ROLE OF DENTIST IN BIOTERRORISM: A KILLER FOR MANKIND.

1*Dr. Vishal Mehrotra, 2Dr. Gauri Mishra, 3Dr. Shashank Gaur, 4Dr. Kriti Garg, 5Dr. Rohini Singh, 6Dr. Priyanka Sharma

1*Reader Department of Oral Medicine and Radiology Rama Dental College Hospital and Research Center, Kanpur.
2Department of Dentistry Associate Professor, Government Dental College, Jalaun. U.P.
3Senior Lecturer Department of Pedodontics and Preventive Dentistry Bhabha College of Dental Sciences, Bhopal.
4Senior Lecturer Department of Oral Medicine and Radiology Rama Dental College Hospital and Research Center, Kanpur.
5,6Post Graduate Student Department of Oral Medicine and Radiology Rama Dental College Hospital and Research Center, Kanpur.

ABSTRACT

Bioterrorism is the intentional use of micro-organisms and toxins to produce disease and death in humans, livestock and crops, their attraction in war and for use in terrorist attacks is attributed to various unique features. Biological weapons can be disseminated by aerosol sprays, explosives or food and water contamination. They can strike suddenly without any warning and inflict considerable mortality and morbidity that can continue for a long period, such attacks may create high level of panic, environment contamination and extreme pressures on emergency health services. These attacks are the real dangers staring mankind in the face. This calls for ever preparedness on the part of the health care workers. Dentists are not perceived as much of help in case of any disaster event. Dentists have the clinical skills and medical knowledge that are invaluable assets in a mass casualty event; dentists can be given the opportunity with additional targeted training to become more effective responders to natural disasters and other catastrophic events. Inculcating disaster training in the undergraduate course will better prepare the dentist for any surge event. This article reviews the role dentists can play in disaster response.
KEYWORDS: Bioterrorism, Dentists, Biological agents, Bio-weapons.

INTRODUCTION

Bioterrorism covers a very broad spectrum of concerns, from catastrophic terrorism with mass casualties, to micro-events using low technology but producing civil unrest, disruption, disease, disabilities, and death. The threat of bioterrorism, long ignored and denied, has heightened over the past few years.[1]

Bioterrorism is defined as the terrorism involving the intentional release or dissemination of biological agents. These agents are (bacteria, viruses or toxins) may be in a naturally occurring or a human modified form.[2]

Popular scenarios of bioterrorism, that may have some mythical origins and cinematic Hollywoodian links, include the use of psychotic substances to contaminate food; the use of toxins and poisons in political assassinations; raids with crude biological cloud bombs; use of dried viral preparations in spray powders; and low flying cruise missiles adding destruction and havoc with genetically-engineered micro-organisms.[3]

In other words a Bioterrorism attack is the deliberate release of viruses, bacteria, toxins and other harmful agents used to cause illness or death in people, animals or plants. These agents are typically found in nature but it is possible that they could be mutated or altered to increase their ability to cause disease, make them resistant to current medicines or to increase their ability to spread into the environment. Biological agents can be spread through the air, water or in food. Terrorists tend to use biological agents because they are extremely difficult to detect and do not cause illness for several hours to several days. Some bioterrorism agents, like the smallpox virus, can be spread from person to person and some, like anthrax cannot.[2] Bioterrorism is an attractive weapon because biological agents are relatively easy and inexpensive to obtain, can be easily disseminated, and can cause widespread fear and panic beyond the actual physical damage they can cause.[4]

This article reviews the importance of bioterrorism as a threat to our community and also highlights the importance and role of medical and dental community to educate the public and policy makers about the threat.
History

Biological terrorism dates back to Ancient Rome, when faeces were thrown into faces of enemies.\[^5\] This early version of biological terrorism continued on into the 14th century where the bubonic plague was used to infiltrate enemy cities, both by instilling the fear of infection in residences, in a hope that they would evacuate, and also to destroy defending forces that would not yield to the attack.\[^6\]

Some of the ancient bioterrorist attacks:

- Assyrian politicians dumped fungus from rye into their opponents’ wells, giving them fatal ergot poisoning in 650 BC.\[^3\]
- Armies besieging a town relied on increased disease among the defending population and threw dead animals into water supplies, to spread it.\[^3\]
- Tatars of the 14th century spread bubonic plague by catapulting diseased corpses into towns.
- In World War I, United States and Germany developed biological weapons to contaminate animal fodder.
- In Cold War, United States and Soviet Union created arsenals of biological agents for use in battle and against civilian populations.\[^5\]
- Dr. Anton Dilger worked with cultures of anthrax and glanders, between 1915 and 1916, with the intention of biological sabotage on behalf of the German Government.\[^6\]

Modern bioterrorist incidents:

- In 1984, pseudo-Buddhist Rajneeshee cult distributed Salmonella in restaurants and grocery stores in Oregon to poison civic leaders and gain control of the local Government.
- In 1992, Russia had the ability to launch missiles containing weapons-grade small pox. A number of terrorist organizations, including Al-Qaeda, have explored the use of biological agents.
- In 1995, Sarin gas was released in a Tokyo subway, by the religious sect Aum Shinrikyo, which immediately killed 12 and hospitalized 5000 people.
- In 2001, letters containing anthrax spores were mailed to a television news anchor, US senator, and others, leading to the death of a few people and hospitalization of a few others.\[^5\]
Types of Biological Agents
U.S. Centers for Disease Control and Prevention (CDC) ranks the biological agents and diseases that have potential to pose a severe threat to public health and safety and officially defined as “select agents.” into 3 categories.[7,8]

Category A
These agents are characterized by ease of dissemination and transmission of disease with high mortality rate, likelihood of causing public panic and social disruption or require special action for public health preparedness. For example: Tulatemia or rabbit fever caused by Francisella tularensis bacterium,[9] Anthrax,[10] Small pox,[11] Botulinum toxin produced by bacterium Clostridium botulinum,[12] Bubonic Plague caused by Yersinis Pestis bacterium,[13] Viral hemorrhagic fevers which includes fever caused by Filoviridae (Marburg and Ebola), and by the Arenaviridae (for example the Lassa fever and the Bolivian hemorrhagic fever).[14]

Category B
These agents disseminate less easily, have lower morbidity and mortality rate. For example: Brucellosis (Brucella species),[15] Epsilon toxin of Clostridium perfringens, Food safety threats (for example, Salmonella species, E coli O157H7, Shigella, Staphylococcus aureus), Glander (Burkholderia mallei),[16] Melioidosis (Burkholderia pseudomallei),[17] Psittacosis (Chlamydia Psittaci), Q Fever (Caxiella burnetii),[18] Ricin toxin from Ricinus communis (castor beans),[19] Abrin toxin from Abrus precatorius (Rosary peas), Staphylococcal enterotoxin B, Typhus (Rickettsia prowazekii), Viral encephalitis (alphaviruses, for example; Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis), Water supply threats (for example, Vibrio cholerae, Cryptosporidium parvum).[20]

Category C
Tan viruses comprise this category. These could be used for mass dissemination in the future because of their availability, ease of production, dissemination and high morbidity and mortality rates. For example: Nipah virus, Hanta virus, SARS, HINI a strain of influenza (flu), HIV/AIDS.[7]

Role of a dentist
The dental profession could potentially play a significant role in the emergency response to a major bioterrorism attack. If a major attack were to occur, little time will be available to develop a response. In preparation for fulfilling such a role if called upon, it is vital to
identify the specific areas in which the dental profession can provide emergency assistance and to prepare dentists adequately. In a major bioterrorist attack, the local needs could be massive and immediate. As hospitals become filled, alternate sites for the provision of health care may be required, and dental offices could fill that need.\(^{21}\)

Other areas where dentists can play their role include: Preparation before an attack, Assistance during an attack, Diagnosis and Monitoring, Referral, Immunizations, Triage, Decontamination and Infection Control, providing immediate medical care- which includes: Treatment of cranial and facial injuries; Providing or assisting in administration of anesthesia; Starting intravenous lines; Performing appropriate surgery and suturing; Providing cardiopulmonary resuscitation.

Following a bioterrorist attack the dentists who are trained in forensic odontology may work closely with local Disaster Mortuary Operational Response Teams, (DMORTs) there by providing local surveillance to detect any spreading of disease beyond the original area of attack or re-emergence of infections in the original attack area.\(^{22}\)

**Preparing the dental students for a bioterrorism attack- Bioterrorism Training**

Dental schools should also prepare dental students to respond once an attack is recognized. The extent to which dentists can respond varies widely based on the level of training received. all dental students should be trained to the basic level of emergency medical services (EMS) capability. In addition, all dental students should be trained to assist in containing an agent and isolating infected individuals in the event of an attack. Appropriate and timely actions taken to contain the spread of an agent can dramatically influence the overall impact of an attack. Optional advanced training may provide students with the skills necessary to provide inoculations and advanced cardiac life support (ACLS). Basic skills should be taught to enable dentists to respond immediately to a terrorism event in a manner that would minimize the spread and impact of the threat.

Finally, dental students should be able to report surveillance information to appropriate sources. Reporting may include ongoing monitoring of the spread of disease and the recurrence of disease following the initial treatment. Training all dental students in these core competencies will provide them with the skills necessary to react to situations that may arise within their practice, should an attack occur using biological or other agents of terrorism. Their response will help to detect the situation as quickly as possible, contain the agent to
minimize the region impacted, and notify appropriate authorities to initiate necessary emergency procedures. Students will also gain knowledge to provide assistance to the responding emergency community should they choose to do so. In addition, students will have the opportunity to undertake more extensive training, enabling them to provide additional services in the event of a major attack.

If dentists are to play a significant role in response to bioterrorism, dental schools have a major obligation in preparing future dentists to fulfill appropriately this responsibility. Dental schools should train all students in a core set of competencies related to bioterrorism and provide additional opportunities for further education.[23]

**DISCUSSION**

Curators and conservationists of biological diversity, public health officials, and biosecurity personnel, developing emergency preparedness provide convincing arguments to continue to maintain live viral stocks for the preparation of new vaccines in guarding against the reemergence of small-pox as a result of either accidental release or planned use in bioterrorism. The microbiological community, and especially culture collections have an important role to play in educating the public to contain unexpected and sudden outbreaks of diseases through minimising the easy acquisition of microbial cultures for use in bioterrorist threats. To offset the illegitimate use of microbial cultures, obtained through either fraudulent or genuine means, the microbiological community naturally occupies a central role in answering the challenges posed in the production of bioweapons Biological agents may be obtained from culture collections providing microbial species for academic and research purposes; supply depots of commercial biologics; field samples and specimens; and application of genetic engineering protocols to enhance virulence.[24]

Appropriate control measures in combating bio- and chemical terrorism, and the production of bioweapons would involve:

1) Enactment of national laws that criminalize the production, stockpiling, transfer and use of chemo and bioweapons.

2) Enactment of national laws that monitor the use of precursor chemicals that lends themselves to the development of chemical and bio-weapons.

3) Establishment of national and international databanks that monitor the traffic of precursor chemicals, their use in industry outreach programmes, and their licensed availability in national, regional and international markets.
4) Establishment and use of confirmatory protocols in the destruction and dispersal of outdated stockpiles, and chemical precursor components.

Bioterroristic risks are minimized through effective responses built around the development of preventive and control measures to contain, control, minimize, and eradicate outbreaks of travel-related vaccine preventable diseases. Tropical medical practitioners, public health personnel, immunologists, microbiologists, and quarantine authorities have an important role to play in safeguarding against potential bioterrorism in the future through timely detection of hepatitis A and B, yellow fever, Japanese encephalitis, rabies, typhoid, anthrax, plague and meningitis.[3]

CONCLUSION

In the wake of current geoclimatic and bioterrorism threats it becomes imperative on the part of the healthcare providers for ever preparedness. Although the first responders are primarily looked upon for in case of any disaster response; if called upon dentists can be a source of vital support in medical surge events. There is a need to harvest the services of wide distribution of dentists practicing in our country. Dentists are well versed in the daily practice of infection control, taking and using information from medical histories to guide their actions, taking and interpreting radiographs, administering injections, suturing wounds, managing infections, prescribing medications and making diagnosis on the basis of clinical signs and symptoms. Members of the established public health systems and medical community must understand that, in medical surge events, members of dental profession are an additional source of assistance in response activities.[25]

For longer-term solutions, the medical community must educate both the public and policy makers about bioterrorism and build a global consensus condemning its use. Current concerns regarding the use of biological warfares result from the increasing number of countries that are engaged in the proliferation of such weapons and their acquisition by terrorist organizations. The need of the hour is to develop biodefence by full international cooperation and to educate the likely target populations about precautions and protective measures to be taken in such attacks.[26]

Dentists can provide a valuable service to their patients and communities by providing quality information about the potential for attacks, what to watch for, and how to respond appropriately should an attack occur.[22]
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