and implementing isolation and control measures to lower the risk of further transmission of the disease while assuring the safety of medical teams and laboratory workers. Strategic contingency plans should incorporate well-defined procedures for hospitalization and isolation of patients, providing regional backup of medical personnel and equipment and maintaining close cooperation between the various bodies in the healthcare system. Quarantine is an effective containment measure, especially if voluntarily imposed. Modern communication systems can help by sending professional teams timely instructions and providing the public with information to reduce panic and stress during quarantine procedures. Informing the public poses a dilemma: finding a balance between giving advance warning of an imminent epidemic outbreak and ascertaining the likelihood of its occurrence. Containment of international bioterrorist attacks depends entirely on close international cooperation to implement national and international strategic contingency plans with free exchange of information and recognition of procedures.

IMAJ 2004;6:658–660

Terror is becoming increasingly more innovative and its devastation more widespread. Starting with simple unsophisticated incidents, terrorists have implemented and refined advanced methods of terrorism to accomplish their missions and promote their goals. These include: hijacking aircraft in the 1970s, taking hostages, using suicide bombers and, more recently, trial use of non-conventional agents in terror attacks.

With a wide range of non-conventional agents of the chemical, biological, radiological, or nuclear kind at their disposal, the choice by terrorists of a highly infectious biological agent presents us with one of the gravest threats yet [1]. Healthcare systems the world over, and especially in the industrialized countries of the west, would have to cope with complex scenarios of this nature should failures occur in deterrence of hostile activities, in intelligence to counter-proliferation, and in prevention of an actual outbreak.

On 5 November 2003 the *Washington Post* reported that the World Health Organization had been found unprepared to deal with such an emergency and that more than 100 nations lacked the surveillance capabilities to detect an outbreak of this kind. Countries attempting to address this issue have their own national protocols that might conflict with those of the others and could therefore block or interfere with the success of an international global response in the case of a global emergency.

Recommendations for containing infection:

- *Employing preemptive rather than response measures*
- *Imposing voluntary quarantine, backed by stress-reducing information supplied by modern electronic communication systems*
- *Ensuring close international cooperation to implement strategic contingency plans, exchange information freely, and recognize procedures*

Useful lessons were learned from an exercise code named "Global Mercury" that took place in September 2003 [2]. It comprised a simulated bioterrorist attack in which a group of "terrorists" deliberately infected themselves with smallpox and then traveled to various countries to spread the infection, via their own bodies, on public transport systems and at car shows, and by distributing contaminated business cards. The countries that participated in the exercise were the United States, Britain, France, Germany, Canada, Italy, Japan and Mexico. The conclusions and recommendations of that experiment were that it would be cheaper to build a global network capable of spotting and containing outbreaks at the place and time of inception than to react after they had already spread.

The emergence of SARS during 2003 served as an excellent demonstration of some of the problems associated with containment

and control of a highly infectious agent on both the national and international levels. The same principles also apply to smallpox, plague, hemorrhagic viruses, and other highly infectious agents.

There can be no doubt whatsoever that containment of an emergency such as the outbreak of an infectious disease – an epidemic – entails the implementation, both nationally and internationally, of a strategic contingency plan.

Containment on the national level

Treating the issue of containment of a biological weapons outbreak successfully on the national or local level, whichever is appropriate, is dependent on certain fundamental conditions being met. Developing efficient clinical detection and identification methods, as well as making rapid and reliable laboratory diagnoses of infected cases are essential requirements. It is also vitally important to develop the epidemiologic capability of ensuring fast and efficient detection and identification of infected cases from background morbidity. This is a complicated matter, as the initial first to second day symptoms of the occurrence resemble those of influenza and are not sufficiently specific. The window of opportunity for effective treatment, in those cases where treatment can be administered, is therefore of very short duration.

Naturally, the medical teams and lab workers must be familiar with all the potential agents. They must be well versed in isolation procedures and in methods for reducing the risk of transmission. They should have the means to implement standard, droplet and airborne control measures for infectious diseases. They should have the will and the commitment to cope with such outbreaks. It is important, therefore, to ensure the safety of the team members by taking steps, such as prior immunization or prompt vaccination at the onset of symptoms of the disease, and the provision of prophylactic treatment and protective gear.

A thorough knowledge of and proper adherence to isolation procedures are also essential prerequisites for ensuring an appropriate response. In the SARS outbreak a large proportion of the patients had been infected in hospitals or by contact with people who had previously been hospitalized. In fact, most of them were members of the medical staff. Others had simply not bothered to take basic isolation and precautionary measures [3].

The provision of facilities for hospitalization and isolation of patients in controlled low pressure rooms is highly recommended. The same applies to the preparation of regional backup medical and nursing teams, as well as suitable backup medical equipment for mechanical ventilation, medicine, and vaccine facilities, etc. This would, of course, be particularly useful in cases of regional or countrywide quarantine.

Close cooperation on the national level between the various bodies in the healthcare system are essential: namely, Primary Care, Hospitals, Public Health, and First Responders. This should include timely dissemination of information and guidelines to the public health and healthcare communities as well as to the general public. It should also include training and drilling of all the elements within the healthcare system and the interfacing units outside it.

Containing an epidemic outbreak effectively entails having the capability to carry out a rapid, efficient wide-scale epidemiologic investigation. This includes monitoring patients and their contacts as well as surveillance of patients with suspicious symptoms. Having reliable and comprehensive databases with as near as possible real-time reporting is also crucial. Effective containment of such an emergency is equally dependent on professional management of the incident on the national and regional levels.

Containment by quarantine

The sudden appearance and spread of an infectious disease poses dilemmas, uncertainties and innumerable difficulties. Quarantine is an effective measure for containing an outbreak. When performed on a voluntary basis and with respect for human dignity, it could be optimally effective, especially if sufficient security margins such as areas suspected of being afflicted are also included. It would not be amiss to say that voluntary quarantine is a primary requisite at times like these, for if it were decided to impose a quarantine it would hardly be possible to keep that decision secret in any country with free and totally involved media. Such a leakage of information could lead to mass flights of people from the afflicted area to avoid confinement under quarantine, thereby facilitating in turn further transmission of the disease. It is doubtful whether it would be possible to impose a quarantine on an entire country or to oblige any country to declare a total quarantine. Enforcing a non-voluntary quarantine might very well be impracticable, especially during the initial stages when the level of panic is at its highest.

Electronic communication

Today, Internet and cellular communication infrastructures could serve as very good additional means for containing an infectious outbreak. Timely and reliable dissemination of guidelines as well as instructions sent by Internet and Intranet both to medical teams and to the general public could be extremely helpful in increasing the chances of containment. Coordinating the preparedness and activities of all the bodies within the healthcare system and of those connected to it from the outside would serve to control and monitor an outbreak, disseminate information, and reduce the incidence of panic, thereby bolstering the public's confidence in the professional organizations.

Cellular communication and Internet chats could also, by means of quasi-virtual family reunion processes, somewhat decrease the distress that quarantine might engender.

The information dilemma

Finding a balance between giving advance warning of an imminent epidemic outbreak and ascertaining the likelihood of its occurrence poses a special challenge. Several questions arise in this context. In terms of time, how significant would a delay be in making the announcement public, and for how long could it be delayed? Which mechanism could guarantee the best results? Should a worldwide or a continental reference laboratory be established, or would a regional one based at an approximately 4 hour flight distance from any service point be preferable? How would one go about setting up an international rehabilitation mechanism that could enable sounding the "All Clear" signifying that an affected country has overcome the danger and become "clean"?

International cooperation

The next aspect that needs to be dealt with is that of cooperation on the international level. When it comes to the matter of effectively addressing the threat of bioterrorism, international intelligence cooperation should be the rule, as should reciprocal international guarantees to carry out coordinated, mandatory action in accordance with international norms and standards, at least as far as industrialized countries are concerned.

Deterrence, prevention, and thwarting options are always preferable to reaction to a particular situation arising from a bioterror incident where, for example, an infectious agent has been used. With regard to the healthcare system, free transmission of information and data between countries should be encouraged and coordinated steps taken to contain outbreaks and minimize resulting damage.

Here, too, modern communication systems can contribute positively to the twin objectives of coordinating the activities of countries and international organizations, and standardizing and classifying terms acceptable to one and all. The recommendations of the U.S. Centers for Disease Control regarding standard, droplet and airborne precautions for isolating and controlling infectious agents can serve as excellent illustrations of this point [4,5].

International bodies should be enabled to participate both in reciprocal consultations of healthcare professions (with regard to topics such as infectious diseases, labs, managers and decision makers) and in epidemiologic research carried out by specialists from different countries.

Since the world has become a global village there is a greater likelihood of international transmission of disease, especially due to highly developed air transport systems. That is why mutual responsibility between nations and international solidarity should be encouraged, especially in the case of highly industrialized countries. A part of this solidarity must express itself in fulfillment of the obligation to provide backing and aid in supplying vaccines, medicines, medical equipment, etc. For this purpose an internationally organized research program should be set up to help develop vaccines and medicines, especially when facing the struggle against advanced biological warfare agents. Cooperation with the various airlines and international airline agencies should also be targeted as part of the effort to contain an epidemic

Conclusion

International cooperation, exchange of information and experience, recognition of procedures, preparedness and planning of strategies should be the order of the day in every country. These steps could make an immense contribution towards raising the global level of response to the major challenge of an international biological weapons attack.

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Capsule

T cell or not T cell in autoimmune aplastic anemia

The accepted treatment for patients with aquired aplastic anemia who are not eligible for allogeneic bone marrow transplantation is immunosuppressive therapy with antithymocyte globuline or cyclosporin, with a response rate of 60–80%. This fact, in addition to the epidemiologic association with particular HLA backgrounds, suggests an immune pathophysiology of this entity. Based on the hypothesis that aplastic anemia is the result of an antigen-specific lymphocyte immune response against hematopoietic tissue, Risitano et al. analyzed the T cell repertoire of patients with aplastic anemia, suggesting a specific oligoclonal T cell expansion of CD8 T cells. Furthermore, after T cell clonal expansion *in vivo*, the high variable region of the T cell receptor was sequenced and the complementary determining region 3 (CDR3) of the β variable (Vβ) chain of the TCR and specific T cell clonotypes were identified. The authors showed that individuals with aplastic anemia have specific dominant clonotypes, not detected in controls. Homology in CDR3 clonotypes was detected between patients with similar HLA haplotype. Moreover, in selected patients, a quantitative relationship was seen between specific clonotypes and disease activity. A dominant clonotype apparently involved in the pathogenesis of aplastic anemia was identified, but the triggering antigen of this abnormal immune response remains unknown.

Lancet 2004;364:355

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