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BIOTERRORISM AN EMERGING WEAPON: REVIEW

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Abstract

Bioterrorism is defined as the deliberate use of microorganisms; virus, bacteria, fungi or other biological agents to cause death or illness in human, animals or plants. List of the most likely biological agents to be used in an act of bioterrorism had been prioritized and these agents are classified into A, B and C groups. Group A agents and disease are moderately easy to disseminate and result in moderate morbidity rates and low mortality rates Group B agents and disease are easily transmitted from animals to human, (except for smallpox, which has no animal reservoir) person to person, having high mortality rates and potential for a major public health impact. Group C agents and diseases include emerging pathogens that could be engineered for mass dissemination. In comparison to political, religious, strict or different beliefs, bio-crime includes the use of a biological agent to kill or make sick a solitary person or group of people, convinced by revenge, black mail or the desire for money. Given the specialized difficulties and weaknesses, the risk of a successful bioterrorist attack is not massive. Nevertheless, regardless of whether the amount of losses is likely to be minimal, the impact of a bioterrorist attack can currently be high. Measures designed to develop diagnostic and therapeutic skills and limits by planning and training would improve society's ability to combat 'normal' irresistible disease flare-ups, as well as mitigate the effects of bioterrorism.

Key: Bioterrorism, weapon, Virus, Bacteria, fungi and Coronavirus

Introduction

Bioterrorism is the use of microorganisms (bacteria, viruses and fungi) as poisons or weapons that cause harm or death to humans, animals and plants. Most bioterrorism agents are zoonotic in origin, there is a heightened awareness and concern about the possibility of bioterrorism involving animals. Veterinarians and livestock owners may be the first to diagnose the early cases of a bioterrorist act, as livestock can be sentinels of such an exposure. Terrorism is the illegal use of force or viciousness against individuals, animals or properties in order to kill or pressure an administration or ordinary citizen population to increase political or social objectives (CDC, 2013). The use of bio-weapons (natural specialists) to cause misfortune or disappearance is certainly not a new concept; nations have been engaged in bioterrorism for a long time.

Bioterrorism can theoretically lead to elevated dismalness and mortality, because in a short timeframe, aerosolized natural operators or animal sickness can taint or kill multiple people. It has the potential to generate a degree of mass obliteration that is much more plentiful than any standard weapon. Indeed, even non-aerosolized attacks, such as the *Bacillus anthracis*

attack, can lead to malaise and mortality (Rebmann *et al.,* 2009). For instance, in world war I (WW I) Germans inoculated cattle with *Bacillus anthracis* and *Pseudomonas mallei,* capable to cause severe ailments, for example*, Bacillus anthracis* and glanders disease, before sending them into foe states. As WW I saw the enormous scope utilization of non-conventional chemical weapons, it was usual that WW II would see increasingly wide utilization of natural weapons. During this war, several nations led research projects to develop bio-weapons; the Japanese bio-weapon delivery program was considered to be the most offensive (1892-1959). Such arms are difficult to detect (boring and odorless) and can be transmitted by air and viral organic operators with the ability to individually transmit, it can trigger mass reversal of unintended populations, such as unbiased or well-disposed powers; much more horrible effect than on the goal (Rebmann *et al.,* 2009).

When multiple people build comparative indications, a high record of doubt should be available. Encased spaces provide perfect goals, particularly those that draw huge groups, such as games, diversion grounds, and most likely every one of those spots where people gather in gigantic numbers. Over the past couple of years, the number of terrorist attacks around the world has decreased, but the proliferation of their lethality is of incredible concern (Mahendra *et al.,* 2017).

Before the twentieth century, three essential methods were used as biological agents: deliberate contamination of food and water with toxic or infectious materials, using microorganisms, natural toxins, animals, or plants (living or dead) in a weapon system, and using organically vaccinated textures and humans. Presently, complex bacteriological and virological methods permit the creation of critical reserves of weaponized bio-agents able to spread and cause illnesses (Legvold, 2012).

Different dissemination strategies gracefully combine oral, intentional food/water contamination, per-cutaneous, polluted animal vector, e.g. release of infected fleas or illness of crown infection. Human-to-human spread, where a person tainted with communicable disease has also been noted to walk among a horde of healthy individuals. It has been established that even physical objects, such as letters, can be used to help spread biological agents, as shown by the *Bacillus anthracis* attacks of 2001. (Legvold, 2012). Nonetheless, bioterrorism readiness mitigates potential negative results, and is required by human services and general wellbeing directing organizations as a major aspect of an extensive crisis the executive program (Carlisle, 2005). The main objective of this paper is to audit possible exposures due to various organisms and their metabolites, which could pose a huge risk to social insurance due to bioterrorism, and to include what can be done to avoid and minimize dismalness and mortality resulting from bioterrorist activities.

Bioterrorist History

Since the beginning of time, chemical weapons such as filth and cadavers, animal cadavers, and viruses have been used to take up arms and spread terror (Robertson and Robertson, 1995). In the city-state of Assyria of Mesopotamia in 600 BC, the absolute initially recorded occurrence of bioterrorism was when they used rye ergot from Claviceps purpurea fungus, which produces mycotoxins in their enemies' wells (Rega, 2004). Bioweapons were used over and over by nations, gatherings and individuals after that point. In 1346, in an all-around Genoese (presently Feodosia, Ukraine), the attack of Caffa controlling seaport increased, targeted the Tartar force and encountered a pestilence of plague (Wheelis, 2002). This plague (also known as the Black Death) was the most devastating general welfare tragedy that spread to Europe and North Africa in the fourteenth and fifteenth centuries, killing more than 25 million Europeans. In addition, plague cadavars were used in Reval in 1710 during the war

between Russian soldiers and Swedish troops. Similarly, during the French-Indian War of 1754-1767, the purposeful use of smallpox by Sir Jeffrey Amherst, the official of the British forces in North America, was suggested to minimize the local Indian population (Christopher *et al.,*1997; Henderson *et al.,* 1999).

In addition, ricin (Ricinus communis) poison was used in World War I as a bioweapon for the covering of slugs and shrapnel or as a powder structure to be inhaled into the lungs (Smart, 1997).In 1984, the United States (US) faced the main known assault of bioterrorism when the supporters of Bhagwan Shree Rajneesh defiled serving mixed green bars in Oregon with *Salmonella typhimurium* microscopic organisms assaulting 751 people with serious food poisoning (Christopher *et al.,* 1997; Caudle, 1997). Another attack in Japan by the passive faction of Aum Shinrikyo created concern around the world. Sarin, a neurotoxin, was released by Faction people in the Tokyo tram structure on March 18, 1995. This resulted in a large number of ordinary people being injured, but just eight deaths. In 1996, in Dallas, Texas, research center staff with an immense therapeutic emphasis got an email to engage in break room biscuits and doughnuts. Twelve individuals later experienced extreme looseness of the intestines, 8 of whom attempted to be constructive for type 2 of *Shigella dysenteriae*. In October 2001, *Bacillus anthracis* was used as both a threat and a tool in the US, using postal assistance for transportation. In New York, New Jersey, Florida, and Washington DC, an aggregate of 18 cases were found. Eleven were inhalational and seven were cutaneous (Salem, 2003). These occasions had uplifted the worry over fear, and brought about statement of war against bioterrorism.

The Origins of Bioterrorism

Globalization and demographic growth are the underlying drivers of bioterrorism, which eventually builds mass movement in this way, speeding up business and travel. E.g. Coronavirus disease pandemic flare-up when there is a pandemic outbreak (CDC, 2019). Every day, nearly 1.8 million carrier travelers cross the outskirts of the planet, contributing to the transmission of enticing biological materials across the world within hours (Drexler, 2010). Destitution is also personally concerned with bioterrorism, which is increasingly increasing with environmental change, population growth and sick farming arrangements (Reuveny, 2007). For instance, due to the Coronavirus pandemic outbreak in late 2019-2020, has caused economic slowdown in most parts of the world due the global lockdown (CDC, 2019; Mbah, 2020).

Bioterrorism has a declining effect on society. A large portion of bioweapons are moderately easy to manufacture, inexpensive and prepared for mass decimation, although simple methods use small quantities. Water supply and water dispersion frameworks are possible focuses for bioweapons as it is the essential need for any environmental well-being and also for the smooth operation of a business and economic segment of our industrialized society (Dembek *et al.,* 2007). Agriculture is another ideal goal for bioterrorism, which employs highly infectious, virulent, and resistant agents that cause countries economic hardship. Moreover, animals, plants, and birds could be used to create biological threats (Meinhart, 2005; Dembek *et al.,* 2007).

Certain biological agents that are likely to be used as bio-weapons

Groups	Diseases	Agents	References
Group A (Fungus)	Anthrax	*Bacillus anthracis*	CDC (2013)
	Botulism	*Clostridium botulinum* toxin	
	Epsilon toxin	*Clostridium perfringens*	
	Ricin toxin	*Ricinus communis*	
Group B (Virus)	Smallpox	*Variola major*	
	Viral hemorrhagic fevers	*Filoviruses and Arenaviruses*	Jagtar and Shweta. (2016)
	Viral encephalitis	*Alphaviruses*	
	Emerging infectious diseases	*Nipah virus, Corona virus and Hantavirus*	
Group C (Bacteria)	Plague	*Yersinia pestis*	
	Tularemia	*Francisella tularensis*	CDC (2013)
	Brucellosis	*Brucella spp.*	
	Food safety threats	*Salmonella* spp., *E.coli*O157:H7, *shigella*	
	Glanders	*Burkholderia mallei*	
	Melioidosis	*Burkholderia pseudomallei*	
	Psittacosis	*Chlamydia psittaci*	
	Q fever	*Coxiella burnetiid*	
	Staphylococcal enterotoxin B	*Staphylococcus spp.*	

Typhus fever	*Rickettsia prowazekii*
Water safety threats	*Vibrio cholerae*, *Cryptosporidium parvum*

Tularemia: The challenge in growing and cultivating these bacteria is Tularemia as a biological weapon, but it can be isolated from contaminated species. A small, aerobic, non-motile, gram negative coccobacillus is *F. tularensis*, the causative agent of tularemia. Tularemia, also known as rabbit fever and deer fly fever, is a zoonotic disease usually acquired by humans following skin or mucous membrane contact with contaminated animal tissues or body fluids or through bites of infected ticks (Pal, 2007). In the early 1800's in Japan and in 1926 in Russia, Tularemia was recognized. Tularemia may be used in many cases as a biological agent, causing varying degrees of casualties. An aerosol release with large numbers of individuals exposed is the most dangerous scenario. Moreover, in the past, it has been armed by the United States and the Soviet Union and can be easily disseminated through aerosol release (Alibek and Handelman, 1999).

Researchers predicted that 250,000 incapacitating victims could be caused by a large-scale aerosol release of 50 kg over a large metropolitan area. Depending on the inoculum of exposure, most of those affected could develop a non-specific febrile disease 3 to 5 days after exposure and subsequently develop pulmonary symptoms consistent with pneumonic tularemia (Dennis *et al.,* 2001).The clinical course is slower with tularemia, the case fatality rate is higher with plague (Inglesby *et al.,* 2000), and probably the pattern of pulmonary manifestations shown on chest radiograph, such as the broad pleural effusions and mediastinal widening characteristic of inhalational anthrax (Inglesby *et al.,* 2000). Q fever, another potential biological weapon agent, may be difficult to distinguish from pulmonary tularemia (Inglesby *et al.,* 2002; Arturo, 2012).

Botulism (*Clostridium botulinum*)

C botulinum is a spore-forming, obligate anaerobe that can be isolated from soil, its natural environment, and is the etiological agent of botulism. Four species of *C botulinum*, based on various genomes and their common *botulinum* toxin, are identified. *Botulinum* toxin is the most lethal toxin known, although there are seven various form. Death also mainly happens to pharyngeal and diaphragmatic muscle paralysis, followed by respiratory arrest (Bhalla and Warheit, 2004).

Botulinum toxin is a major bio-weapon threat because of its extreme potency and lethality, and also the ease in which it can be formulated, distributed, and misappropriated, and the need for lengthy intensive care for all those who are infected (Biological and chemical terrorism: strategic plan for preparedness and response, 2000).

In addition, the absence of cross-neutralization recognizes seven antigenic types of botulinum toxin (A-G).The toxin is a di-chain polypeptide with a heavy chain of 100 KDa joined by a single disulfide bond to a light chain of 50 KDa, which is a zinc-containing endopeptidase that prohibits acetylcholine-containing vesicles from fusing with the terminal membrane of the motor neuron, resulting in flaccid muscle paralysis (Arnon *et al.,* 2001). An outbreak of botulism is a medical emergency requiring prompt botulinum antitoxin distribution and often mechanical ventilation, and a public health emergency involving immediate intervention in

order to prevent unnecessary cases. An astute clinician who quickly notifies public health officials is essential to early diagnosis of a botulism outbreak. The most poisonous substance known is botulinum toxin (Inglesby *et al.,* 2000).

Biological Weapons Dissemination Process

Biological agents could be delivered in multiple forms: wet or dry. Dry powders with really small particles tend to have better output characteristics and storage advantages. Dried agents have to produce an increased level of technological sophistication, although technology for freeze drying or spray is drying has been available throughout the industry for several years. An aerosolized agent has been most widely used in delivery methods. Attaching a spray machine to a moving conveyance can disperse the agent.

An example is an industrial insecticide sprayer designed to be mounted on an aircraft. While the sprayer is operating, a line of release would then occur. This is recognized as the source of the line and is sprayed perpendicular to the wind direction, upwind of the target area predicted. Anyone down winding such a line source would technically be at risk up to a certain range (CDC, 2013).

The range achieved by such an infectious or toxic agent depends on several factors, including the speed and direction of the wind, the stability of the atmosphere, and the nature of conditions of inversion; and on the characteristics of the agent itself.

Biological agents can be released by spraying them into the air, infecting animals which also infect humans, and contaminating food and water. Hundreds of human pathogens have the potential to be used as weapons; however, only a few were reported as having the potential to cause mass casualties and social disorder. There are a number of reasons why biological weapons may be more powerful agents for mass casualties leading to civil destruction. Using off-the-shelf machines like industrial sprayers or other types of aerosol-producing devices, an ideal biological warfare agent can be easily disseminated in the open air.

Aerosol application is the most effective way to spread biological warfare agents. The aim of aerosol delivery systems is to generate invisible particle or droplet clouds with a diameter between 0.5 and 10 micrometers that can stay suspended for long periods. In that size range, the aerosol release of respirable particles results in a risk of primarily inhalation because the particles will settle deep in the lungs. Biological warfare agents may contaminate food, water, or supply systems. Most pathogens and toxins are eliminated by heat; thus, most agents will have to be used on food that is served raw or added after the food is prepared and presented for serving to be active.

Many pathogens and some toxins may well be detoxified through standard water purification techniques (chlorination and filtration). Many spores will not be detoxified by chlorination, and commercial filtration will be ineffective against spores, cysts, viruses, and many bacteria. If the same activated charcoal is used, filtration would thus be powerless against toxins. By secret injection, biological warfare agents were delivered. When injected, some agents (for example, ricin) are lethal. Depending on the model of the delivery system employed, the time of day, the weather conditions, and the local geography, the possible BW attack modes in any operational environment can vary significantly with location (Pinson *et al.,* 2013).

Biological Weapon Protection and Prevention

Training and awareness of threats and risks associated with biological agents should be offered to the public at large. Only cooked food and boiled/chlorinated/filtered water should

be consumed, insect and rodent control measures should be immediately initiated, confirmed and confirmed cases should be technically isolated. The key to preventing biological warfare casualties is early, precise diagnosis. Therefore, for confirmatory laboratory diagnosis, a network of specialized laboratories should be established. This is necessary to pursue more rigorously the treatment and disease surveillance system as well as vector control measures and a mass immunization program in the suspected area. Enhancing clinicians' resources and experience are essential in preventing the attack's adverse effects. Because bioterrorism and infectious diseases will remain rare events, this will be necessary to maintain inventive ongoing ways to ensure attention to potential new cases (CDC, 2013).

Many BW danger agents can be stopped or mitigated through implementing appropriate precautions. In order to provide safety, immunizations, pre-exposure and post-exposure prophylaxes, therapeutics, and protective clothing are available. Prior to entering an area of operations where BW agent employment is a risk, staff should have the required immunizations administered. Command-directed chemoprophylaxis would be appropriate for all staff in the area if an attack is felt to be imminent, or is known to have occurred. However, in the absence of such a threat condition, it is impractical and wasteful to place everyone located in a potential target area on long, routine antimicrobial prophylaxis (CDC, 1999). All immunizations should be administered in enough time for the initial protection to take effect before troops are deployed to the area of operations; if it is not possible, troops must receive the immunizations as soon as the mission enables operations. To provide protection, some immunizations are combined with pre-exposure chemoprophylaxis or post-exposure chemoprophylaxis. The use of protective equipment combined with chemoprophylaxis could be used to provide protection for those BW agents for whom specific immunization is not available (Roxas-Duncan*, et al.,* 2012).

Vaccination is a practical way to provide continuous protection against BW threats before and during the hostile actions. There are many vaccines available against a few potential BW agents. Many of these vaccines were formulated to protect laboratory workers or staff working where the target diseases are common (CDC, 2013).

Conclusion

Bioterrorism can lead to elevated dismalness and mortality, because in a short timeframe, aerosolized natural operators or creature sickness can taint or kill multiple people. It has the potential to generate a degree of mass obliteration that is much more plentiful than any standard weapon. Indeed, even non-aerosolized attacks, such as the *Bacillus anthracis* attack, can lead to malaise and mortality. The key to preventing biological warfare casualties is early, precise diagnosis. All immunizations should be administered in enough time for the initial protection to take effect before troops are

deployed to the area of operations; if it is not possible, troops must receive the immunizations as soon as the mission enables operations. To provide protection, some immunizations are combined with pre-exposure chemoprophylaxis or post-exposure chemoprophylaxis.

Therefore, we recommend that there should be an improvement of mass public awareness before, during and after such an attack (presumably). The people should be educated regarding potential exposure of a biological weapon, and various steps that are required to be taken to check our bio-defense capabilities and ensure sufficient protection from emerging threats.

Conflict of interest

No conflict of interest

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