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Review Article

Threats of bioterrorism in public health, Epidemiological clue, Detection and Safety pre-cautions for outbreaks

Abstract

Bioterrorism is release of biological agents such bacteria, viruses and toxin in peoples to reduce their population by causing illness which is leads to death. These bio-wars are continue panic threat in public health which is ignored and denier. Disrupting the economic, religious, social distraction, ideological and political influence. These infectious agents have massive impact on human life as compare to war. Millions of population have been died with life threatening agents which including bubonic plague, smallpox, measles, influenza, typhus. Bioterrorism is international practice of biological products or pathogen to cause destruction in human-being, animals, plants and other living organisms. For decades Epidemiologists investigated the non-infectious and infectious diseases among human and animals population. Investigation identified the risk factors, vehicle and transmission mode among the familiar and unfamiliar outbreaks. Verity of information systems are used to detect the occurrence of disease or syndrome, dominated syndromic system. Importance of the system is to identify the data of outbreaks and storage of disease information that helpful in control of life threatening diseases via automatic monitoring system, detection or occurrence of disease in various groups. The launch of particular system is to collect the information or data for disease syndrome or occurrence. It can be identify the number of disease or quantity of outbreaks in abundant areas according to Zip-code, city, state or region. Health department and human services play important and critical role over medical and public health response to bioterrorism. Center for Disease Control and Prevention CDC takeover effort of nation and public health to detect the response to a bioterrorist events. Certain federal, states, provinces and other local communities are improving their health of population capacities to reply-back to various sort of outbreaks or emergencies.

Bioterrorism is still remain major problem and threats in public health. Naturally occurring infectious diseases lead to life threatening in well-being. These infectious diseases have massive impact on human life as compare to war. Millions of population have been died with life threatening agents which including bubonic plague, smallpox, measles, influenza, typhus. Bioterrorism is international practice of biological products or pathogen to cause destruction in human-being, animals, plants and other living organisms. Bioterrorism is not sole problem in public health while it is also huge problems in national security because the infectious agents are only biological weapons that easier in import and export throughout the global as compare to other chemical weapons, nuclear weapons. There is tiny facilities to detect the infectious agents or biological agents [1].

Bioterrorist performances could have religious, political, dialogical or criminal motivational and could be planned by single or group of individuals who already part of terrorist activities or events. Those biological agents that are enlisted

as bioterrorism weapons such as variola virus (smallpox), *Yersinia pestis* (plague), *B. anthracis* (anthrax), *Yersinia pestis* (plague), *Francisella tularensis* (tularemia) and agents of viral hemorrhagic fevers. *Vibrio cholerae* (cholera), *Brucella* spp. (brucellosis) were recently removed from the list of most likely agents but remain a possible agent along with *Coxiella burnetii* (Q fever), *Burkholderia pseudomallei* (glanders), agents of viral encephalitis, Staphylococcal, mycotoxins enterotoxin, and ricin [2].

Bioterrorists agents can be genetically modified organisms that are commonly resist to various well-known drugs and vaccines, these are highly contagious and can harm massive population. A small outbreak of illness can be initial caution for much more severe attack, recognition and identification of agents and its properties can prevent the death rates by develop of suitable vaccines and antibiotics for particular organisms. It can save the thousands of population lives. Medical staff must be aware from epidemiological skill of attack and must have knowledge about outbreaks of disease [3].



Epidemiological clues

The use of biological agents had documented been in US for the first time in 1984. Food is tested to investigate the particular agents which was *Salmonella typhimurium* cause illness in 751 peoples at the same duration of time. For decades Epidemiologists investigated the non-infectious and infectious diseases among human and animals population. Investigation identified the risk factors, vehicle and transmission mode among the familiar and unfamiliar outbreaks. There are numerous ways to identify and describe the clinical epidemiology and laboratory investigations for biological and chemical weapons. Outbreak of disease caused by single or uncommon causative agents such as viral hemorrhagic fever, smallpox, inhalation of anthrax deprived of epidemiological description. Clues are including morbidity and higher mortality rate with common diseases but it is critical to deed or concluded that no one of these clues may be sufficient to the situation to suggest the bioterrorism because these are mostly found in naturally occurring outbreaks such as toxic shock syndrome, Lyme diseases, hypoglycemic shock syndrome and Hantavirus syndrome [4].

Center for disease control and prevention give rank or category for bioterrorist agents that effect the detection especially for early detection. Experts are developed the profile for bioterrorism on the basis of potential epidemics. These profiles are reflect the knowledge of diseases due to their epidemiology might differ if novel model of transmission is discover. Each disease have quality that can increase and decrease recognition in the early outbreak via clinical diagnosis or syndrome [5].

Epidemiological features

- Within hours or days disease or illness spreads rapidly in normal population with increasing their numbers.
- During in short duration epidemic curve is rises or falls.
- Receiving huge number of cases from single geographical location.
- Those Patient bestowing severe illness that is uncommon with sign and symptom and could be bioterrorism attack.
- Diseases will have been found rarely in those population who remain or stayed at home as compare to outdoor population due to less exposure to disease outbreaks.
- Large numbers of rapidly fatal cases [6].

Microbiology and clinical features of bioterrorism agents

Suspected micro-organisms or bioterrorism agents are discussed below, also included those organism or toxins which are considered as potential biological weapons. The CDC has not yet issued recommendations for specimen processing and presumptive identification for these agents, since they are considered less likely to be used by terrorists than the agents already discussed. Recommendations for dealing with

these agents may be articulated as the CDC's bioterrorism preparedness program moves forward [2].

Viral Hemorrhagic Fever (VHF)

Hemorrhagic fever is much serious or life threatening syndrome, could be caused by mostly viruses. RNA viruses are highly responsible include Filoviridae, Arenaviridae, Bunyaviridae and Congo-virus. These all are those agents mostly found in infected animals and arthropods, humans are get infections while highly expose to infected animals or come in contact. Viral hemorrhagic fever has high mortality and morbidity rates are reported worldwide. This viral group agents are triggered infections by vascular damage and transformed vascular permeability, symptoms are include prostration, fever, myalgia's, shocks and hemorrhages in mucus membranes. Mortality and morbidity rates of viral hemorrhagic fever are highly conveyed and observed in various cases. The most effective treatment like Antivirals agents such as ribavirin is used in the treatment of infection with certain agents such as Bolivian, Lassa fever virus, Congo and Junín. Diagnosis can be performed or handle in only reference laboratories such as BSL-4 has facilities to equip these agents and can be diagnose by culture or non-culture techniques, which also include immunological, immunohistological, serological and nucleic-acid amplification methods. Specimen is draw from patients carefully and transport it to the preferred laboratories [2].

Anthrax

The incubation period of causative agent is relatively massive that's about 2-44 days, many cases are reported in 1-2 weeks from period of exposure while in few countries the incubation period is reported as vary such as In united states during outbreak of disease the distribution or frequency of incubation period was limited it was about 2-7 days. Nonspecific prodromal period of anthrax is reported from hours to few days [5].

Tularemia

Tularemia has typical incubation period as well as narrow when individual is exposed to aerosol of *F. tularensis*, with non-specific febrile illness or without symptoms of respiratory. In 3-6 days progression of disease is rapid become life threatening that is lead to pneumonitis. Mostly patients are with narrow incubation period is met with rapid progression by which result cases are much complicated in the acute exposure. *F. tularensis* is slow growing bacteria, also fastidious organism may tale 2-5days after the exposure while organism is detectable when it's complete their incubation period. After recognition or identification special sort of antibiotics are recommended to individual for the recovery of health [5].

Pneumonic plague

Yersinia pestis is causative agent of pneumonic plague that is transmit through aerosol droplets, typical incubation period. Which ranges from 1-4 days of exposure with relatively short period of prodrome followed by rapid progression causes pneumonia. Massive outbreaks would reported in onset of



epidemic by rapidly increases their cases. Standard is Non-specific for clinical finding but microscopic examination of sputum smear is supportive or may indicate the characteristics of finding which would considered as prompt in diagnosis. Blood and sputum are used to culture for particular disease and grow best within 24-48 hours, specimen process needs special attention to carry on. Conformation is done by special test which is avail for reference laboratories. Symptoms of the disease is life-threatening in early stage but can be treat with antibiotics in febrile patients [5].

Clostridium botulinum

They are gram +ve rod shaped organism, producing toxin and Causative agent of botulism causes foodborne illness, having typical incubation period relatively narrow about 12-72 hours. Sometime incubation period is vary due to certain environmental changes. They release toxin in food and can be transmit through aerosol droplets, clinically picture indicate the evidence of botulism in which include paralysis these special sort of characteristics lead to botulinum episode. Little amount of dose of botulinum can be lethal if ingested in cooked foods, restaurant food, spoiled food or previously stored foods. Botulism is diagnose with special type of tests that are avail in only CDC state laboratories. Clinician should be prescribe Antitoxins to suffer individuals who can get recovery with antitoxins therapy [5].

Smallpox

The most serious, viral disease of the time with massive incubation that's about 11-14 days. Early symptoms are nonspecific macular rashes, severe febrile illness over 2-5 days, rashes are start from up to down limbs. Suspected person can appear body rashes while done by the detection of virus under the electron microscope. Specimen isolates from particular vesicular or pustular fluid for laboratory use or electron microscopy. Vaccination can be prevent the individual health after the exposure 2-4 days later. Disease could be diagnosed easy when rashes are appear on the precise individual body [5].

Recognition of bioterrorism via Information system

Verity of information systems are used to detect the occurrence of disease or syndrome, dominated syndromic system. Importance of the system is to identify the data of outbreaks and storage of disease information that helpful in control of life threatening diseases via automatic monitoring system, detection or occurrence of disease in various groups. The launch of particular system is to collect the information or data for disease syndrome or occurrence. It can be identify the number of disease or quantity of outbreaks in abundant areas according to Zip-code, city, state or region. These system have installed been in USA for the evaluation of outbreaks resulted from bioterrorism attacks. Data must be stored through proper registration or standardized pathway which is release by center for disease control CDC in the form of 'Report' team working on outbreaks are responsible for data entry and having knowledge about disease syndrome and surveillance [7].

Molecular-based detection of suspected bioterrorist agents

Rapid molecular detection of blood can used to be fulfil the rapid diagnosis which is necessary for biodefence. Blood or other body fluid can be used to detect the bacterial species that is suspected as bioterrorists, from these selected agents mortality rate might be reduced by prompt treatment. If the diagnostic assays are subcontract to reference laboratories in-result treatment can be delay, bioterrorism agents can infect the blood stream meanwhile bacterial species are in progress of life-threatening disease [8].

Sensitive assay is used to detect the bacterial DNA such as *Bacillus anthracis* DNA can be extract by phenol-chloroform according to standard, *Burkholderia mallei* and *Yersinia pestis*. 16s rRNA genes is used for the identification as specific-DNA sequence, these specific sequences are conserved sequences and in PCR for it uses a universal primers. For detection of Specific pathogen and sensitivity real-time PCR is suitable or well because it is conducted in hermetically sealed wells which is widely reduce the risk of cross-contamination therefore, it does not need to perform the post-PCR analysis. PCR have been developed for numerous specific agents on the basis of nucleic-acid sequences and properties [9].

Relationship between medicine and public health

Public health and medicine is typical response to bioterrorism attack or outbreaks it is formed relationship among. Outbreak of disease is first recognized or diagnosed by physicians in emergency room currently working in hospitals. It include medical personals who exposed to suspected bioterrorist agents in flawless sense, by the passage of time communication systems become track specific disease outbreaks that is quickly occur and isolated accurately. There is no valuable data of patients but who will charged in hospital they will conformed as outbreak illness [10].

Governor should be make agencies for the determination of bioterrorism attack because bioterrorism can be in different sort such as biological, chemical and nuclear attacks which will conducted by an agency in proper way or channel. They will required special tailored defense system to detect the outbreaks in such manner. Public health policy should be make at national wise or national security level or should be trained the physicians, nurses and other medical professionals for bioterrorism attacks. Provide them suitable or proper diagnostic procedure and laboratories where they will conduct or treat patients easily, preparation of vaccines and drugs to prevent the attack and must be stored in future outbreaks [11].

Strategies for bioterrorism planned by CDCs

Health department and human services play important and critical role over medical and public health response to bioterrorism. Center for Disease Control and Prevention CDC takeover effort of nation and public health to detect the response to a bioterrorist events. Certain federal, states, provinces and other local communities are improving their health of population capacities to reply-back to various sort of outbreaks or emergencies [12].



Mission of CDCs comprises to promote health quality of life by controlling and preventing the disease outbreaks including injuries, disability and detection of biological weapons or toxic biological agents. CDCs are increased the capacity of diagnosis, detection of biological agents, and discover the proper management criteria for disease outbreaks. Identification and characterization of toxins, pathogenic agents and chemical exposure is improved by CDC, supported to public health capacities and provide control measures to the disease and emergencies, information systems are install to collect date and analyzed data of outbreaks of disease. These information systems are used to monitor disease and detect the outbreaks and helpful in improvement of public health of community, act as disease alert about emerging outbreaks and disease threats. Provide easiest pathway and quick detection of bioterrorist agents and diagnosis of disease in hospitals and laboratories to improve the health of population in communities [13].

CDCs reference laboratories

Initiation of bioterrorist attacks CDCs had limited source to test the pathogens which are listed as critical biological agents such as botulinum, tularemia, plagues, viral hemorrhagic fever and smallpox these all are listed as biological weapons were used in bioterrorism attacks. Additionally CDCs has now ability to test anthrax toxins and these biological agents can be transmit among individuals and responsible for high mortality rate. New labs and staff must be provided to national capacities to triage strategies and for rapid identification of disease outbreaks. There are 50 labs exists for public health in which plagues, tularemia and anthrax are testing, CDCs are provide certain laboratories by which some tests are perform and some are nor [13].

CDCs research improvement

In-collaboration of CDC with NIH national institute of health are Investing in research and vaccines production against the life-threatening biological agents. They discover and release vaccine against the smallpox virus and get award from Cambridge. Massive quantity of vaccines are produced in initial step, approximately 40 million doses were delivered but later vaccines production need to be raised. Numerous organization are working at that duration such as NIH, CDC, FDA and DDHS, these organization are also currently working on the vaccines production and development against for following biological hazard agents such as *Clostridium botulinum*, *Francisella tularensis*, *Bacillus anthracis*, *Variola major* and *Yersinia pestis*. These organization are develop strategies for public health and national medical care through which they protect the civilian population health from bioterrorism. Modification of research centers and focused on bioterrorism education, installation of computer systems through which they detect the naturally accruing outbreaks of bioterrorism [13].

Bio-safety or safety precautions for bioterrorism

Laboratory isolation precautions: Transmission of bioterrorist agents cannot spread from individual to individual generally but can be transmit through aerosolization of

agents among population. Patients with suspected illness of bioterrorism attack or having such symptoms must be facilitated with healthcare, standard precautions must be utilized. As we know the transmission of disease can be reduced by standard precautions, it is planned for recognized and unrecognized source of infection. Direct body fluid like blood, mucus membrane, secretion and excretion can be prevented by standard precautions, routinely it applies in medical practices for patients care [6].

Washing hands: Hands should be washed-out with antiseptics after dealing patients body fluids, such as blood, excretion and secretion these fluids can contaminate the hands and can be source of infection for others. Glove must be remove after when done to check or touch to patients, antimicrobial soap should be apply for washing hands [6].

Use of gloves: Gloves should be used when dealing or touching the patients and even examine the patients. Glove should be properly discard after examine the patients specimen due to contamination, which act as source of infections. Wash hands after performing procedures or clinical examination [6].

Masks or face shields: Mask and eyes protection must be apply to protect from body fluid or specimen of patients, disposable mask should worn [6].

CDCs precaution/control standard

Various issues are provoke by healthcare facilitators when examine or dealing with suspected bioterrorism attack patients as related to other communicable diseases. Healthcare personal should be aware from mode of transmission of disease, epidemiology of disease and clinical features very carefully. Medical personal can also take helpful guideline from relevant websites where precaution measure are avail according to CDCs rules and regulation. Issue could be control by recognition of those individual who are highly at risk or exposed to bioterrorist agents or infection. Medical personnel's can prevent the transmission of infection among visitors and patients, should provide chemotherapy and immunization dose to suspected patient to prevent the population with due attack of bioterrorism, equipment must be protective and appropriate that is operating by healthcare facilitators for patient diagnosis and/or specimen isolation. Stuff should be immunized with proper dose who are dealing with smallpox exposed patients [14].

Microbiological Laboratories Precautions (MLPs)

The role of microbiology laboratories is critical or key in the control of biological agents. American society for microbiology and infectious disease created policies for infection control that is published in 2001. Transmission of infectious diseases can be prevented by microbiology lab staff they have massive contribution in healthcare by detecting the organisms and understanding the appropriate epidemiological features and importance of pathogenic agents. Identifying the disease outbreaks and provide antimicrobial patterns and recommend safety precautions during transmission of outbreaks.



Bioterrorism attacks are identified by microbiology laboratory personals due to availability of tools and investigation knowledge [15]. The National Committee for Clinical Laboratory Standards (NCCLS), and Clinical and Laboratory Standards Institute (CLSI) developed guideline and detection of biological attacks by testing the antimicrobial susceptibility and interpretation patterns. These organization should access be given to microbiological labs to identify organism at genotypic level. Implementation of control measures, room selection and patients treatment are involving in clinical decisions, this can be done by rapid diagnostic testation. Safety precautions, immunization and prophylaxis are include in control barrier, microbiologists must provide guideline, rapid diagnostic test result to patients and control to avoid the disease or outbreaks. These report of rapid diagnostic test, importance of agents and epidemiological clues are must be reported to public health agencies to develop strategies for control and safety precautions [14].

Conclusion and Recommendation

Bioterrorism or bio-war is does not something new that is go away, its need high technology to end the bioterrorist attack because it highly effect the population lives. Bring modification in field of diagnosis, microbial identification, public health, antimicrobial therapies, surveillance and develop strong immunizing system to control relevant infections. Population should be aware about terrorism and delivery them education and training about infectious disease hazards. Determine the source of disease and develop the quick detection system while changes occur in disease pattern and arising of outbreaks. Install modified and advance information systems in hospital, laboratories and other public healthcare center. Appropriate reporting system and data-bases should be progress in cities, states and national even at international level where data must be avail and provide procedures for control of bioterrorism attack and outbreaks.

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