Review

Bio-terrorism : The New Challenge

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Abstract

The Current global political situation mandates preparation for attacks using biochemical weapons, which the aggressor can easily make, transport and deploy. Management of biological attacks requires recognition of the clinical syndrome, initiation of adequate and effective therapeutic responses and putting in place protective measures which could drastically limit the morbidity and mortality of the bio-warfare agents.

A working knowledge of bio-warfare agents is of paramount importance, particularly for the health care professionals, because in addition to the caring for the injured, they may need to assess the hazard site, establish decontamination procedures, communicate with law enforcement agencies and allay public fear, anxiety and apprehension.

Keywords

Terrorism, Biochemical agents

Introduction

Security experts are of the opinion that it is not a matter of "if" there will be release of one or more biological agents, but only a question of "when"[1]. The release and spread of a contagious agent such as smallpox virus, anthrax, botulinum toxin could prove catastrophic because they are characterized by substantial accessibility, low visibility, high potency and relatively easy delivery[2]. They are unconventional weapons which can be delivered by unconventional means like aerosol sprays, food and water contamination, conventional explosives or by covert injections[3]. As all these agents of bioterrorism have concealed mode of delivery, easy transportation and difficult identification they are readily adaptable for terrorist operations[4].

With the end of World War II and the onset of Cold War the emphasis was focused on nuclear weapons, as so called "weapons of mass destruction" and the resulting "nuclear winter"[4]. The deployment of biological agents no longer remains a hypothetical scenario but a life threatening contingency which can cause mass casualties and overwhelm the health care resources of the community leading to chaos and panic[5].

History of Bioterrorism

Biological weapons have evolved from the crude use of cadavers to contaminate water supplies, to the development of specialized munitions for battlefield and covert uses[6]. Until recently, bio-warfare was considered to be a lesser threat and in the year 1969 USA under President Nixon[7] decided to terminate the US offensive biological weapons programme and the subsequent endorsement by most countries of the 1973 Biological Weapons Convention which called for destruction of all stocks of biological weapons and the cessation of research on their use as offensive agents.

Unfortunately, events in the recent past once again highlighted the destructive potential of bio-warfare agents

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leading to the expression of global concern[8], for example :

1) In 1995, a Japanese religious cult, Aum Shinrikyo, released nerve gas, "Sarin", in the Tokyo Subway. The cult was later discovered to have had plan for large scale bioterrorism and members of this group even travelled to Zaire to obtain samples of Eboila virus for bioterrorism[9].

2) In Sept. 1984, contamination of restaurant salad bars in Oregon by members of the Osho cult infected 751 persons with *Salmonella typhimurium* organisms[10].

3) The end of Gulf-war revealed that Iraq had a surprisingly large biological weapons programme under which it had produced, filled and deployed bombs, rockets and aircraft with spray tanks containing *bacillus anthracis* and botulinum toxin[11].

4) In 2001, shortly after 9/11 incident, there were anthrax attacks in USA[12] where anthrax spores circulated in US mails. 22 persons became sick and 5 geographic areas were affected.

All such incidents highlighted the role of "Bioterrorist" and the realistic uncertainties as to "when" or "if" other attacks might occur with a sense of utter helplessness of the average citizens regarding protective measures they should undertake.

Biological Weapons

On the basis of how efficiently the disease can be transmitted, how difficult the microorganisms are to produce and distribute, how well they can be defended against and how likely they are to alarm the public and produce widespread fear, the Centre for Disease Control and Prevention (CDC), Atlanta, USA have ranked bioweapons into three categories, A, B, C based on the following criteria[13] :

A	B	C
o Readily disseminated. o Cause high mortality. o Public panic with social disruption. o Required special public health preparedness. o For example : Anthrax, Botulinum, Plague, Small pox, Tularemia, Viral haemorrhagic fevers.	o Moderately easy to disseminate. o Moderate morbidity but low mortality. o Require specific diagnostic and surveillances. o For example : Brucellosis, Food Safety threats (Salmonella), Water safety threats (*Vibrio Cholerae*), Glanders.	o Emerging pathogens that could be engineered for mass dissemination because of availability, ease of production and potential for high mortality and morbidity. o For example : Nipah virus, Hanta virus.

Table 1

The summary of some of the important biological weapons include :

Agent	Incubation	Symptoms	Signs	Diagnostic assay	Vaccine
Bacillus anthracis	1-6 days	Fever, cough, abdominal and chest pain.	Widened media-stinum on CxR.	Gram stain or Wright stain, ELISA, PCR.	Yes
Small Pox (Variola Virus)	7-17 days	Fever, headache, Prostration, vomiting.	Centrifugal, synchronus rash on the face, mucous membranes, hands and forearms.	PCR, Viral isolation, electron or light microscopy, serology.	Yes
Pneumonic plague (Yersinia pestis)	1-6 days	Fever, cough, dyspnoea	Fulminant Pneumonia, Respiratory failure, septicemia shock.	Gram stain, Wright Stain, culture, ELISA, PCR.	Yes
Botulism (Clostridium botulinum)	2 hrs – 8 days	Nausea and Vomiting, abdominal pain.	Symmetrical cranial nerve palsies. Ptosis, diplopia, dysarthria, dysphonia, dysphagia.	Clinical diagnosis.	Yes

Table 2

Sl. No.	Criteria	Chemical terrorism	Biological terrorism
1.	Speed.	Very rapid (min-hrs).	Delayed (days-weeks).
2.	First – Responders.	Paramedics, Police, Rescue Workers, Law enforcements.	Physicians, Nurses, Hospital Administrators, Laboratory experts.
3.	Decontamination.	Critically important.	Not necessary.
4.	Medical-Interventions.	Chemical antidotes.	Vaccines and Antibiotics.
5.	Quarantine.	After decontamination, no need.	Crucial for effective control.

Contrary to earlier beliefs, events in the recent past have shown acquisition of biological weapons is not difficult, methods for transforming them are widely known, and the requirements for space and sophisticated equipments to produce them are modest. Biological weapons are cheap, can cause mass casualties and are relatively easy to produce, thereby drawing the attention of the terrorist (**Table 1**). Defence studies have shown that conventional warfare costs \$2,100 / km^2, chemical warfare costs \$700 / km^2, whereas biological warfare costs \$1 / km^2 [14].

In 1995, USA decided to launch the development of national preparedness programme to deal with bioterrorism and it resulted in the formation of "Chembio" response teams. The neologism "Chembio" signified identical strategies and techniques were to be employed, however there are certain distinctions between biological and chemical warfare which requires to be adhered to[15] (**Table 2**).

Future Scenario

In Europe and USA funds have been allocated and small pox vaccine, antibiotics are being stockpiled, a national network of diagnostic laboratories are being created and biodefence research programmes are underway.

A robust biodefence plan must be anticipatory, flexible and rapidly responsive. It should exploit cross cutting technologies with multidisciplinary scientific insights and use methods that have substantial scalability[16]. Examples include computational approaches for predicting drug – ligand interactions, advances in microfluidics for rapid, sensitive, point of care diagnosis and automated robotic system for rapid drug screening and vaccine production. The primary responsibility of those who treat victims of bioterrorism is to protect themselves by wearing adequate protective equipment including military protective mask, protective gloves, overboots, HEPA filter (High Efficiency Particulate Air) masks.

Now, it is high time to have serious and sustained investments in the field of science and technology to build agile defence against the ever-evolving spectrum of bioterrorism. It is often said that the military forces are trained to fight the last war and not the next one. The same holds true for public health care personnel including physicians and nurses who are the "First responders" in the battle against bioterrorism as we cannot afford to be constrained by the past, nor can we afford incremental short term goals.

India with its scientific advances and manpower in the field of biotechnology, bioinformatics and nanotechnology should take proper and effective measures to successfully face the challenge of bioterrorism.

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