

The Challenge of the Hospitals and Health Care Systems in Preparation for Biological and Chemical Terrorism Attack

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Abstract: In the present study a few aspects of planning for terrorism events that expose large numbers of people to contamination are discussed. Many issues were considered as an absolute requirement for implementation of NBC response: 1) policy, 2) plan and 3) emergency department response to surge capacity. Key elements of the healthcare facility response plan include prompt recognition of the incident, staff and facility protection, patient decontamination and triage, medical therapy and coordination with external emergency response and public health agencies. Controversial aspects include the optimal choice of personnel protective equipment, establishment of patient decontamination procedures, the role of chemical and biological agent detectors and potential environmental packs and water treatment systems. Bioterrorism is an event in a civil setting that is equivalent to an epidemic in a medical setting. This incident usually results in a direct challenge to the medical community. The medical profession must assume a central role and participate actively in the discussion and planning of strategies in order to influence formulation of policies that will be activated in response to bioterrorism events.

Key words: Weapons of Mass Destruction, Terrorism Attack, Chemical Attack, Biological Attack, Health Services, Hospitals

INTRODUCTION

Disaster planning is a difficult task. Perhaps no form of disaster is more difficult to prepare for than one resulting from the intentional covert release of a biological pathogen or chemical toxin. The complexity of the response operation and perils of inadequate preparation cannot be overemphasized. Even with detailed planning, deviation from anticipated emergency operation plans are likely to occur. Several federal programs have been initiated to assist communities in enhancing their preparedness for events involving biological and other agents of mass destruction, such as the Metropolitan Medical Response system (MMRS) program. Community preparedness is far from perfect. Local healthcare, emergency care, EMS, law enforcement and FBI agencies have been trying to implement responses for possible disaster planning. Improved real time regional patient healthcare capacity status is another way to improve the response. Development of an affordable and accurate biological agent detection system, incorporation of standard education and training curriculum on terrorism and biological agents into healthcare training programs and expansion of federal and state programs to assist communities in developing increased public awareness and education programs have been on the rise, particularly after the September 11 attacks. Weapons of Mass Destruction (WMD) keep every state in every country

vulnerable across each domain, including communication, healthcare facility preparedness, professional training, interagency collaboration, public healthcare infrastructure, surveillance capability, food supply and environmental resource allocation. It is a significant challenge to prepare for an unknown event without a clear-cut indication of whom to protect and from whom protection is needed

Hospital Based Planning for Chemical and Biological Terrorism: Healthcare facilities are an essential component of an emergency response system but, at the present time, are poorly prepared for an incident [1]. The greatest challenge may be the sudden presentation of a large number of contaminated individuals. Gathering information on contaminated patients has been based on the traditional collection of material from those with military experience, which is not directly applicable to the civilian. This study discusses a few aspects of planning for terrorism events that expose large numbers of people to contamination. Key elements of the healthcare facility response plan include prompt recognition of the incident, staff and facility protection, patient decontamination and triage, medical therapy and coordination with external emergency response and public health agencies. Controversial aspects include the optimal choice of personnel protective equipment, establishment of patient decontamination procedures, the role of chemical and biological agent detectors and potential environmental packs and water treatment systems. These all needs to be

The fundamental precept in hospital-based planning for bioterrorism events includes having a comprehensive emergency room disaster plan that is based on threat and vulnerability analysis. The JCAHO environmental healthcare standards and approach to disaster planning and management form the basis for a solid bioterrorism response plan. Preparation, education and training are imperative. Clinicians must maintain a high index of suspicion for use of bioterrorism agents, be able to make a rapid diagnosis and initiate empirical treatment. However, the personnel, fellow administration, security, public relations, laboratory, pharmacy and facility management department should be familiar with the plan and know when to activate it. A recognized incident command system should be used. Hospital leadership must be aware of facility capabilities, capacity and should also have plans for expansion of service to meet the surge in demand. The command center should coordinate the emergency personnel teams, decontamination, security, acquisition of supplies and notification of public health and other authorities, including the media. If the plan is implemented, stress management and psychological support will play an important role in recovery [2-4].

It is thought most of the time, that chemical warfare agents is a military issue [5]. Several recent events have demonstrated that civilians might also be exposed to these agents. The resources of US communities to respond to chemical incidents have been designed primarily for industrial agents, but must be expanded and developed regarding incident management, agent detection, protection of emergency personnel and clinical care. It is a need to be well aware that the weapons of mass destruction (WMD) are a threat and all healthcare facilities must prepare for this threat [6]. Every healthcare facility is a vital part of the community response system and must be ready to respond. A terrorist attack using WMD can occur in any location, urban or rural. Private vehicles or busses might need to transport the majority of patients, with only a small percentage arriving by emergency medical service. Most will go to the hospital closest to the incident, even if it results in overcrowding. Others will go directly to their private physician's office or primary hospital, even if these facilities are not part of the local disaster plan. Most of these victims will not be decontaminated before arrival. If the hospital allows any of these patients inside, the staff may become ill from the toxic exposure and the facility may require closure for decontamination. The risk is universal. The healthcare facility must plan for communication that allows local government to transmit alerts regarding the emergency.

Healthcare facilities must also communicate the status of the emergency needs to local officials. They must be prepared to establish a single entry control point and attempt to secure all other entrances. They must be able to establish a patient decontamination team from on-duty

staff, with only a few minutes notice, at any time of the day or night.

Are the Hospitals Ready?: A hospital preparedness for incidents involving chemical or biological weapons was examined [7]. A questionnaire/survey from 224 hospital emergency departments in four Northwestern states was used. Eighty three percent of the emergency rooms involved responded to the questionnaire. Fewer than 20% of the respondent hospitals had plans for biological or chemical weapons incidents. About half (45%) had an indoor/outdoor decontamination unit with isolated ventilation, shower and water containment system, but only 12% had one or more self-contained breathing apparatuses or supply airline respirator. Only 6% had the minimum recommended physical resources for a hypothetical sarin incident. Of the hospitals providing quantitative answers about medication inventories, 64% reported sufficient ciprofloxacin or doxycycline for 50 hypothetical anthrax victims and only 29% reported sufficient atropine for 50 hypothetical sarin victims. The study concludes that most of the hospital emergency departments that were interviewed were not prepared for a WMD disaster. Treat *et al.* [8] study presented that, they interviewed hospital personnel in 30 different hospitals. Data collected included level of preparedness, mass decontamination capabilities, training of hospital staff and facility security capabilities. The results showed that 73% of the people interviewed believed that they were not prepared for a biological incident and were not able to manage chemical or biological weapons. Seventy three percent of the hospitals stated that they had single-room decontamination. Thirteen percent of hospitals reported no decontamination plan; most of these hospitals were rural hospitals. WMD preparedness had been incorporated into hospital disaster plans by 27% of the facilities. Eighty seven percent believed that their emergency department could manage 10-50 casualties at once. Only one facility had a stockpile of any medication for WMD treatment. All of the facilities had network communication. There were no hospitals that had prepared media statements specific to WMD. Nearly 1/4 of the hospitals stated that their hospital staff had some training. All others reported the need for more training. Seventy seven percent of hospitals had a facility security plan in place, but 1/2 of those plans had never been tried

or activated. In conclusion, most of the hospitals that were interviewed reported no preparation to handle WMD events, particularly in the areas of mass decontamination, mass medical response and awareness among healthcare professionals, healthcare communication and facility security.

Are Health Care Personnel Ready?: We have known about the problem with terrorist incidents since 1996 when the trans-Olympic games were part of the preparation for possible terrorist attack. At that time, unprecedented preparations were undertaken to cope with health consequences of a terrorist incident involving chemical or biological agents [9]. Local, state, federal and military resources joined to establish a specialized incident assessment team and science and technology center. Emergency rooms were also prepared. It seems that after 1998, all of this was discarded because no one took advantage of the chance to prepare other states or cities for the same scenario. In 2001, the American College of Emergency Physicians and the Department of Health and Human Services gave specific training objectives for ED staff to prepare for casualties of nuclear, biological or chemical (NBC) incidents [10]. There are courses available and there are possibilities for preparation, but not every hospital has participated. The best thing to do at this point would be to hire a company to deliver a specific effort to prepare the hospital. There are private companies that are very well equipped to do this and they act in the best interest of the state, hospital or private company. The joint commission on the accreditation of healthcare organizations (JCAHO) requirement is now focusing on prevention of WMD. They have focused healthcare facility attention on emergency preparedness for terrorist attacks. Historically, healthcare facilities have been unprepared for contaminated patients presenting to their facility (these incidents must be properly managed to reduce the health risk to the victims, providers and facility). The occupational safety and health administration (OSHA) training requirements for persons involved with decontamination response, as well as the issue of team selection and training has been made more available to more hospitals. Simple OSHA operational level training curriculum integral to the healthcare environment should be outlined in every hospital [11]. If that is not possible, it is suggested going through a privat corporation for these courses so the hospital or facility will be prepared (PSSI) to pass the GSO or OSHA test. Horby and Col [12] wrote a paper about a postal questionnaire they sent to the clinical directors of most of the emergency room departments. This study was presented before the September 11 incident. Ninety four percent of the emergency room departments responded to

the questionnaire. Thirty eight percent of the emergency departments stated that members of the staff had received training in the preceding years. Twelve percent possessed the level of personnel protective equipment recommended for decontamination and only 7% of them had a room that was safe for decontamination. Twenty seven percent had the capability of decontaminating casualties outside of the department and 23% had neither the decontamination room nor the ability to decontaminate casualties outside the department. Only 10% had

adequate personnel protective equipment. After this, nothing was done and England, like the United States, was left alone until the terrorist attack in September of 2001. In 2001, a study was published before September 11 by Silber [13]. The purpose of the study was to see if New York was prepared for a medical disaster, using the New Years Eve weekend as a model. The results showed that 97.8% of the hospitals interviewed were prepared for some disaster, 87% had a disaster plan, 90% had an incident command system and 73.9% had a live mock Y2K drill. Potential terrorism influenced Y2K preparedness in 84.8%.

Y2K survival indicated that the threat of terrorism influenced future preparedness in 73% of the hospitals. Seventy three percent actually had protocols for chemical, 62% for biological and 51% for a combined WMD incident. Sixty two percent of the hospitals were confident in their ability to manage victims of chemical events, but only 35.6% felt similarly about victims of biological incidents. Eighty percent felt there should be government standards for hospital preparedness for events involving WMD and 84% felt there should be government standards for personnel protection. Eighty two percent would require a moderate to significant amount of funding to affect their standards. The conclusion of that study showed that, although hospitals were on a high state of alert, emergency department directors were not confident in their ability to evaluate and manage victims of WMD incidents, especially biological exposure. The New York City experience is an example of the rest of the nation; that we all underscore the need for further treatment and education for preparedness plans for WMD. The study concluded that federally supported education and training was available, but not readily available. The study was published between the months of April and June, a few months before the terrorist attack.

We all know that New York responded quite well to the terrorist attack but we think that, based on this study, the response could have been better if more hospitals and more emergency room directors were prepared and more funding was spent before the terrorist attack. Therefore, we would like to point out that we never know when a WMD attack is going to occur, or in which city it is going to occur. We do not want to be unprepared for another WMD attack. In 2002, Greenberg [14] wrote a paper which

stated that Philadelphia was ready to treat victims of terrorist biological or chemical agent attacks. All hospitals with emergency room departments in the Philadelphia area were interviewed. A survey consisting of 38 questions was mailed to the physician director of each emergency room. Fifty four of sixty two directors returned usable

departments responding to this survey was low, based on set predetermined implicit criteria. Therefore, this study showed that a large city like Philadelphia was not prepared to undergo a WMD attack.

NBC PLANS

Implementation of an NBC Plan: Many issues were considered as an absolute requirement for implementation of an NBC response: 1) policy, 2) plan and 3) emergency department response to surge capacity, including design of the emergency department, equipment required, personnel required, education and training, occupational health and safety issues and surveillance systems.

Surge capacity is the ability to rapidly mobilize to meet increased demand. While large amounts of federal funding have been allocated to public health laboratories, little federal funding has been allocated to hospital microbiology and chemical laboratories. There is concern that hospital laboratories might have inadequate surge capacity to deal with a significant bioterrorism incident. A workflow analysis of a clinical microbiology laboratory that serves major medical centers was performed by Shapiro [15] to identify a solution to this problem. Their conclusion was that hospitals must provide an increased number of biological safety cabinets and the amount of space that they give to the clinical laboratory, should cross-train more technologists and should give better training to most of the staff.

Policy and Plans: The most important aspect of implementation is recognizing that the hospital needs a response to external domestic or international disaster. The emergency department is the key area that needs to be strengthened for this response. An emergency department needs a protected area to prevent secondary contamination of staff in the department. Clear labeling of contaminated and clean linens is needed when an NBC response has been activated. All patients presenting after an NBC incident require decontamination. In the ambulance bay, there needs to be a cubicle with one showerhead. Further, three rows of two showerheads need to be installed to have more room for more people. For decontamination, patients are required initially to shower with their clothes on and then remove their clothing, step forward to the next showerhead and shower while gently cleansing with soap. They then move

surveys, with a response of 88.5%. Deficiencies in preparedness were identified involving physician training and education, antidote stocking, written policy, interagency agreement and decontamination facilities. The overall level of preparedness for hospital emergency

forward to dry themselves and put on a clean disposable suit in the clean zone. The principle is to move at all times toward the clean zone. Staff puts the patient's belongings in a clean bag and the bag and the patient are labeled with identical numbers. The bags of belongings should then be placed in the contaminated clothing bin. All showers should have temperature regulation to prevent hypothermia and provide patient comfort. Having the showerhead in the ceiling of the ambulance bay allows decontamination to be carried out under cover. The ceiling should also be fitted with a sprinkler system that is isolated from the rest of the department so that it can be used if the shower proves inadequate. Once patients are decontaminated, they are allowed into the hospital. Depending on the triage category, they will go into the emergency department in a demarcated area.

It is very important to understand the concept that there is a reported risk from secondary exposure to contaminated patients at healthcare facilities. Even though this has been graded as a low risk, we know that if there is not a good decontamination facility and there are many patients coming in at the same time to the same hospital, this risk can be very high. This risk should be adequately addressed with level III personnel protective equipment, including air purifier and respiratory technology, unless the facility determines that specific local threats require an increased level of protection.

Ambulance Traffic: The regulation of movement of ambulances is very important. The emergency ambulance carries patients to one entrance, they stop at the drop-off point and then move away in one direction, assuring smooth traffic flow. The emergency department should have the same system of one-way entrance to the emergency department where the decontamination should be continuous or treatment should be initiated.

Personnel Protective Equipment (PPE): PPE comprised of plastic overalls, face mask with filter and work boots and gloves needs to be obtained. No PPE is adequate enough to protect staff from every agent. The PPE needs to be selected and needs to conform to Federal Government standards. Extra medication is to be obtained and kept in the emergency department, pre and post, at all times. Storage needs to be available in case more medication

needs to be used.

Personnel Requirements: This includes medical, nursing, security, clerical, patient care assistances, etc., depending on the type of threat. The actual composition of the staff and numbers require careful planning and numerous shift rotations might be required for a prolonged response. The initial response requires a senior doctor, a senior nurse, a clerk and a security officer be in the contaminated zone while wearing PPE. Later, more staff members, especially security staff, will be needed in the PPE and contaminated zones. The exclusion criteria for the staff include people with upper respiratory infections, people who have vomiting or diarrhea or people who have had diarrhea in the previous 72 h. Therefore, about 1/5 of the staff would not be available; therefore, these people need to be covered with other at-home staff.

Education and training: This needs to be organized in terms of level, like it is done with advanced cardiac life support or advanced trauma life support. The hospital needs to provide at least two to four courses per year for updating purposes. Credit and recognition will be given with a deadline to repeat the course for continued updates on NBC disaster planning.

Occupational Health and Safety Issues: The provision of a safe workplace is one of the most important issues. Given the nature of NBC advances, a specific planned response should be mandatory in the hospital. Appropriate PPE should be available in all hospitals and it should be mandatory that staff participate. Failure to provide employees with adequate training and protective equipment can result in improper disposing of toxins and violation of occupational health and safety regulations and may result in potential litigation.

Surveillance System: A surveillance system needs to be implemented in the emergency department and should include the following: 1) Be sure that all staff have appropriate training with the appropriate updates, 2) Be able at all times to survey the area or the possible NBC zone and 3) Have at least two decontamination rooms inside the hospital, in addition to another three rooms ready to be converted to decontamination rooms.

Decontamination System: The decontamination system is very important, because it can save the health care workers life. We have included two pictures that appeared in an MGA [16] article by Gin Tan and Mark C. Fitzgerald about NBC planning. It is important to understand the concept that the emergency room and the hospital are a community asset that requires protection and patients should not be allowed in these areas until decontamination is completed. Not surprisingly, staff members may rush to the aid of a contaminated patient

and may become a patient themselves, leading to an exacerbation of the problem. This problem can be avoided with a well-understood response plan and adequate training. The belief that patients will arrive at the emergency department already decontaminated needs to be challenged. Studies have shown that in the event of a disastrous situation, most patients will present to local hospitals by private transport [16]. However, it is very important that all hospitals have adequate decontamination facilities where they can quickly and efficiently decontaminate stretcher patients, as well as mass casualties.

Laboratory NBC Plan: The Center for Disease Control (CDC) is working with state public health authorities in developing a nationwide plan for bioterrorism preparedness. One thing that they are working on is the differentiation between laboratories within the hospitals or healthcare facilities that are classified into four levels, depending on their testing facilities and abilities. Level A laboratories are represented by the majority of clinical microbiology laboratories that culture and identify routinely isolated pathogens. These laboratories will perform a small number of simple rules out tests and if suspected, isolate them depending on tests results and refer those organisms to a higher level laboratory for further testing. The laboratories in the hospital are graded according to the laboratory response network (LRN), which is voluntary and public health authorities are attempting to ease the burden of additional work. Level B laboratories in LRN are represented by many public health laboratories and should contain a biosafety level III facility. These laboratories include tests for rapid presumptive identification (fluorescent antibody reagents) and confirmatory identification antimicrobial susceptibility testing. Critical biological agents would be referred from a level B laboratory to a level C laboratory, which has the capability for nucleic acid amplification testing, molecular typing and toxin testing. Level C laboratories would include certain public health and other laboratories that perform strain typing procedures. Critical biological agents would be referred to a level D laboratory, or Ahot@ labs, according to the CDC. The role of these laboratories is to archive critical biological agents and to perform other specialized tests, such as culture or molecular identification of highly dangerous viral agents. More on laboratory testing can be found on the web page, www.bt.cdc.gov. Laboratories are very important because they can be one of the first assets in a healthcare facility or hospital for an NBC response.

CONCLUSION

Bioterrorism is an event in a civil setting that is equivalent to an epidemic in a medical scenario. This incident usually results in a direct challenge to the medical community. Therefore, the medical community is required to prepare a stockpile of vaccine, supplies, correct drugs, immunization for first-responders, research and development, new rapid test methods, investigation of therapeutic drugs and protection, safe immunization methods and investigation of need for specialized hospital centers with specially trained personnel to handle bioterrorism attack victims. The medical profession must assume a central role and participate actively in the discussion and planning strategies in order to influence formulation of policies that will be activated in response to bioterrorism events. This policy must integrate the various activities and interest of federal and local government agencies, law enforcement, fire departments and other agencies involved in reaction to a massive bioterrorism attack. The efficiency of this novel interdisciplinary cooperation will be crucial to contain and prevent such events. An answer needs to be considered and found now rather than waiting. The time has come to prepare and develop an integrated policy.

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