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Bioterrorism: A Mini Review

Dr. R.S. Khillare[1*] and Dr. Muskan Kaushal[2]

[1]Scientist, [2]Senior Research Fellow
Department of Veterinary Public Health, Mumbai Veterinary College, Parel, Mumbai-400012.
Maharashtra Animal & Fishery Sciences University, Nagpur (Maharashtra)

**Corresponding Author: rajpalkhillare10@gmail.com*

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Man being a megalomaniac always demands, supremacy and power leading to war and terrorism. From ancient warfare system including cavalry chariots, swords, daggers and arrow to modern warfare system including ammunition, tanks, missiles the utilization of the weapons have transfigured. Now in the modern periodbattle things have been changed usage of bioweapons are preferred.Among of all the weapons of mass destruction, biological ones are the most feared. Biological weapons have been referred to as the poor man's atomic bomb, as thecosts associated with a biological weapons programme are muchless than those for a nuclear weapons programme (Pearson,1997). Bioterrorism is a form of terrorism that uses biological agents such as bacteria, viruses and toxinsas weapons against humans, animals and crops. The main aim of bioterrorismis to intimidate the civilian population and authorities, as well as to accomplish the terrorists' expectedpolitical, religious and ideological demands. According to Model StateEmergency Health Powers,bioterrorism as theintentional use of any microorganism, virus, infectioussubstance, or biological product that may be engineeredas a result of biotechnology or any naturally occurringor bioengineered component of any suchmicroorganism, virus, infectious substance, orbiological product to cause death, disease, or otherbiological malfunction in a human, animal, plant, orother living organism to influence the conduct ofgovernment or to intimidate a civilian population(Noah *et al.,* 2002).The main effects of bioterrorism are diseases that oftenlead to death, contamination of water, food and soil (Venkatesh andMemish, 2003). Bioterrorism attacks cause mass panicand fear among the public, chaos in many spheres of life, economic losses and loss of faith in government authorities.Most of the bioweapons are relatively easy and inexpensive toproduce, cause death or disabling disease, and can beaerosolized, have common

delivery methodsand distributed over largegeographic areas.Biological weapons may be developed by terrorist groups or criminals.

Biological weapons can initiate large-scale epidemics with an unparalleled lethality.Medical, Healthcare professionals need to be more aware of the essentials of bioterrorism and biological weapons, as these may be used as part of a terrorist attack in any part of the world. Thus, healthcare professionals need to be trained and always prepared in case of a potentially catastrophic event, where quick action and decision-making may potentially save lives. The features of bioterrorism can be contamination caused by a single exposureto biological agents can be recognized in different areas atdifferent times because of the latency period.Developmentof diseases could differ among individuals according to theirhealth status, including agent-specific immunity.Thenumber of patients can increase by a secondary infection. Distinguishing bioterrorism from naturally occurring infectiousdiseases could be difficult, especially in covert cases. Attacks against livestock or poultry are used asbiological agents. These attacks are defined as theintentional introduction of an animal infectious diseaseto strike fear in people, damage a nation's economyor threaten social stability. Livestock bioterrorismis considered attractive to terrorists because biologicalagents for use against livestock or poultry are morereadily available and difficult to monitor thanbiological agents for use against humans (Yeh*et al*.,2013).

Category/classification of bioterrorism agents

Classification of these Bioweapons is highly essential for proper early identification and management of disease during bioterrorism. The biological weapons can be classified into three categories as A, B, C based on various factors, including the morbidity and mortality caused by the disease in humans, their virulence and death rates by the Centre for Disease control and Prevention Atlanta United states. Among these category stands for the top most priority to be considered as a potential bioterror agent and the C stands the least. Yet C category agents are also hazardous.

1.**Category A:** Highest priority. Pose a risk to national security. They are easily spread/ transmitted from person to personand have high morbidity and mortality. They would have a significant public health impact, cause panic, and result inspecial public health preparedness requirements.Category A includes anthrax (*Bacillus anthracis*), plague(*Yersinia pestis*), tularemia (*Francisella tularensis*), smallpox(variola major), viral hemorrhagic fevers, including filoviruses(Ebola and Marburg) and arenaviruses (Lassa and Machupo)and botulism (*Clostridium botulinum* toxin).

2.Category B: Second highest priority. These include diseases with lower morbidity and mortality as compared to category A. They are also moderately easy to disseminate. Category B includesBrucellosis (*Brucella* species), Glanders (*Burkholderia mallei*), Melioidosis (*Burkholderia pseudomallei*), Q fever (*Coxiella burnetii*), Psittacosis(*Chlamydia psittaci*), Typhus fever (*Rickettsia prowazekii*), Ricin toxin from *Ricinus communis* (castor beans), Water safety threats (*Vibrio cholerae*, *Cryptosporidium parvum*), Epsilon toxin of *Clostridium perfringens*, Viral encephalitis (alphaviruses, such as eastern equine encephalitis, Venezuelan equine encephalitis, and western equine

encephalitis), Food safety threats (*Salmonella* species, *Escherichia coli* O157:H7, *Shigella*), *Staphylococcal enterotoxin* B

3.Category C: Third highest priority. They have the potential to cause significant morbidity and mortality. They are mostly of emerging pathogens that could potentially be engineered for mass dispersion in the future because of their easy availability, production and dissemination of these pathogen.Category Cincludes Emerging infectious diseases like Nipah virus and hantavirus (CDC,2021).

Bioterrorism issues concern in the past years

Table 1. Examples of biological and chemical warfare use during the past 2000 years

Sr.No.	Year	Event
1	600 BC	Solon uses the purgative herb hellebore during the siege of Krissa
2	1155	Emperor Barbarossa poisons water wells with human bodies in Tortona, Italy
3	1346	Tartar forces catapult bodies of plague victims over the city walls of Caffa, CrimeanPeninsula (now Feodosia, Ukraine)
4	1495	Spanish mix wine with blood of leprosy patients to sell to their French foes inNaples, Italy
5	1675	German and French forces agree to not use “poisones bullets”
6	1710	Russian troops catapult human bodies of plague victims into Swedish cities
7	1763	British distribute blankets from smallpox patients to Native Americans
8	1797	Napoleon floods the plains around Mantua, Italy, to enhance the spread of malaria
9	1863	Confederates sell clothing from yellow fever and smallpox patients to Union troopsduring the US Civil War
10	1914-18 (World War I)	German and French agents use glanders and anthrax
11	1939-45 (World War II)	Japan uses plague, anthrax and other diseases; several other countries experimentwith and develop biological weapons programs
12	1978	A Bulgarian exile, Georgi Markov, was assassinated in London in what later came to be known as the“umbrella killing”
13	1979	There was an outbreak of anthrax in the Russian city of Yekaterinburg
14	1986	The Rajneesh cult in Dalles,United States, contaminated salad bars with *Salmonella* in local restaurants
15	1980–1988	Iraq uses mustard gas, sarin, and tabun against Iran and ethnic groups inside Iraqduring the Persian Gulf War
16	1995	Aum Shinrikyo uses sarin gas in the Tokyo subway system
17	2001	In the United States, a series of letters containing anthrax spores were mailed to senators, journalists, andmedia buildings

Source: Stefan Riedel(2004) Biological warfare and bioterrorism: a historical review.

Preparedness forbioterrorism attack/biological warfare

Countermeasures consist of preparedness and response.Countermeasures against bioterrorism implies an extension ofcountermeasures against natural outbreaks. The basic principle ofinfectious disease control is based on the mechanism of infection.From the perspective of risk management, countermeasures arebased on the principle of risk analysis, including risk assessment,risk management, and risk communications (WHO,2004). To respond to an incident, detection of the event is the firststep. Abnormal increase in the number of patients can bedetected in comparison with the normal baseline of patients.Thus, understanding the baseline number of patients for eachdisease in the community is essential.Patients with these diseasesare reported to a public health centre by medical practitioners.When an outbreak is anticipated, local government, mainly thepublic health centre and public health laboratory, would takeaction toward public health response, including epidemiologicalinvestigation and identification of causative agents. Promptidentification of causative agents plays a crucialrole. Advanced technologiesin diagnostic microbiology provide comprehensivemicrobiological identification. These include meta-genomesequencing using a next-generation sequencer and time-offlightmass spectrometer analysis, which are shownto be powerful tools for field genome surveillance for emerging zoonotic diseases.Further responses include vaccination, prophylacticadministration of antibacterial or anti-viral drugs, isolation ofpatients, school closure, and risk communications.Preparedness during the non-emerging period includes a stockpile of essentials drugs, adequate necessities and equipment for microbial tests, and training of health-care professionals. A possible scenario is that the first responders are healthcare professionals and ambulance service personnel in the case of bioterror attacks. In a bioterrorism incident, the diagnosis could be uncertain or drugs could be insufficient. To protect the community, including first responders under these critical circumstances and to allay public fears, it is always important to plan public health preparedness. Most of research focuses on the pathogens that have already emerged as a potential bioweapon, instead of working on genuinely known bioweapons, work can be made on potentially hazards bioweapon, which may outbreak in future.A group of professional's expertise in disaster management and bioweapons can be set up as infectious disease community and they must be responsible for spread of awareness and education, laboratory diagnosis, distribution systems for therapeutics, hospital response and scientific research (Eto and Kanatani, 2018).

The Veterinarian's Responsibility in bioterrorism preparedness

As the more than 60% of the humancontagious diseases are of zoonosis type and majority of the pathogenic agents considered a concern for bioterrorism are zoonotic agents, hence veterinarians play an important role in preparedness of, recognition and response to a bioterrorist threat.Theability to control animal diseases, whether it is occurringnaturally or intentionally, will depend on the earlydetection and rapid response capacity of veterinaryservices regarding diseaseoutbreaks (Plante and

Dehove,2010). Most of the emerging infectious diseases inhumans, including those caused by bioterrorist agentsthat are zoonoses in nature. Although bioterrorist agents are affecting mostly livestock, many of these agents can cause disease in companion and wildlife animals.These zoonotic diseases can infect animalsand humans, both the medical and veterinary sector should work closely together in clinical, public healthand research section. Veterinarian should be establishing a working relationship with medical professionals to allow open communication and coordination of efforts in times of bioterrorism crisis.Human and veterinary –medicine can benefit by making collaboration. Asbarriers between animal species collapse, it expands and improve, exchange, theknowledge base of human and veterinary medicine. Now a days one health concept is came into existence in which collaborations among veterinarians, physicians, agriculturists, ecologists, microbiologists, epidemiologists andwildlife biologistsfor the prevention and control of zoonotic diseases.These combine efforts would increase understanding ofzoonotic disease, their host range, expandand finally improveprevention and controlstrategies. If the biological warfare occurred in animals and if it is properly recognized by veterinarian then it minimizing human illness and death in the society(Enserink, 2007).Public health, health-care, and veterinarycommunities have an enormous challenge in the earlyrecognition, reporting, treatment, and prevention of emerging and re-emergingzoonotic diseases. Aone-medicine approach enhances zoonoticdisease detectionand control by surveillance and communication. Afundamental role of the veterinary profession is theprotection of human health through wholesome, safe foodand control of diseases of animal origin, especiallyzoonoses. Therefore, training of veterinary students, field veterinarians and veterinarian working in different sectors viz. zoo, slaughter house,worldwide needs to face the new challenges posed byemerging diseases, both from wildlife and domesticanimals (Chomel and Marano, 2009).

Conclusion

Bioterrorism is a real threat which affects thelife of humans and animals. Biological weapons are unique in their invisibility and their delayed effects.A biowarfare agents attack would not only cause illness and death in a large number of victims but also aim to create fear, panic situations among the people. Its aim to disruption of social and economic activity, the breakdown of government authority. To fight against it, theawareness education in people and training among medical, veterinary community is an important component of preparedness and protection. Veterinarians are keyplayers on bio-defense and thus share responsibility for the bio-security and welfare.Providing first responders antidotes, proper diagnostic equipment's, vaccines and proper training can help to alleviate the effects of bioterrorism.

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