Bioterrorism: Law Enforcement, Public Health & Role of Oral and Maxillofacial Surgeon in Emergency Preparedness

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Abstract

Introduction The contrived and deliberate use of pathogenic strains of micro-organisms such as bacteria, viruses or their toxins to spread life-threatening diseases on a mass scale with the aim to devastate the population of an area is referred to as ‘bioterrorism’.

Risk assessment The threat of bioterrorism is higher than ever. It is now a well established fact that the capability to create immense panic and unimaginable fear has allured the terrorists for the despicable use of biological agents for causing terror attacks. Moreover to add to the grievance, this era of biotechnology and nanotechnology has created an easy accessibility to more sophisticated biologic agents apart from the conventional bacteria, viruses and toxins. These biologic weapons can cause large-scale mortality and morbidity in large population and create civil disruption in the shortest possible time.

Preparedness and mitigation Fight against bioterrorism is a global concern and necessitates that the issue should be criminalized internationally with the assistance of

international co-operation and laws in favor of global public health. National public health agencies must also fortify their ability to be able to detect and respond to such biological attacks with better research and training facilities to health professionals, enhanced surveillance and improved diagnostic facilities by evolving an empowered public health system. Public health education and awareness are imperative; people should be made aware of reporting early to health institutions on arousal of signs and symptoms related to suspicious bioterrorist attack.

Conclusion Effective bioterrorism planning, prevention and response requires cooperation and collaboration between law enforcement and public health; Oral and maxillofacial surgeons can be successfully integrated into the emergency medical response system. With their education, training, skills and amenities in form of equipments they can augment medical and surgical personnel in early identification and subsequent control of a bioterrorist attack.

Keywords Bioterrorism · Public health · Bio-weapons · Law enforcement · Oral and maxillofacial surgeon

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Introduction

Since early times heretical nations and terrorist groups exist that possess both the motivation and capability to selectively cultivate some of the most dangerous pathogens and to employ them as biologic weapons. Bioterrorism is the intentional use of microorganisms or toxins derived from living organisms to cause death or disease in humans, animals, or plants on which we depend [1]. The use of such weapons by a nation against other nations and by subversive groups within nations as maneuvered by hostility is

generally referred to as bio-warfare, while the use of these weapons for terrorist activities is generally referred to as bioterrorism. Bio-weapons, thus are replicating microorganisms (viruses, fungi, and bacteria, including chlamydia and rickettsia) or protozoa. The other agents that can be used may be the products of metabolism of microorganisms, animals or plants that kill or incapacitate the targeted host. These include biological toxins, as well as substances that interfere with normal behavior, such as hormones, neuro-peptides and cytokines. (e.g., botulinum toxin [2, 3], cobra venom, and the plant toxins, ricin [3–5] and abrin [5]). Depending on the pathogen being used, these weapons may be employed against humans, animals or crops.

Bioterrorism is a growing threat and meticulous strategies and programs are being formulated globally to increase the awareness, preparedness and mitigation of these threats for tackling the problem responsibly since the use of biological weapons can inflict great trauma upon civilian population.

The History of Biological Warfare

Early historical experience of the use of biological weapons include those practiced in the middle ages when diseased carcasses and bodies were catapulted over enemy walls in attempts to induce sickness in humans or animals in Europe; during the French and Indian Wars, the British supplied Indians with smallpox-infected blankets; during World War II, Japanese Unit 731 experimented with biological weapons on prisoners of war in Manchuria, resulting in more than 1000 deaths [6]. During the Indo-Pakistan war of 1965, a scrub typhus outbreak in north-eastern India came under suspicion. In 1984, the salad bars at two restaurants in the Dalles, Oregon, were contaminated with *Salmonella* by followers of Shree Rajneesh. The perpetrators of this bioterrorist action were attempting to sicken citizens and prevent them from voting in an upcoming election [7]. In 1995, after the gulf war, Iraq was found to have produced bombs, rockets, and aircraft spray tanks containing *Bacillus anthracis* and botulinum toxin [8]. In the incident usually known as Japan Subway Sarin Incident, nerve gas sarin was released by perpetrators of a religious movement Aum Shinrikyo in the Tokyo subway system in 1995 killing 13 people, severely injuring 50 and causing temporary vision problems for nearly 1000 others [9]. In India mysterious outbreaks of plague were observed in Surat (Gujarat) and Beed (Maharashtra) in 1994 [10] and in district Shimla (Himachal Pradesh) in 2002 [11]. After the terrorist attacks on 11 September 2001, the biological attacks with powders containing *B. anthracis* sent through the mail during September and October 2001 reignited biological warfare research and preparedness in U.S. [12].

In October 2001 anthrax scare reached Mumbai, when offices of both chief minister and deputy chief minister received a mail with white powder [13].

Risk Categories of Biologic Agents

Based on the priority of the agents to pose a risk to the national security and the ease with which they can be disseminated, these biologic agents are classified and labeled as Categories A through C [14]. Category A agents are the highest priority agents and include organisms that can be disseminated easily or transmitted person-to-person. They have the potential for major public health impact as they can cause high mortality and create public panic and social disruption and require special action for public health preparedness.

Category B agents are the second highest priority agents and include organisms that are moderately easy to disseminate, cause moderate morbidity and low mortality and require specific enhancements of CDC diagnostic capacity and enhanced disease surveillance.

Category C agents are the third highest priority agents and include emerging pathogens that could be engineered for mass dissemination in the future because of availability, ease of production and dissemination and have the potential for high morbidity and mortality and can cause major health impact (Table 1).

Discussion

It is now widely recognized that the capability to create immense affright and unimaginable fear has appealed the terrorists for the nefarious use of these biological agents for causing terror attacks. The substantial accessibility, as many of these agents occur naturally or are relatively easy to produce, since many are used for development of vaccines and antibiotics [15] and the fact that they are highly infectious and efficiently dispersible is also fascinating. Small quantities of these biological agents are sufficient that make the concealment, transportation and dissemination relatively easy.

Moreover to add to the grievance, this era of biotechnology and nanotechnology created an opportunity of easy accessibility to more sophisticated biologic agents apart from the conventional bacteria, viruses and toxins. Agents like prions and bioregulators may be utilized in offensive terror attacks. Prions are extremely resistant to decontamination techniques including standard autoclaving and the use of bleach or other oxidants and are the causative factor in Mad Cow Disease, Creutzfeldt–Jacob Disease and Alzheimer's disease. Bio-regulators are a new class of

Table 1 Critical biologic agent list

Biologic agents	Disease
Category A	
Variola major	Smallpox
B anthracis	Anthrax
Y pestis	Plague
Clostridium botulinum (botulinum toxins)	Botulism
Francisella tularensis	Tularemia
Filovirus (Marburg and Ebola)	Viral hemorrhagic fevers
Arenavirus (Lassa, Argentine/Junin)	Viral hemorrhagic fevers
Category B	
Coxiella burnetii	Q fever
Brucella spp.	Brucellosis
Burkholderia mallei	Glanders
B pseudomallei	Melioidosis
Alphaviruses	Encephalitis
Venezuelan equine encephalitis	
Eastern equine encephalitis	
Western equine encephalitis	
Rickettsia prowazekii	Typhus fever
Toxins	Toxic syndromes
Ricin	
Staphylococcal enterotoxin B	
Epsilon toxin—C perfringens	
Chlamydia psittaci	Psittacosis
Food safety threats (Salmonella spp., <i>Escherichia coli</i> O157:H7)	
Water threats (Vibrio cholera, <i>Cryptosporidium parvum</i>)	
Category C	
Emerging pathogens (Nipah virus, Hantavirus, tick-borne encephalitis virus, tick-borne hemorrhagic fever virus, yellow fever, multi drug resistant tuberculosis)	

Data from CDC strategic planning workgroup. Biological and chemical terrorism: strategic plan for preparedness and response. Recommendations of the CDC strategic planning workgroup [14]

weapons naturally occurring in organisms that can damage the nervous system, alter mood, trigger psychological changes, retard physiological processes such as inflammation, clotting and can produce fatal consequences. The main groups of bioregulators are cytokines, eicosanoids, neurotransmitters, hormones and proteolytic enzymes [16]. Biological agents can be spread as aerosols achieving cost effective wide-spread dissemination [17] or can be delivered through water or in food, by robotic delivery or by the dreadful use of “suicide coughers” who can get self-inoculated with lethal strains of bio-warfare agents and go into public gatherings causing mass fatalities on unprecedented scale.

Inadequate preparedness during a period of biological attack can lead to corrosive political consequences and acute as well as chronic medical consequences in the affected population.

Global Legislative Preparedness Against Biologic Disasters

The Geneva Protocol signed in 1925 is a customary international law that prohibits the use of asphyxiating, poisonous or other gases and of bacteriological methods of warfare. Biological and toxin weapons convention of 1972 was the first multilateral disarmament treaty signed by about 170 countries that forbids nations from developing, producing, stockpiling or otherwise acquiring biological agents or toxins that have no justification for peaceful or defensive purposes. In 2001, Model State Emergency Health Powers Act (MSEHPA or Model Act) was drafted to help America’s state legislatures in revising their public health laws to control epidemics and respond to bioterrorism [18]. USA PATRIOT Act was also signed into law in 2001. The title of the act is a ten letter backronym (USA

PATRIOT) that stands for Uniting and Strengthening America by providing appropriate tools required to Intercept and Obstruct Terrorism Act of 2001 [19]. A new federal law “Public Health Security and Bioterrorism Preparedness and Response Act” was passed in US in 2002 [20]. The Act deals with National preparedness for bioterrorism and other public health emergencies, enhancing controls on dangerous biological agents and toxins, protecting safety and security of food and water supply, the prompt approval of safe and effective new drugs that are critical to the improvement of the public health and the review of human drug applications and the assurance of drug safety. In 2004, US Congress passed the Project Bioshield Act, which funds the government to purchase and stockpile new vaccines and drugs to fight anthrax, smallpox and other potential agents of bioterrorism [21]. The Indian National Crisis Management Committee approved a model of standard operating procedures for preventing and responding to a bioterrorism attack in March 2007. According to this model, the Ministry of Home Affairs (MHA) is in charge of coordinating command, control and preparedness measures as well as post-attack response mechanisms, but primary responsibility for responding to attacks lies with the State governments.

Strict legal and regulatory laws dealing with quarantine and jurisdictional concerns must be framed and implemented at an international level to restrain catastrophic bioterrorist attacks and penalize the nations and terrorist groups with illicit intentions.

Public Health Emergency Preparedness

Based on scientific calculations, the World Health Organization gave an estimate of possible casualties following the release of 50 kg of dried anthrax powder by aerosolisation for 2 h in a city of 500,000 inhabitants. It was calculated that 95,000 deaths would occur, with 125,000 individuals being incapacitated. The strain on medical resources would be tremendous, leading to bed requirements for 12,500 individuals (10 % of those incapacitated), antibiotics for 60 days for 125,000 people, and the disposal of 95,000 dead [22]. This would almost certainly lead to a rapid breakdown in medical resources and civilian infrastructures. Increased vigilance and preparedness for unexplained illnesses are crucial for public health protection against bioterrorism. In scenario of a biologic threat, a more sophisticated and integrated public health response is needed, which requires assessment of the outbreak by prompt methods of disease surveillance and accurate laboratory diagnosis and characterization of the biologic agent enabling the implementation of prevention and treatment protocols. Preparedness also requires enhanced public

health capacity for stockpiling of adequate resources including drugs, vaccines, prophylactic medicines, chemical antidotes, personal protective measures like gloves, masks etc. and equipments that may be required in a bioterrorism attack incident. First responders should be trained in disease recognition, biologic mass casualty hospital protocols, infection control and decontamination procedures. Aggressive treatment of diseases, isolation, quarantine, imposition of travel restrictions on the affected individuals, safe management of deceased victims and spreading public awareness about the incident should be the keystones of emergency public health response [23]. Public health systems must be strengthened to achieve enhanced surveillance and epidemiologic capacity to detect the emerging disease and to provide the relevant information that emergency medicine professionals require to respond to a bioterrorism attack. Public health professionals can recon the emerging disease trends and implement appropriate prevention and control strategies. The institutions that possess, use, receive or transfer or have access to certain select biological agents and toxins or receive such agents/toxins should be tracked about the handling and storage of these substances. Dealing with chemical, biological, radiological and nuclear attacks should be “an integral component of the teaching and training curriculum of every health professional [24]. Then in every medical surge event epidemiologists, dentists, nurses, clinical microbiology and laboratory staff can invariably be the efficient medical first responders to identify the initial cases and co-ordinate with the medical professionals.

Collaboration Between Law Enforcement and Public Health

Coordination and partnership between law enforcement and public health is prerequisite to planning and investing in the right training and defensive measures during every phase of emergency management: preparedness, mitigation, response, and recovery [12]. To identify a potential covert bioterrorism attack, coordination between public health community that collects and analyzes medical and syndromic surveillance information with the law-enforcement community that derives intelligence and case-related information related to threat assessment is required. Public health community will aim for developing effective disease prevention and control measures and law enforcement will proceed towards attempt for prevention and deterrence of future attacks. In public health incidents that involve suspected criminal activity, as in case of a covert bioterrorist attack, the best method for timely detection is early communication between the two communities and recognition

of the extent and origin of the threat by conducting joint investigations. Complementing public health response, the role of law enforcement in a suspected bioterrorism attack is conducting threat identification and assessments, including intelligence collection and analysis, implementing public health orders related to quarantine, travel restrictions and evacuation; locating an infected person who is either knowingly or unknowingly spreading a disease, securing healthcare facilities and public health sites such as mass vaccination or treatment sites, controlling crowds and protecting national stockpiles of vaccines or other medicines [25]. In response to bioterrorism and other threats to public health, to promote coordination between public health and law enforcement, the concept of forensic epidemiology has been made a part of the formal joint investigative training of public health and law enforcement officials in United States [26]. To promote the understanding that nurturing partnerships between the health and security sectors is crucial for effective resolution of many complex health and social issues '*Law Enforcement and Public Health*' subject was launched at the University of Melbourne.

Role of Oral and Maxillofacial Surgeon in Preparedness against Bioterrorism

In June 2002, the American Dental Association held a consensus workshop on "The Association's Role in Bioterrorism," and it was concluded that dentistry possesses assets in personnel and facilities that could be of great value in responding to a major bioterrorist attack. Dental and maxillofacial offices are equipped with air and suction lines and sterilizing capability. They can expeditiously function as alternate auxiliary hospitals serving as aid stations, post exposure prophylaxis dispensing sites, or even quarantine sites when medical facilities are overburdened with patients in incidents involving bioterrorism [23, 27]. Maxillofacial surgeons are the "connecting link" between dentistry and medicine. They are trained along with medical residents in pain control and anesthesia, basic medicine, pathology, general surgery and plastic surgery. They work in collaboration with other specialties including ophthalmology, otolaryngology, general surgery, plastic and reconstructive surgery, oncosurgery, neurosurgery, pediatric surgery and orthopaedic surgery. They practice in hospitals, outpatient facilities and in dental offices. An oral surgeon is an important weave for effective communication in the referral network of medical profession and additional targeted training in dealing with hazardous natural or manmade disasters can render skilled responders in the form of maxillofacial surgeons. All oral and maxillofacial surgeons must be involved with their local

hospital/community mass casualty response committees and take an active role in the preparation for a mass casualty bioterrorist event [23].

Maxillofacial surgeons must be properly acquainted with a wide range of general medical and surgical conditions. They must be well versed with biologic, chemical, radiological, nuclear and explosive agents that can be used as terrorist weapons.

Maxillofacial surgeons must be familiar with the characteristics of the biologic agents, routes of exposure, nature of epidemic, treatment and basic principles of selection and use of personal protective equipment. This involves being well versed with the pertinent manifestations of diseases caused by bioterrorism agents, especially Category A agents.

Oral and maxillofacial surgeons should be precisely aware of principles of surveillance and individual reporting of potential or actual emergencies that could affect the health of a community. Evidences that might indicate an event of a bioterrorist attack include an influx of people seeking medical attention with non-traumatic conditions such as flu-like or possibly neurological or paralytic symptoms or specific signs of a bioterrorist agent. Absence from school or work or cancellations of appointments can also be significant indicators. They should be efficient in performing triage and scanning of patients. They can aid in diagnosis by simple methods such as primary screening of oral and cutaneous lesions or by collecting salivary/nasal swabs for laboratory examination. The identified cases must be subsequently referred to the required medical specialty and the prognosis of the disease should be concomitantly monitored. This can limit the spread of exceptionally contagious diseases directly reducing the number of fatalities caused.

They must be aware of principles of post exposure management, such as post exposure smallpox vaccination, anthrax antibiotic prophylaxis for asymptomatic patients who may have been exposed and counseling of the patients to help prevent psychological casualties of bioterrorism. Being well-versed with infection control methods and principles of decontamination, oral surgeons can apply their knowledge in reducing the spread of infections. The goals of decontamination are to prevent further agent absorption by patients and to protect health care providers from contamination [28]. Maxillofacial surgeons can participate in mass immunization programmes, [29] administer drugs through parenteral routes, assist in endotracheal intubation or administration of anaesthesia and can provide cardiopulmonary resuscitation as they are often certified in advanced cardiac life support. Oral and maxillofacial surgeons are competent trauma surgeons and can treat maxillofacial injuries. The training of advanced trauma life support can be made mandatory in their curriculum.

By immediate detection of the emerging disease, prompt referral to the concerned health care facility, its immediate reporting to the public health authorities and effective participation in controlling the disease, maxillofacial surgeons can serve as effective first responders and complement the public health system in curbing the menace of the epidemic caused due to bioterrorist attack.

Conclusion

To combat a bioterrorism attack focus should be laid on developing full international cooperation amongst nations for dealing with this problem since formal international scientific collaborations will need to be created and international laws against use of biological weapons will have to be framed. Response against any bioterrorist event will necessitate co-ordinated efforts of public health departments (surveillance, laboratory response network, alertness of medical and paramedical faculties) and administrative systems including intelligence agencies, army, law enforcement machinery and civil administration for protecting the public and promoting its welfare. From the perspective of medical and public health communities the challenges to be faced include comprehensive detection and assessment, mass casualty management and implementation of preventive, curative and specific control measures for containing the further spread of the disease. Oral and maxillofacial surgeons can contribute to terrorism response plans and complement the medical fraternity in overcoming the overt catastrophic incident. They should be trained mandatorily in a core set of competencies that will enable them to respond to a significant bioterrorism attack by helping to contain the spread of the attack and participating in surveillance activities as appropriate upon direction of proper authorities.

Conflict of interest None.

Compliance with Ethical Standards

Research Involving Human Participants and/or Animals This is a review paper and did not involve human participants or animals.

Informed Consent This is a review paper and did not involve any sort of study on any form of living beings.

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