

## BIOTERRORISM - THE LATEST FRIGHT FOR THE PRESENT GENERATION

*In this universe there are many types of weapons of mass destruction developed by various countries e.g. nuclear weapons, chemical weapons and biological weapons in addition to the conventional weapons. Terrorists can get control of any of these weapons and can cause havoc. Sometimes they develop weapons particularly for causing panic rather than destruction like dirty bombs. Dirty bombs are conventional bombs but also contain nuclear waste. On detonation nuclear waste is spread and people get panicky that bomb is nuclear though small amount of nuclear material may not cause damage more than a single exposure of the person for routine x-ray examination. In this chapter we will limit ourselves to biological warfare and bioterrorism, which is a powerful tool in the hands of the states and terrorists. History dates back to the eighteenth century (1754 – 1767) when British colonial commanders distributed blankets used by small pox patients to the Native Americans and the mortality in some tribes was as high as 50%. Japanese army also used smallpox weapon against the Mongolians and Chinese during the Second World War. Brucella suis was the first agent to be weaponized as a biological weapon by the U.S. in 1954. Terrorists are using the conventional means of destruction but there are chances that unprotected biological weapons may get into the hands of the terrorists and they may use it on a vast scale to create terror. Anthrax letters were used after 9/11 in the U.S.A. to create terror. Recently Ricin letters were used in the U.S.A. by the terrorists. Bioterrorism is the use of biological weapons as terror attack or terror threat or use of biological weapons in terrorism. In Bioterrorism agents may be bacteria, viruses or toxins.*

*The various agents of bioterrorism may be bacteria like Bacillus anthracis (Anthrax), Yersinia pestis (Plague), F. tularensis (Tularemia), Vibrio cholerae (Cholera) and Salmonella typhi (Typhoid fever) or viruses like Ebola and Marburg (Yellow fever), Variola virus (Small Pox) and viruses causing flu, Congo Crimea hemorrhagic fever and encephalitis. These may be Toxins; which may be naturally occurring toxins from plants, bacteria and viruses e.g. Bacterial botulinum (Botulism), Clostridium perfringens, Staphylococcal enterotoxins B, mycotoxins from fungi, and ricin.*

*A biological agent, which can be produced easily, has a long shelf life, can be easily dispersed and can produce high mortality rate within a short span and does not have an effective treatment will be an ideal agent for biological weapons. It requires considerable sophistication to produce biological weapon. It should be very infectious i.e. 10 to 50 organisms should be able to cause disease. Genetic modifications to make organisms drug resistant increase the effectiveness of biological weapon. It is not easy to find out the source of attack of bioterrorism. It causes a panic in the population, as the attack is invisible, slow and deadly. There is economic disaster when it involves livestock or crops. Biological weapons are cheap and have enormous power of destruction of life. The estimated cost of killing unprotected civilians in an area of one square mile is about \$5,000 for conventional weapons, \$2,000 for nuclear weapons, \$1,500 for nerve gas weapons, and only a meager \$2.50 for biological*

*Biological weapons have some disadvantages also e.g. the effect is not immediate due to different incubation periods of various agents before the symptoms appear and the disease can develop. If there are strong winds then the disease may spread into the area other than the target area and if weather is very hot germs may be killed by the adverse weather and may not remain effective. A feeling of hatred will develop against the persons using biological weapons*

*Biological weapons are not in common use because it is difficult to produce and handle such weapons of sufficient lethal strains in bulk. It is difficult to transport such weapons without affecting their efficacy. Small amount of pathogens may destroy a herd of animals, field of crop or city of population but terrorists need to know how to disperse the pathogen effectively, and this involves ensuring that the pathogen is delivered to the target over a large area in the right particle size and in sufficient concentration to cause mass infection. For weaponizing a biological agent a detailed knowledge of the behavior of biological organisms in air is required because it is exposed to sunlight and varying degrees of temperature, which can cause the death of the microorganism. As the biological agents survival is very difficult outside the laboratory a large amount of the agent may be required to cause perceptible damage.*

*Usually such attacks will be through aerosols by some specially designed aircraft if a large population is targeted or may be as a sporadic event as through letters (anthrax spores). Such aerosol attacks usually produce severe respiratory illnesses some of which may be life threatening. In 1972, Biological Weapon convention was signed by 144 countries to prevent the use of biological weapons but in bioterrorism it is not effective.*

*Detection of use of biological weapon is a big problem unless it is an announced event by the terrorists but this may not be always and it may be a covert incidence; many a times there may be hoaxes only. In such situations it may become very important to detect and diagnose such an attack. Such detections may be syndrome based or based upon the epidemiological features of the diseases in a given population. In syndrome based criteria we detect the disease on the base of the syndrome caused by the disease and do not wait for the results of the laboratory tests to take preventive actions for the further spread of the disease and all the related personnel are alerted to take preventive steps.*

*From the epidemiological features we may suspect the disease if it presents as an unusual event of some endemic disease. If people with respiratory or gastrointestinal complaints present along with fever in large number of cases and if within hours or days there is a rapidly increasing disease incidence in the healthy population especially. An endemic disease when rapidly emerges at unusual time also gives indication of such an event and an epidemic curve rising and falling during a short period of time also indicates towards such an event. In such attacks people who live indoors are affected less and many people are affected in a single locality and with high mortality rate. If such an event could occur due to bioterrorism, there should be a strong suspicion of bioterrorism attack if all these factors point to bioterrorism*

*An attack of bioterrorism can be tackled only if there is awareness in the medical profession about bioterrorism. It can be integrated into emergency management or any other mass disaster management. It will involve a multidisciplinary approach involving health departments of state and central governments, private health care providers, local administration, epidemiologists and media people and there should be effective communication between these groups.*

*It should be emphasized that many of the diseases caused by such agents are not transmitted from person to person and re-aerosolization of such agents remains a remote possibility. We have to take standard precautions to prevent the spread of the disease like hand washing with plain water or with antimicrobial soaps, wearing gowns and disposable or sterilized gloves, wearing facemasks and having eye protection. In some diseases like small pox and pneumonic plague additional precautions are required like prevention of direct contact with all the body fluids (blood, excretions, secretions and non intact skin and mucous membranes.)*

*Infectious patients will have to be isolated and if sufficient space is not available to isolate such large number of patients, patients with similar signs and symptoms can be put together and movements of such patients should be limited and only essential movements of the patients should be allowed with precautions to reduce the transmission of the disease*

*Proper precautions should be taken to clean and sterilize the various instruments and equipments. All the surfaces and objects likely to be contaminated by the patients should be properly cleaned with antimicrobial agents. Single use articles should be discarded after the use along with the contaminated waste as per the local guidelines. Every care should be taken to properly handle the linen of the patient. All precautions should be taken to prevent the occupational injuries to the health care providers.*

*Only when the patient become noninfectious should be discharged but if it is not possible to keep all the patients in the hospital due to large number of patients, instructions should be given to the relatives regarding hand washing, barrier precautions and waste management. They should be instructed regarding the care of the patients and disinfection of the environment*

*While doing the postmortem on such cases all standard precautions should be taken to prevent the spread of the disease and relatives should be instructed to take precautions while cremating or burying them.*

*Decontamination of the patient and environment should be considered if there is gross contamination of the patient. Patient should be helped or instructed to take bath with soap and water and no bleaching agent should be used for this purpose. Eyes should be washed with normal saline or ophthalmic solutions. Removed clothes should be handled minimally and should be put in an impervious bag.*

*If any health care provider is thought to have been exposed such person should be identified and managed.*

*If large-scale exposure is suspected or present, non-emergency services should be discontinued and available equipment should be judiciously used depending upon the severity of the condition of the patients. Patients should be properly evaluated and those not serious or contagious should be discharged with proper instructions to them. Source should be identified from where to get the vaccines, immune globulins, antibiotics and antitoxins*

*Arrangements should also be made to handle large number of cadavers, for their postmortem examination and for their cremation and disposal. Usually there is panic, horror and anger against the state and terrorists if such an outbreak occurs. There is fear of infection and social isolation, which causes demoralization of the public. In case of such an event it should be handled carefully and trained psychiatrists, social workers and volunteer religious and non-governmental organizations, should provide psychological support. At the same time anxiety in the health care providers should also be taken care of and they should be properly educated to protect themselves. This fear can be greatly reduced if they are regularly taking part in the disaster drills held regularly.*

*There should be proper laboratory facilities to diagnose and confirm from the samples both at local level, district level, state level and national level. Samples should be properly packed to prevent the spread of the disease from the samples. Triple packing is advised and there should be no leakage even if the containers fall from a height of six feet. Visitors should be strictly prohibited to visit the patients in the hospitals.*

*People should be properly informed through the media about the sign and symptoms of the disease, its mode of spread and the precautions which the public should take and when should they seek medical advice in case of need and from where to get that help. This will help greatly in reducing the anxiety, fear and misunderstanding in the public who usually in such circumstances attribute nonspecific symptoms to an attack of bioterrorism.*

*We should be able to recognize the agent, which can be used for bioterrorism. We should develop tests to rule out agents or confirm them. This can be done locally or can be done by sending the samples to distant laboratories taking due precautions not to spread the disease. We should develop and apply biosafety precautions and safeguards in institutions*

dealing with potentially harmful and dangerous organism, which can be used as an agent of bioterrorism. We have to prepare emergency plans to tackle the bioterrorism attack. In such situations a large number of patients will come suddenly. We should have the plans ready for getting the medicines, disinfectants and vaccines in bulk in such situations and there should be cohesion between various agencies involved in tackling such situations. We should have good working relations with the media to avoid panic and horror.

Anthrax is caused by gram-positive *Bacillus anthracis* by eating the infected uncooked meat of goats, sheep and cattle that in turn get infected by ingesting the spores in the soil. *B. anthracis* is a spore-forming bacillus. There cannot be spread of the disease by inhalation from person to person. There can occur secondary cutaneous infection by direct contact with the ruptured vesicle secretions. In bioterrorism attacks usually it will be through aerosols, which will be inhaled

All of us are aware of the anthrax letters attack in the U.S.A., which occurred in the October 2001 and later. Spores of *B. anthracis* are ideal biological weapon and mortality is as high as 85% once the symptoms of inhalation anthrax appear.

The sudden appearance of large number of patients in a region with acute onset of flu like disease and with mortality of about 80% and half of the deaths occurring in 24 to 48 hours of start of the symptoms is highly likely to be anthrax. Anthrax has many properties of an ideal biological weapon.

*Botulism* is caused with anaerobic gram-positive bacillus *Clostridium botulinum*. In nature it is most commonly seen as a food borne disease but in bioterrorism it may be both foods borne as well as air borne. This bacillus produces a powerful neurotoxin, which inhibits the release of acetylcholine causing flaccid paralysis. Post exposure botulinum antitoxin should be given after sensitivity testing, as there is high rate of hypersensitivity reactions, which may be as high as more than 90%. Public should be informed that it is not a contagious disease and they should not be scared of. Public should be informed of the sign and symptoms of the disease and when and where to report.

Plague is caused with the bacillus *Yersinia pestis* and rodent is the vector. From infected rats transmission occurs by infected fleas. Incubation period is 2 – 8 days. In nature there may occur bubonic plague if spread is lymphatic or if spread is by blood septicemic plague may occur. In an event of bioterrorism event spread will be through aerosol and then there will be pneumonic plague.

The *Variola virus* causes small pox and in case of bioterrorism event even a single case should be considered as an emergency. Last case of small pox was reported in Somalia in 1977 and on May 8, 2000 WHO declared global eradication of small pox. Small pox has many good qualities of an ideal biological weapon. In aerosol suspension it is quite stable and infection dosage is quite low. It is highly contagious by droplet inhalation as well as by ingestion and direct contact and there is large susceptible population and mortality rate is quite high.

*Ebola and Marburg viruses* cause viral hemorrhagic fever. Various viruses responsible for viral hemorrhagic fevers are *Arena viridae*, *Bunya viridae*, *Filo viridae* and *Flavi viruses*. Diagnosis is a clinical one and not a diagnosis of laboratory. There is no treatment for various hemorrhagic fevers except a few exceptions. There is no vaccine available for prevention.

*Brucellosis* is caused with *Brucella abortus*, *B. melitensis*, and *B. suis* and *B. canis*. *B. suis* was the first bioweapon produced by U.S. In this mortality is < 5%. It is a very stable organism. It can be transmitted by ingestion and direct skin contact. It is highly infective by aerosolization and infective dose is 10 -100 organisms with incubation period of 5 days to more than 6 months. In this there is no person-to-person transmission.

*Tularemia* is caused by bacterium *Francisella tularensis* that is found in rodents, rabbits and hare. Infection spreads by directly breathing in the bacteria, drinking infected water or eating infected food or handling infected carcasses. It also spreads by being bitten by infected ticks, deerfly or other insects. It is not known to spread from person to person so no isolation is required. Treatment is with antibiotics and vaccine for this is still under review.

*Ricin* is a toxin produced from the seeds of *Ricinus communis* (castor oil). This toxin is glycoprotein in nature and acts as a cellular poison and inhibits protein synthesis in the cells. It has a wide availability. After extraction of the oil from the seeds of castor oil ricin is present in concentration of 5% in the left over waste. Seeds of castor oil are available easily and ricin poison is quite stable for a long time hence it is good for a biological weapon, as it has no specific treatment also. It was used in the past to assassinate the enemies. Recently three senate buildings were closed after tests confirmed the presence of ricin in the powder found in the office of the senate majority leader in U.S.A. Ricin is poisonous by numerous routes. It can be used in water, food, and aerosol or by injection by laden projectiles. Aerosol can be prepared by liquid ricin or lyophilized powder. All these routes can be used by bioterrorists. Protective masks are useful and they give protection against aerosol exposures. Decontamination by washing with soap and water will be useful. There is no specific treatment. No antitoxin or vaccine is available for its treatment or prevention. Only symptomatic treatment is there. Anti cough and antipyretics will help the patients. Care should be taken for adequate hydration. Respiratory support will be needed.

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