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AUTHOR DeGraffenreid, Jeff Gordon
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ABSTRACT

The challenge facing many emergency medical services (EMS) is the implementation of a comprehensive educational strategy to address emergency responses to terrorism. One such service, Johnson County (Kansas) Medical Action, needed a strategy that would keep paramedics safe and offer the community an effective approach to mitigation. A comprehensive, cost-effective model for educating paramedics in emergency response to terrorism was created. The model is easy to implement and requires no special funding or additional staff. Paramedics implement the model by using a self-study module that builds upon previous learning and covers safety, fundamental concepts, departmental policies, a flow chart for first response, mass decontamination procedures, and a drug formulary for chemical and biological exposures. Implementation of this model should significantly enhance the actions of the first responders. Paramedics who have the knowledge to make wise decisions in the first minutes of a terrorism incident may significantly reduce morbidity and mortality. (Contains 38 references.) (Author/KC)

Chemical and Biological Terrorism
Improvements to Emergency Medical Response

by

Jeff Gordon DeGraffenreid

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Director of Graduate Studies

ABSTRACT

Chemical and Biological Terrorism
Improvements to Emergency Medical Response

Jeff Gordon DeGraffenreid

The challenge facing many Emergency Medical Services is the implementation of a comprehensive educational strategy to address emergency response to terrorism. Johnson County Medical Action needed a strategy that would keep paramedics safe and offer the community an effective approach to mitigation. Regardless of the mechanism or motive behind a terrorist incident, emergency response personnel should remain focused on reducing the impact of the event as efficiently and safely as possible.

This project provides a comprehensive, cost-effective model for educating paramedics in emergency response to terrorism. It is a model that is easy to implement and requires no special funding or additional staff. Emergency medical services providers and the community alike will benefit from this proactive approach to terrorism response.

The method of implementation is a self-study module that enhances previous learning. It includes an overview of safety, fundamental concepts, departmental policies, a flow chart for first response, mass decontamination

procedures, and a drug formulary for chemical and biological exposures. It concludes with an assessment tool.

It is anticipated that implementation of the creative project will significantly enhance the actions of the first responders. Paramedics who have the knowledge to make wise decisions in the first minutes of a terrorism incident may significantly reduce morbidity and mortality.

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CHAPTER 1

RATIONALE

Introduction to the Problem

The threat of terrorism hangs over all communities. No community is immune, as terrorism transcends geographic and demographic boundaries. Suburban, urban and rural communities in the United States are all at risk. Terrorists, both international and domestic have demonstrated that they have the knowledge and capacity to strike anywhere in the world. The emergency response challenge is profound. It will be the local resources that are initially summoned to mitigate such an attack on society. This fact, compounded with the knowledge that first responders will be a deliberate target, requires an integrated response plan.

Problem Statement

The challenge facing many Emergency Medical Services is the implementation of a comprehensive educational strategy to address emergency response to terrorism. A strategy that will keep prehospital medicine practitioners safe and offer consumers an effective approach to mitigation. Regardless of the mechanism or motive behind a terrorist incident, emergency response personnel should remain focused on reducing the impact of the event as efficiently and safely as possible.

The purpose of this creative project is to analyze the current strategies for terrorism response by emergency medical services and to evaluate

perceived effectiveness of these strategies in a local third service, emergency medical service. The project then provides a comprehensive cost effective model for educating paramedics in emergency response to terrorism. This model will be easy to implement and require no special funding or additional staff. Emergency medical services providers and the community alike will benefit from this proactive approach to terrorism response.

Significance of the Project

Literally dozens of federal and state government agencies have created new programs, or augmented existing ones to address the threat of terrorism. Senior government officials, congressional leaders and military experts now routinely call attention to the threat of Weapons of Mass Destruction terrorism. It is ranked among the most serious challenges to United States Security. (Falkenrath, 1998) The media has produced countless stories on the subject increasing the general public's awareness of this emerging threat. The military and other federal agencies now have outstanding proficiency in confronting potential chemical or biological attacks. But who will be the first to answer a call of distress from the local community suffering at the hands of terrorists? The local responders. Knowledge that the military and federal government has acquired would prove of great value to domestic first responders. Local responders will be required to initially manage the chaos that will follow scenarios ranging from the release of a

chemical gas as such sarin in a crowded meeting place to the discharge of a biological agent such as anthrax into the air handling system of a school.

Overview of Chapters

Chapter two will present a thorough review of the current literature pertaining to emergency response to terrorism. This chapter will focus on detailed information from a wide variety of sources that emphasizes the importance of this education. It will benefit all that are involved in the learning process of paramedics within the context of initial response to hazardous environments resulting from terrorism.

Chapter three presents the design of the creative project. It leads this project into fruition. The project design, procedures and materials will be introduced. Original instructional design, National Fire Academy distance education and other materials will be explored.

Chapter four will present a model of the creative project. It is a modular approach to arrive at a minimal level of awareness. The intent is for it to be adapted and utilized by numerous emergency medical services to fit into their jurisdictions.

Chapter five addresses anticipated outcomes of this project. It includes the implications this piece of work has on other paramedic special operations education. It will also hypothesize the consequences of ignoring the threat and choosing to not educate paramedics concerning terrorism. The chapter concludes by offering recommendations for future design

modifications. The responsibility for combating the results of local terrorism lies with first responders.

CHAPTER 2

LITERATURE REVIEW

Introduction

Terrorism is not a new phenomenon. But today's terrorists, be they international cults like Aum Shinrikyo or individual domestic actors like the Unibomber, act on a greater variety of motives than ever before. More ominously, terrorists may gain access to weapons of mass destruction, including nuclear devices, germ dispensers, poison gas weapons, and even computer viruses. Catastrophic terrorism has moved from the far-fetched Hollywood horror repertory to a contingency that could happen next month. Although the United States takes conventional terrorism seriously, it has not yet prepared the local emergency services providers to adequately deal with the consequences during the first few hours.

Overview

How serious is the current threat of terrorist activity on the United States? Between 1980 and 1990 there were 12,216 bombing incidents in the United States (Slater and Trunkey, 1997). Most of these were pipe bombs. In 1990 alone, there were 1582 bombing incidents causing 222 injuries and 27 deaths (Slater and Trunkey, 1997). The trend during this ten-year period showed an increase each year.

Increases in the number of bombing incidents have been paralleled by an increase in the destructive power of the individual devices. Powerful

explosive devices can be constructed from seemingly mundane materials. This is illustrated by the massive destruction after the detonation of an 1800-kilogram ammonium nitrate and diesel fuel bomb in Oklahoma City, Oklahoma, in 1995. This incident killed 167 people and destroyed the nine story Alfred P. Murrah office building (Mallonee, 1996). Large bombs are not only a threat but also a reality. Despite Oklahoma City, the World Trade Center in New York, and the United States military housing facility in Saudi Arabia, most terrorist bombings consist of relatively small volumes of explosives, covertly placed, that produce low mortality rates (Bellamy & Zajtchuk, 1990). Although these small devices are not as efficient at producing fatalities, they succeed in their primary objective of producing terror in the civilian population (Bellamy, 1990).

Since terrorist organizations operate outside of the law, they are not restricted in their choice of weapons or targets. Weapons that have been explicitly prohibited from military use by international convention are fair game for terrorists (Geisenheyner, 1987). Because weapons systems that contain radioactive, chemical, and biological components are sure to create panic in those civilians who are even marginally exposed, they represent an ideal weapon for terrorists.

Weapons of choice

Although we think of the emergence of nonconventional weapons as a relatively recent event, they have been used throughout history. The

Athenian army poisoned the water supply to the city of Kirrha in 600 before Christ using a toxin derived from the hellebore plant (Buchanan, 1997). The Greeks also used biological warfare as long ago as 300 before Christ, when they intentionally polluted enemy wells with animal corpses (Newark, 1988). Throughout the Middle Ages, catapults were used to hurl diseased animal and human corpses into enemy cities (Poupard & Miller, 1992). "Widespread use of smallpox against the Native Americans by the French, British and eventually the United States is well recognized" (Slater & Trunkey, 1997, p.5). World War I saw the use of both biological and chemical warfare. The Germans used Anthrax, cholera, and glanders against human and animal targets and the use of chemical weapons was also widespread (Cole, 1996).

Biological Weapons

The threat of terrorism from chemical and biological weapons is already a reality. One incident of biological terrorism occurred in September 1984 when 750 people became sick after eating in restaurants in The Dalles, in Oregon. A member of a religious group spread Salmonella bacteria on salad bars in 4 local restaurants in an attempt to disrupt elections in eastern Oregon (Cole, 1996).

In 1993, Canadian customs apprehended a man from Arkansas who had four guns, 20,000 pounds of ammunition and enough ricin to kill 30 million people (Cole, 1996). Other extremists in the United States have been

arrested for possession of botulism and ricin toxins. It is even possible to mail order some of these agents from biomedical supply houses (Williams, 1996).

Chemical Weapons

One of the most serious examples of the threat of chemical terrorism recently occurred in Japan. In June of 1994, the Aum Shinrikyo cult either accidentally or intentionally released sarin gas in the community of Matsumoto, leading to several deaths and hundreds of casualties. This was followed in March 1995 by a widespread attack on the Tokyo subway system. Sarin gas was placed in five subway cars on three separate lines. The attack was planned for the early morning rush hour and coordinated to occur beneath Japanese national government office buildings. Twelve people were killed and 5500 casualties were related to this single attack. The cult had also purchased a Russian helicopter with the intent of the aerial spraying of nerve gas. More recently, a container of the potent nerve gas VX was found less than forty-five centimeters underground alongside a river in Japan. It was manufactured by a cult and if optimally distributed could have killed 4 million people. Some cults have recently been seeking to obtain the Ebola virus from Zaire (Fullerton, 1992). Chemical and biological warfare agents have become weapons for terrorists.

There are five general classifications for chemical warfare agents: Nerve agents, blister agents, blood agents, choking agents and incapacitating agents (Fullerton, 1992). Some of the more common nerve agents are tabun,

sarin, and soman, although other compounds exist. Blister agents consist of distilled mustard compounds. Blood agents are hydrogen cyanide and cyanogen chloride. Choking agents are phosgene and chlorine. Incapacitating agents represented by quinuclidinyl benzilate. Biological toxins are classified with biological warfare agents, although they share many characteristics with chemical agents. Nerve agents inhibit the ability of choline esterase to hydrolyze acetylcholine, which in turn stimulates muscarinic and nicotenic receptors as well as the central nervous system directly. Symptoms vary depending on the exposure. The diagnosis can be made from physical signs. The treatment includes immediate intravenous administration of atropine to block the muscarininc, cholinergic receptors followed by 2-pradlidoxime administration to reactivate acetylcholine esterase (Sidell, 1998).

Blister agents are known as vesicants. They are cytotoxic alkylating compounds. These agents are particularly effective in warm climates where heat and humidity enhance contact damage to the skin. Diagnosis is straightforward once the blisters have appeared. It is initially difficult to diagnose as the inflammation of the eyes and upper respiratory tract often predominates early on and can be confused with the choking agents. Dermal damage usually occurs within minutes of contact. Immediate decontamination of the victim is of top priority. Green soap and water is

usually adequate. The eyes are flushed with water, antibiotic ointment is applied, and the eyes are patched.

Choking agents cause pronounced irritation of the upper and lower respiratory tract. They are particularly treacherous because the onset of pulmonary edema may be delayed for several hours following exposure. Phosgene, a common agent in this class, has a characteristic odor of freshly mown grass, which may aid in the diagnosis. Most choking agents cause irritant effects on the eyes and tracheobronchial tree, which in turn leads to tearing, coughing, and chest discomfort. Dyspnea and tachypnea may be the first effects noted. Patients often recover without permanent aftereffects. Treatment is supportive including flushing of the eyes and skin and nebulized breathing treatments.

Blood agents form highly stable complexes that halt aerobic cellular metabolism. Death is due to cellular hypoxia. Identifying an agent such as hydrogen cyanide is difficult without a history of exposure. Nitrates are effective antidotes as they form methemaglobin to which the cyanide preferentially binds. Commercial cyanide kits are readily available but costly to stock. Incapacitating agents are a heterogeneous group of chemical agents that cause potent central nervous system effects and impair normal functioning. However, they are usually not life threatening and seldom cause permanent damage. Treatments are compound dependant. Incapacitating

agents include cannabinols, barbiturates, and morphinelike compounds. They destroy motivation and cause sedation.

Nuclear Weapons

One of the more frightening and serious problems is the threat of nuclear terrorism. This threat is dependent not only on the amount of plutonium and enriched uranium that is available but also on the fact that security is often inadequate (Williams, 1996). Williams (1996) states that at present, the world stocks of plutonium total almost 1100 tons and are predicted to reach 1600 tons by the year 2000. The smuggling of plutonium and enriched uranium is a problem. The number of nuclear smuggling incidents has increased during the past few years. German authorities reported forty-one incidents in 1991, 158 in 1992, and 241 in 1993 and 267 in 1994 (Williams, 1996).

The relative unfamiliarity of most emergency medicine personnel with the diagnosis and treatment of injuries from nonconventional weapons combined with the high casualty generation potential of these weapons will exacerbate the challenge of response. This was well illustrated by the data from the 1995 Tokyo subway gas attack, where only twelve people were killed despite more than 5500 casualties.

The potential for extreme numbers of victims raises the need for an organized, efficient means of treating them in the correct order. The sickest should be attended to first. The North Atlantic Treaty Organization

Emergency War Surgery Handbook divides casualties into five groups. Urgent, immediate, delayed, minimal, and expectant are the group names. In the United States most non-military first responders triage with the colors red, yellow, green and black. Red stands for critical patients, yellow for those who can receive delayed care, and green for the walking wounded. Black is for the expired patients or mortally injured that are deemed unsavable. Triage is critical in war surgery and in civilian mass casualty catastrophes. It may be even more critical when dealing with the large numbers of casualties generated by nonconventional weapons systems. "Properly conducted triage allows for the optimal use of medical resources and prioritizes casualty care to achieve the best possible outcome for the greatest number of patients" (Frykberg, 1988). Optimally triage is dynamic and flexible, which makes it usable when copious resources are not readily available. Most importantly it should be based on common sense.

Medical care

The risk of terrorism has increased worldwide and the United States is not immune from these acts, which are committed by internal and external perpetrators. Most disaster plans anticipate large numbers of casualties from natural disasters such as earthquakes, floods, and tornadoes. But it is now prudent to include disaster medical care planning for blast and Nuclear, Biological, and Chemical terrorism (Cooper, 1983).

Secondary and tertiary blast injuries should not require changes in our current disaster plan other than the possibility of the sheer number of potential patients that could be encountered. The problem is that primary blast injuries are not seen frequently by health care providers in the United States outside of the military. The unique damage to air-containing organs and the risk for air embolism needs to be incorporated into our educational programs for physicians and paramedics (Slater & Trunkey, 1997).

Casualties from terrorism will challenge our disaster medical plans and health professionals to the extreme. Not only will the number of casualties be potentially overwhelming, but there is also a risk of contamination from the patient and the environment. To minimize contamination of health care providers, protective devices are available. Mission Oriented Protective Posture gear is available for military use. It is commonly referred to as "MOPP" gear. The civilian equivalent is a Level A fully encapsulating suit with self-contained breathing apparatus. This equipment is needed for protection against chemical vapors and provides protection against biological aerosols. It is only marginally effective for nuclear fallout (Buchanan, 1988). The problem in studies of simulated chemical and biological warfare environments is that between four and ten percent of participants terminated the exercise because of psychological symptoms ranging from claustrophobia and anxiety to panic (Carter, 1995). These studies were conducted in the military environment. This has profound implications for the civilian sector

where minimal training is conducted in the provision of emergency health care while wearing protective clothing (Fullerton, 1994). Inability of care providers to tolerate prolonged periods within protective clothing will result in secondary casualties among the health care workers.

The other component of terrorism that has to be incorporated into disaster medical care is detection of the various agents. Gas chromatography and other chemical detectors are sensitive for specific chemical agents. Detectors for biological agents are available and the recent development of polymerase chain reaction technology has increased sensitivity. The downside is that the process takes a long time to perform and the apparatus is large. The local responders need more practical and economical devices. Measurement of radioactivity is easy and inexpensive. Most fire departments that are capable of responding to hazardous materials incidents have hand-held Geiger counter type assessment devices.

Decontamination

Although the first priority at the disaster scene or in a triage area would be detection, the second priority is decontamination and maintaining the safety of those individuals doing the decontamination. Very few disaster plans include a comprehensive decontamination component. Decontamination requires large quantities of water, the ability to apply it to the patient, and a means to dispose of contaminated wastewater and clothing that the patient was wearing. If the health care workers doing the triage are

not wearing protective clothing, it will be unsafe for them to render lifesaving resuscitation until the patient has been decontaminated. Chemical and biological terrorism presents two potentially major complicating realities not commonly encountered in industrial and transportation hazardous materials incidents. (Miller, 1999) Miller (1999) states the first is the large number of patients who may be contaminated and the second is that some chemical agents require that respiratory support and specific antidotes be administered during and immediately following decontamination. This situation requires coordination between the hazardous materials team and emergency medical services.

The responders will need to establish a plan to accomplish mass decontamination of the effected people. This mass decontamination is intended to provide large volumes of water at low pressures. "Volumes in the range of 400 to 500 gallons per minute at 30 to 40 pounds per square inch are suitable (Moultrie, 1998, p.77). A decontamination corridor can be established by placing a hand line with a fog nozzle on each side and an elevated master stream at the end. Corridors using this configuration can be established in seven to ten minutes (Moultrie, 1998). The basic concept is that high volumes of water at low pressure in fog patterns should insure that victims passing through the corridor would be completely decontaminated. Additionally, liquid soap, sponges, and buckets can be placed in the corridor for victims to wash themselves.

After triage and decontamination have occurred, the patient will be admitted to an acute care facility and given appropriate treatment. Paramedics, nurses and physicians who have never treated such patients must have readily available reference materials to recognize signs and symptoms and also to initiate appropriate treatment.

Terrorism from firearms, blast, nuclear, biological, and chemical weapons constitute a threat to our society. Awareness of the various agents used and their antidotes becomes imperative for responders. Protective clothing, decontamination, and specific antidotes must be part of all disaster medical plans.

Federal Response Plan

The Federal Response Plan, involving twenty-eight agencies, provides a framework for response to most natural and manmade domestic emergencies. There is an annex to the Federal Response Plan that specifically deals with the response to domestic terrorism. Many of the Federal Agencies currently have some very highly trained and well equipped teams available to respond to such an event. But the response capability is limited as compared to the potential threat (Hoffman, 1998). A Presidential Decision Directive, titled U.S. Policy on Counterterrorism, was signed on June 21, 1995. Presidential Decision Directive 39 (1995) states that, "The United States shall give highest priority to developing capabilities to. . . manage the consequences of nuclear, biological, or chemical material or weapon used by

a terrorist." This reinforces the interagency process for combating terrorism, and it directs lead agency responsibility and support requirements for response to both domestic and overseas terrorist incidents. A significant new requirement identified in this Presidential Decision Directive calls for coordination between crisis and consequence management agencies in resolving a terrorist incident involving weapons of mass destruction.

The Department of State is the lead agency for both crisis and consequence management in overseas terrorism incidents. The Federal Emergency Management Agency is responsible for ensuring the Federal Response Plan is adequate for responding to the consequences of terrorism, including terrorism involving nuclear, biological and chemical materials or weapons. The Federal Bureau of Investigation is responsible for the crisis management of such an incident. The Department of Defense has significant resources that will be integrated at the onset of a domestic terrorist incident. This includes assistance to the Federal Bureau of Investigation for crisis response and to the Federal Emergency Management Agency for consequence management. Department of Defense support of a federal response to a domestic terrorism incident will be personally managed by the Secretary of Defense, with the assistance of the Chairman of the Joint Chiefs of Staff and the Secretary of the Army. The Department of Defense crisis management response will be provided through the national interagency terrorism response system. The Department of Defense response forces will

be employed either under the operational control of the Joint Special Operations Task Force or a Response Task Force assigned to the appropriate Unified Combatant Commander.

The Department of Defense has specially trained and equipped units capable of operating in a hazardous environment and tasked to respond to a terrorist crisis. Several Department of Defense elements have expertise that can be tasked. A twenty-four hour, on call emergency response capability to respond to biological or chemical incidents with the personnel trained in biological, chemical, and explosive ordnance disposal operations is available within the Department of Defense.

The United States Army Chemical and Biological Defense Command develops technological countermeasures and equipment that provide rapid warning and facilitate quick response in the event of a chemical or biological incident. Under the United States Army Chemical and Biological Defense Command, the Edgewood Research, Development, and Engineering Center also maintains a rapidly deployable mobile environmental monitoring and technical assessment system, the Mobile Analytical Response System. This system provides state of the art analytical assessment of chemical or biological hazards at an incident site.

Also under the United States Chemical and Biological Defense Command is the United States Army Technical Escort unit, which is a specialized army unit with missions of escorting the movement of chemical or

biological material, and finding and destroying chemical or biological munitions. This unit maintains a twenty-four hour, on call alert team that will be tailored specifically to a current situation for both the crisis and consequence management response.

Under the United States Army Medical Research and Material Command, the United States Army Medical Research Institute of Infectious Diseases develops strategies, information, procedures, and training for medical defense against agents of biological origin and naturally occurring infectious diseases of military importance that require special containment. A key capability of the Institute is its staff of physicians, who are experienced clinicians and also understand the unique diagnostic and therapeutic challenges posed by biological warfare agents. Inexperience in this area is a problem among most physicians in the United States.

The Naval Medical Research Institute provides basic applied research competence in infectious diseases, immunology and environmental medicine. They have developed rapid, hand held screening devices that can be deployed to assess nonclassical threats.

The Marine Corps' Chemical Biological Incident Response Force is a deployable force capable of performing chemical or biological consequence management following a terrorist attack. It is most effective when forward deployed in response to a credible threat. A panel of civilian and military experts in chemical and biological agents supports them. These experts

assist in the training and development of the response force. They are capable of decontamination, treatment, and transport of patients resulting from terrorism.

Domestic Terrorism Preparedness

The United States will do everything in its power to prevent nuclear, biological and chemical weapons from being used on its citizens. However the Unites States must be prepared to respond effectively to protect lives and property should such an attack occur. National security emergency preparedness is imperative, and it requires a comprehensive prevention and planning effort by federal, state, and local departments and agencies. (Macko, 1998)

The Defense Against Weapons of Mass Destruction Act of 1996, authored by Senators Nunn, Lugar and Domenici, calls for a program to provide federal resources, training, and technical assistance to federal, state, and local emergency management personnel who would respond to a terrorist incident. The act was passed in response to a growing concern that nuclear, biological and chemical weapons could be used in terrorist attacks. (Macko, 1998) The cornerstone of the program is the training and exercising of local first responders to enhance their response capabilities. These agencies include fire departments, police agencies and emergency medical services.

The training program includes two parallel and concurrent efforts. One is to train responders in the nation's largest 120 cities. The second program is to develop training modules and establish mechanisms to provide federal expertise to every community in the nation. The training program for the cities begins with interagency teams who meet with city emergency management personnel and responders. The city defines the scope and requirements of its training program. The training that follows will come from those federal agencies with the required expertise. The training program is based upon a train the trainer concept, where a small number of federally trained local responders become the trainers for the remainder of the city's responders. These groups are known as Metropolitan Medical Strike Teams.

The Metropolitan Medical Strike Team is a highly trained, readily deployable, and fully equipped local response team organized and equipped to address the human health problems associated with terrorism. They have specialized skills, pharmaceuticals, and equipment that would enable it to assist in identifying a weapon of mass destruction agent and initiating victim decontamination, conduct medical triage, and initiate appropriate therapy prior to transportation to emergency and definitive medical care facilities.

The second thrust of the Domestic Preparedness Program includes the development of training modules available through mass media technology, making federal expertise available to every community in the country to assist in improving their response capability against a terrorist event. The

Department of Defense is designing low-cost training packages for wide dissemination. This includes formats such as CD-ROM, video, Internet, and distance learning. The National Fire Academy is advocating awareness training for all of the fire service and making the training free of charge. The Department of Defense is also developing a help-line and a hot-line to give local responders immediate access to federal experts in terrorism. On September 23 1996, Congress passed Public Law 104-201, The Defense Against Weapons of Mass Destruction Act. With uncharacteristically blunt language, the law described the nation's ability to conduct consequence management:

> ". . . US lacks adequate planning and countermeasures to address the threat of nuclear, radiological, biological, and chemical terrorism . . . State and local emergency response personnel are not adequately prepared or trained for incidents involving nuclear, radiological, biological, and chemical materials...Exercises of the Federal, State, and local response to nuclear, radiological, biological, and chemical terrorism have revealed serious deficiencies in preparedness and severe problems of coordination." (Public Law 104-201, 1996).

Summary

The proliferation of nuclear, biological, or chemical weapons and their delivery means is not a hypothetical threat. (Staten, 1997) More than 25 countries have or are developing nuclear, biological, or chemical weapons and the means to deliver them. (Staten, 1997) This presents a daunting challenge. The United States will need innovative ways to combat terrorism.

There has been a dramatic reduction in the threat of these weapons from legitimate countries. But the real threat is the rouge terrorist organization.

Chapter 2 describes in detail the weapons of choice, medical care of casualties, the Federal Response Plan, and local preparedness. A thorough thematic literature review reveals that the local preparedness is the weakest link in the response chain. This project will provide a plan of education that increases the local capabilities to deal with acts of domestic terrorism.

CHAPTER 3

DESIGN AND PROCEDURES

Preface

The intent of this project is to present a self-study module for Johnson County Medical Action Emergency Services to utilize in addressing the emerging threat of terrorism. American military forces have been struggling with the medical response to chemical and biological warfare for decades. There has been a recent concern for civilian safety during chemical and biological attacks. Emergency Medical Services have an admirable record of helping the public cope with floods, storms, traumatic injuries, and acute illness. But, fortunately, Emergency Medical Services has very little experience with the consequences of chemical and biological terrorism. This project will provide an overview of safety, fundamental concepts, departmental policies, a flow chart for first responders, mass decontamination procedures, and a drug formulary for chemical and biological exposures. This will address the needs that Johnson County Medical Action has in preparation for chemical and biological incidents. It is important to understand the point of view of the project before implementing this self-study module. This project is designed to meet the specific needs Johnson County Medical Action. Other emergency medical services may need different education.

First, there is no way to prepare in an optimal fashion for a terrorist incident. There is too low an incidence to justify the enormous financial outlay it would take to optimally prepare every community for every possible incident. Furthermore, there are not enough incidents for any community to acquire enough experience to make a significant impact on response to the next episode.

Second, there is no guarantee that the terrorist will announce the attack. Without such an announcement, there will be no recognition that a biological attack is occurring until enough cases, including a number of fatalities, are observed and reported to allow recognition of an epidemic of an unusual disease.

Third, virtually all of the weaponized biologic agents present with early clinical symptoms that resemble a viral flu. The viral flu syndromes are usually non-serious prompting unrecognized exposures. It needs to be acknowledged that it is impossible to prevent all mortality no matter how well prepared a community is.

Fourth, the approach that the project took to attack this problem is an enhancement to pre-existing plans. Johnson County Medical Action is nationally recognized as a superior emergency medical services provider. Other agencies implementing a similar plan may need to have a different approach.

Fifth, Johnson County Medical Action is a partner in the Kansas City Metropolitan Medical Strike Team. Numerous supplies, trained responders and command staff are located throughout the greater Kansas City area that supplements the local response. This eliminates the burden of costly procurement of equipment specially designed for terrorism response.

Even though the task of being prepared and responding adequately appear to be immense, this project believes that by utilizing the current resources, along with improvements in education, communication, and operations, it will be possible to minimize the damage that a terrorist attack would cause. The goal, as always in medicine, is to reduce morbidity and mortality and minimize suffering.

Design

This project will suggest a specific program of didactic education that all field paramedics of Johnson County Medical Action will complete. Field paramedics will complete this self-study module while they are on-duty. It begins with an overview of safety and a review of fundamental concepts. It displays departmental policies. It introduces a flow chart for the first arriving responders. It describes mass decontamination. It provides a drug formulary. It concludes with an assessment tool.

Procedures

The process of implementing this project involved gaining support from the management of Johnson County Medical Action. The overview was

written from information gathered in the literature review. The departmental policies were authored. The drug formulary was compiled from various information sources. The self-study module will be presented to the field as part of the ongoing Special Operations Training for Johnson County Medical Action.

Materials

This project requires numerous additions to the Policy and Procedure Manual of Johnson County Medical Action. Johnson County Medical Action Policy and Procedure number 102, the Master Policy, was utilized to create all new policies. The most important project materials are the actual paramedics that would respond if a terrorist attack should occur in Johnson County. Their dedication to protect the community from disaster is admirable.

CHAPTER 4

Introduction

Terrorists have the ability to strike anywhere in the world. In recent years the United States has experienced the chaos that a terrorist incident can cause. All communities contain vulnerable targets. It will be the local fire and emergency medical service organizations that will initially respond to terrorist incidents. This self-study module will enhance previous learning for Johnson County Medical Action concerning the response to chemical and biological terrorism. It includes an overview of safety, fundamental concepts, departmental policies, a flow chart for first response, mass decontamination procedures, and a drug formulary for chemical and biological exposures. It concludes with an assessment tool.

Safety

When dealing with any potential terrorist attack, past experience has taught responders that the first necessary task is to secure the area and ascertain the nature and severity of the threat. In the past few years, several instances have been reported where a secondary explosive device has been targeted at emergency responders. This is a direct attempt to harm or kill rescuers and disrupt emergency operations. The ambulance may be the first responder on the scene of a terrorist related incident. Safety is a crucial element of scene management. Several considerations should be made.

Do not endanger yourself. Stay out of the area of an incident and do not attempt to affect a rescue. Responders should stage uphill and upwind from incidents to reduce the risk of contamination and exposure. Responders should secure an initial area of at least one hundred fifty feet around the incident. All civilian personnel not suspected to be contaminated need to be moved away from the epicenter of the incident. Civilian personnel who are contaminated need to be moved to the perimeter of the incident. This follows the concept of TIME, DISTANCE and SHIELDING. Another act of safety is to ensure that the response is adequate for the incident. The lack of sufficient resources is dangerous. Responders will follow the Incident Management System as the command structure of such an incident.

Fundamental Concepts

There are five categories of terrorist incidents. They include biological, nuclear, incendiary, chemical, and explosive. There are four routes of entry including inhalation, absorption, ingestion, and injection. Responders should use good judgment in using personal protective equipment. The use of protective clothing, including positive-pressure, self-contained breathing apparatus, will enhance the responder's chances of a safe and successful response.

Biological

Several biological agents can be adapted and used as terrorist weapons. These include anthrax, tularemia, cholera, encephalitis, the

plague, and botulism. Biological agents are fairly accessible to terrorists. These agents are commonly disseminated by the use of aerosols, contaminating foods or water supplies, direct exposure or injection. There are four common types of biological agents. They include bacterial, viruses, rickettsia, and toxins.

Nuclear

It is unlikely that any terrorist organization could acquire or build a nuclear device, or acquire and use a fully functional nuclear weapon. The greatest potential terrorist use of nuclear materials would be with a conventional explosive. Combining nuclear waste or radioactive material with conventional explosives is called a radiological dispersal device. There are three main types of nuclear radiation emitted from radioactive materials. They are alpha, beta, and gamma radiation. Response to a radiological terrorist event is similar to a traditional response to radiological emergencies.

Incendiary

An incendiary device is any mechanical, electrical, or chemical device used intentionally to initiate combustion and start a fire. Only specially trained personnel should handle incendiary devices discovered prior to ignition. The response to an ignited device is similar to a traditional fire response.

Chemical

The chemical category includes five different classes: Nerve, Blister, Blood, Choking and Irritating.

Nerve

Nerve agents are similar in nature to organophosphate pesticides. They often have a higher degree of toxicity. The agents include sarin, soman, tabun, and VX. These materials are liquids that typically are sprayed as an aerosol for dissemination. The clinical presentation is similar to organophosphate poisoning. The victim will salivate, lacrimate, urinate, and deficate without control.

Blister

Blister agents are also referred to as mustard agents due to their characteristic smell. They are similar in nature to other corrosive materials that responders encounter. They readily penetrate layers of clothing and are quickly absorbed into the skin. Mustard and lewisite are common blister agents. All are very toxic. Blister agents are heavy, oily liquids, dispersed by aerosol or vaporization. Outward signs of blister agents include complaints of eye and respiratory irritation along with reports of a garlic-like odor.

Blood

Blood agents interfere with the ability of the blood to transport oxygen, and result in asphyxiation. Common blood agents include hydrogen cyanide, and cyanide chlorine. Clinical symptoms of blood agents include respiratory distress, vomiting, diarrhea and headaches.

Choking

Choking agents stress the respiratory tract. Chlorine and phosgene are the common chemicals used as weapons. Clinical symptoms include severe eye irritation and respiratory distress. Most people recognize the odor of chlorine. Phosgene has the odor of newly cut hay. Both are gasses and must be stored and transported in bottles or cylinders as a compressed gas.

Irritating

Irritating agents are also known as riot control agents. They include tear gas and are designed to incapacitate. Common irritating agents include chloropicin, MACE, tear gas, capsicum spray and dibenzoxazepine. Clinical symptoms include burning eyes, difficulty breathing and nausea.

Explosive

It is estimated that seventy percent of all terrorist attacks worldwide involve explosives. It is the weapon of choice for terrorists. Many different types of explosive devices are utilized by terrorists. The first responders should evaluate the scene and always expect that there is a secondary device.

Summary

It is critical that emergency responders understand the implications of these modern threats and know proper response procedures and the limits of safe and prudent response. This knowledge will prevent further fatalities. Injured or incapacitated responders are no help to anyone.

Policies

With the emergence of terrorism from chemical and biological weapons there is a need for a standard approach to response. The following pages describe the responsibilities and procedures for the first unit arriving to a hazardous materials incident. They also address the emergency medical services response to bomb related incidents. These policies are a departure from the way emergency medical services usually treat incidents. It requires strict adherence to give maximal safety and effectiveness.

FIRST UNIT TO A HAZARDOUS MATERIALS INCIDENT

DESCRIPTION:

The Med-Act ambulance will usually arrive at a hazardous material incident before the Hazardous Materials Medical Support Team (HMMST). The following steps are provided as a guideline for those circumstances that can be crucial to the management of contaminated patients.

RESPONSIBILITIES:

All Personnel: Each individual will be responsible for identifying any hazards posed by a hazardous material. By completing a risk analysis of a chemical (*MAF915A),* the crew will be able to decide what type of patient contact will be the lowest risk to the crew.

Team Leader/Supervisor: When additional information or consultation is required, the Team Leader or Supervisor may consider the following resources:

- Contact either St. Joseph's Health Center or KUMC for risk analysis information.
- Contact an on duty HMMST member through dispatch (this action may require sending the HMMST member to station 6 to access reference materials).
- Contact the HMMST Coordinator through dispatch for risk analysis information (this action may require sending the HMMST member to station 6 to access reference materials).

Jurisdictional Fire Department: Provide contamination reduction, when risk analysis indicates, any symptomatic patients, and provide containment of water run off as needed.

PROCEDURE:

Step 1: Scene safety and security

- ***DO NOT*** endanger yourself. Stay out of the area of an incident and do not attempt to affect a rescue.
- Stage uphill and upwind from incident.
- Secure an initial area of at least 150 feet around the incident.
- Order all civilian personnel who are ***not*** suspected to be contaminated away from the area.
- Order all civilian personnel who are suspected to be contaminated to the edge of the "hot zone" perimeter as long as that area is deemed safe.
- Ensure that the response is adequate to the incident, and implement Med-Act ICS procedures as indicated.

Step 2: Product identification

- Attempt product identification. If at a facility, contact facility personnel for ID assistance (ask for Material Safety Data Sheet "MSDS"). Utilize placards and unit resources as needed for identification process. Information to be obtained if possible:
  1. Product name?
  2. Form of product? (Liquid, gas, solid)
  3. Hazards?
  4. Is respiratory protection needed?
  5. Is the product water reactive?
     (If so, do not perform water irrigation)

Step 3: Initial contamination reduction

- When risk analysis indicates and you can proceed safely, have contaminated patients remove all clothing.
- Ensure shelter and patient warmth is available.
- If available and not contraindicated, initiate dry decon (brush off excessive powder) and/or water lavage (fire department booster line) as indicated. Use splash protection for person(s) performing wet or dry contamination reduction procedures.
- Ensure, when possible, to limit and contain water runoff.
- Contact KUMC-ED or St. Joseph's Health Center ED to confirm proper treatment of patients. Patients who are or have been contaminated are to be transported to these hospitals only.

PROTECTIVE CLOTHING:

Splash protection is provided via body fluid isolation gowns, blue nitrile gloves, and face shields. After completing the risk analysis, the reference book should indicate the level of protection needed for adequate protection.

Related Policies:

MAF915A - Hazardous Materials Risk Analysis Form
SUP915A - Glossary

EMS RESPONSE TO BOMB INCIDENTS

DESCRIPTION:

This policy describes the EMS response procedures to events where suspected or confirmed detonation of explosive devices has occurred. Events in which an explosive ordinance has detonated are unique and pose many dangers to responders. This policy is a departure from the way EMS usually treats incidents and requires strict adherence for maximal safety and effectiveness.

RESPONSIBILITIES:

All personnel: will adhere to the procedures outlined below when managing the many aspects of a bomb incident.

Supervisors: will strictly adhere to the IMS concept of Unified Command and oversee EMS crews in applying this policy.

CONCEPT OF RESPONSE:

- ***Anticipate the secondary device***

It is a very real probability that there will be a secondary explosive device, perhaps even greater than the first explosion. Think before rushing in. It is important to not become complacent. Keep radio traffic and cell phone use to a minimum. Radio frequency energy can cause the detonation of a secondary device. This includes the broadcast equipment of all two-way radio and wireless communication devices used by EMS, fire, police, the media, and AVL equipped vehicles. Any type of communications within a 300 foot perimeter of the suspected blast site should be limited to emergency traffic only.

- ***Manage the scene with an "Exclusion Zone" of 1000 feet.***

Rapid establishment of an exclusion zone or perimeter to 1000 feet will reduce the potential for injuries to responders, the public and patients. Unified command post should be located upwind, uphill and between 2000 and 4000 feet from the incident.

- ***Rapid Evacuation***

Treat the bomb scene as you would a car engulfed in flames. The potential for further damage and harm is very real. Rapidly remove victims from the scene to a safe treatment area at least 1000 feet from the incident before any treatment is initiated.

PROCEDURE:

Responding to the scene: Med-Act's role may be to assist with the rapid evacuation of the non-injured and injured depending on the circumstances of the event. Therefore all Med-Act units will respond code 1 to a Bomb incident regardless of reported injuries because ***Rapid development of a 1000 foot "Exclusion Zone"*** horizontally and vertically will reduce the potential of injury for patients, the public and responders.

Duties of First arriving Med-Act Unit:

1. Comply with the procedures for staging and unit placement, *P&P 904 Incident Management Practices.*
2. Report to the Incident Commander (IC), face to face when possible, give the IC your company passport, and assume the duties of the Medical Sector Officer (MEDICAL)
3. Ask command the following questions:

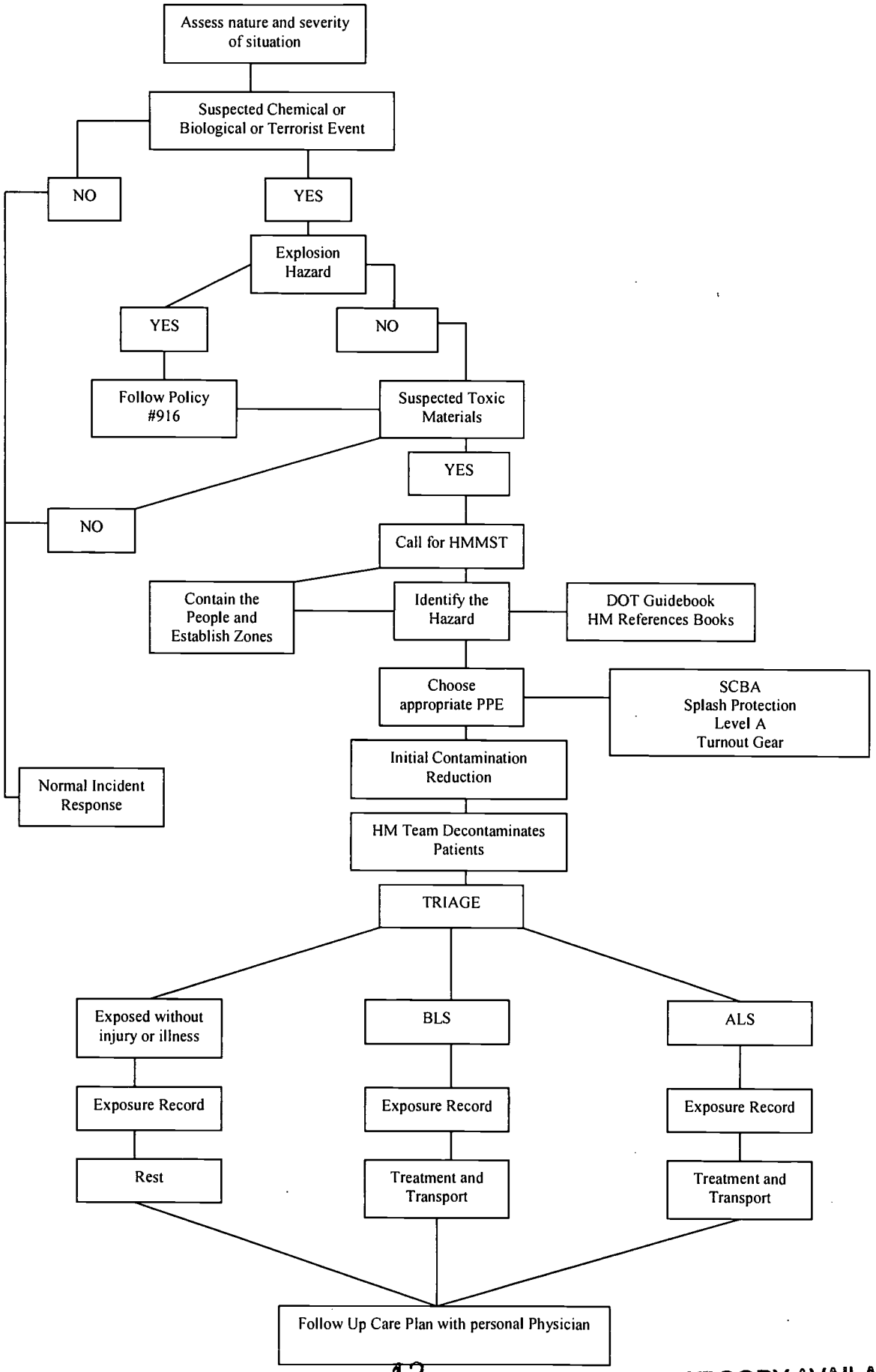
- "Where is the 1000 foot perimeter?"
- "Where should treatment be located?"
- "Will the fire service assist in rapid evacuation of victims to TREATMENT?"

4. Establish sectors as needed.
5. Continue with MEDICAL procedures.
6. Consider becoming MEDICAL OPERATIONS when a manager can assume MEDICAL at the Unified Command Post.

Other responding Med-Act units should strictly adhere to *P&P 904 Incident Management Practices and P&P 906 Personnel Accountability System.*

Related Policies:

904-Incident Management Practices
905-Medical Branch Operations
906- Personnel Accountability System



Mass Casualty Decontamination

Introduction

After responders have recognized the signs and symptoms of a chemical or biological attack they should don personal protective equipment and self-contained breathing apparatus. Next they should seal off the area and not allow any potentially contaminated victims to leave the area. They should also deny entry to the scene to any unaffected persons. The next step is to initiate a command structure. Finally, the responders should establish a Mass Casualty Decontamination corridor.

Description

In these events, first arriving units likely will be overwhelmed by the event and implementation of the previously mentioned actions. The next step is for two or three responders to deploy a preconnected handline, charge the pump and line, and begin directing victims through a makeshift corridor until additional units arrive.

Mass Casualty Decontamination is intended to provide large volumes of water at low pressures. An ideal range is from four hundred to five hundred gallons per minute at thirty to forty pounds per square inch. Too much pressure can be detrimental to victims who have been seriously affected. Too little pressure will provide ineffective fog patterns.

An effective decontamination corridor can be established by placing pumpers approximately twenty to twenty-five feet apart and incorporating a

master stream at the end of the end of the corridor. Between three hundred and five hundred persons can be decontaminated in as little as an hour. Corridors using this configuration can be established in ten minutes. The basic concept is high volumes of water at low pressures forming a fog pattern that ensures victims passing through the corridor will be completely decontaminated. Additionally, liquid soap, sponges, and buckets can be placed in the corridor for victims to wash themselves. A diluted bleach solution of 0.5 percent has been suggested as the decontamination solution of choice.

Victims need to be advised of what is expected of them in a terrorism incident. Prewritten signs, public address systems or bullhorns can be used to direct victims to the corridor and impart instructions to them.

The decontamination corridor should be uphill and upwind from the site of the release. The victims should travel against the wind and away from any runoff. When it is impossible to adhere to all of these guides, use the wind direction as the prevailing idea. The volume of water running in the decontamination corridor will quickly disperse any agent that is washed from the patients.

Seasonal and weather conditions are other important considerations. In cold climates, hypothermia can be a very real problem. It would be appropriate to have a heated quanza hut style inflatable tent to direct the patients into after they have been through the contamination reduction

process to prepare for transport. If a tent is unavailable, try to commandeer a building to securely shelter the patients that have been decontaminated. Commuter busses, school busses or other mass transit vehicles can be used to move patients to hospitals. It is important to have an emergency medical provider with each transport vehicle to assist with care during transport.

Summary

Decontamination of a large number of people will be a daunting task no matter how prepared a department is. The main goal is for a speedy cleansing of a large number of people. The methods described in this section will provide a cost efficient and effective way to provide mass decontamination.

Drug Formulary

Treating victims suffering from exposure to weapons of mass destruction requires medications that are not normally needed on a traditional ambulance. The following pages contain the formulary of medications for treating chemical and biological injuries. The categories of information include the drug class, its actions, indications for usage, dosage, contraindications, how it is supplied and drug interactions.

HMMST Formulary

Medication:	Dosage	Route/Rate/Repeat	Indication
Atropine	2mg .05mg/kg	IV push q 3-5 min IV push q 3-5 min	OPs / Carbs peds dosing
Calcium Gluconate	1gm .5gm ad lib	Slow IV over 5 min Slow IV over 5 min topically	HF Exposure peds dosing gel form
Methylene Blue	1-2mg/kg peds dosing is the same	Slow IV over 5-10 min	Methemoglobins
Pontocaine	1-2gtt/eye peds dosing is the same	topically	Burns to eyes
Pralidoxime HCl	1gm 20-40mg/kg, 1gm max	Slow IV over 5-10 min SAA	OPs peds dosing
Na Bicarb	3mEq/2cc NS Aerosol @ 6 l/min peds dosing is the same		Cl Inhalation
Na Nitrate	300mg .2cc/kg	Slow IV over 2.5-5 min Slow IV over 2.5-5 min repeat ½ dose in 20 min	CNs / HS peds dosing
Na Thiosulfate	12.5gm 1.65cc/kg	Slow IV over 2.5-5 min Slow IV over 2.5-5 min repeat ½ dose in 20 min	CNs peds dosing
Solu-Cortef	.1-.5gm MD ordered dose	IV over 30 sec	Asthma peds dosing
Polyethelene Glycol	ad lib peds dosing is the same	topically	Phenols
Mineral Oil	ad lib peds dosing is the same	topically	HCs /Metals

TREATMENT PROTOCOLS

DESCRIPTION:

Proper care of chemically exposed patients by the HMMST require treatment modalities above and beyond those found in the general treatment protocols of the organization. The following treatment modalities have been approved by the Medical Director, reviewed by staff at the Poison Control Center, and will be used by the HMMST with approval of Medical Control at a pre-planned HM receiving hospital.

RESPONSIBILITIES:

HMMST MEMBERS: shall demonstrate full competency in this protocol and the pharmacology of the agents listed herein.

MEDICAL DIRECTOR: Will evaluate any changes in HMMST treatment modalities and approve or disapprove their implementation.

1. Consider Sodium Bicarbonate aerosol breathing treatment, 3mEq 8.4%/2cc of NS, nebulized at 6 LPM for dyspnea and respiratory irritation associated with Chlorine Gas inhalation.

2. Consider Sodium Nitrite 3% solution,300mg, given over 2.5 - 5 minutes, followed by Sodium Thiosulfate 25% solution, 12.5gm, given over 2.5-5 minutes, for symptomatic cyanide poisoning.
   Repeat at ½dose in 20 minutes.

3. Consider Sodium Nitrite 3% solution, 300mg, given over 2.5-5 minutes, for symptomatic hydrogen sulfide poisoning.

4. Consider Methylene Blue 1% solution (10mg/cc), 1-2mg/kg, over 10 minutes for symptomatic methemoglobinemia.

5. Consider Atropine Sulfate,2mg, for S/S of organophosphate or carbamate poisoning. Repeat doses every 3-5 minutes. Consider Pralidoxime Chloride (2-PAM), 1gm, over 5-10 minutes for S/S of organophosphate poisoning. Repeat dose after 1hr. if needed.

6. Consider Calcium Gluconate 10% gel, mixed 1gm Calcium Gluconate with 5oz.ter soluble lubricant, applied topically over Hydrofluoric Acid burns. Consider Calcium Gluconate 10% sol'n,1 gm IV, for muscle tetany, QT prolongation, or cardiac arrest secondary to hydrofluoric acid exposure.

7. Consider Ponticaine eye drops, 1-2gtts/eye, for chemical exposure to the eyes which require irrigation.

8. Consider Ventolin 2.5mg/3cc aerosol for treatment of chemically induced asthma.

9. Consider Solu-Cortef,100 - 500mg,IV over 30 seconds, for chemically induced asthma.

10. Consider Polyethylene Glycol (GUNK) topically for phenol exposure.

11. Consider Mineral oil topically for hydrocarbon and active metal exposure.

RELATED POLICIES:

HMMST P+P 400
POLICIES 700 - 722

ATROPINE SULFATE

I. **CLASS**:
ANS- Anti-Cholinergic, Parasympatholytic

II. **ACTION**:
Competitive antagonist for muscarinic ACH at post-synaptic receptor sites and in the CNS.

- HEART:
  1. positive chronotrope- particularly SA node, atrial and junctional tissue. Cardiac output increases due to increased heart rate. Increases MVO2.
  2. positive dromotrope-through entire conduction system except purkinje system
  3. ventricular dysrhythmias may be stabilized as a result of increased supraventricular pacing.
- SYSTEMIC:
  1. CNS- stimulation particularly with toxic doses may proceed to toxic psychosis (restlessness, excitation, confusion, hallucinations, and delirium).
  2. mydriasis- paralysis of the ciliary muscle with resultant photophobia
  3. dries mucous membranes of respiratory system and relaxes smooth muscles of the airways.
  4. decreased smooth muscle tone and decreased sphincter tone.
  5. decreased pancreatic enzyme secretion (insulin, glucagon).

III. **INDICATIONS**:

- Cholinergic crisis due to organophosphate or carbamate poisonings.
- Asystole or bradycardic PEA.
- Symptomatic bradycardia.

IV. **DOSAGE**:
Cholinergic crisis:

- Adult- consider 2mg increments IV push repeated every 3-5 minutes until muscarinic toxicity is controlled (mouth is dry, airway is clear, pupils dilate)
- Pediatric- consider 0.05mg/kg every 3-5 minutes

* See dysrhythmia and cardiac arrest protocol for other dosing procedures

V. **CONTRAINDICATIONS**:

- Glaucoma-(relative)- due to increased intraoccular pressure. The iris is crowded against the back of the anterior chamber and drainage of aqueous humor is inhibited.
- Absence of cholinergic effects, especially bronchorrhea.

VI. **HOW SUPPLIED**:

- 8mg/20cc vials (0.4mg/cc).

VII.**DRUG INTERACTIONS**:

- Increased effect of other anticholinergic (antimuscarinic) agents.
- Increased effect of sympathomimetic agents.
- Concomitant use of Pralidoxime may potentiate antimuscarinic toxic effects.

VIII. **ROUTES OF ADMINISTRATION**:

- IV
- ET
- IO

Pralidoxime Chloride
(Protopam Chloride, 2-Pam)

I. **CLASS**:
Cholinesterase reactivator

II. **ACTIONS**:
Pralidoxime reactivates cholinesterase (mainly outside the CNS) inactivated by phosphorylation due to an organophosphate or related compound. Destruction of accumulated acetylcholine can then proceed, allowing neuromuscular junctions to function normally. It also slows the " aging " of phosphorylated cholinesterase to a non-reactive form, and detoxifies certain organophosphates by direct chemical reaction. The drugs most critical effect is relieving respiratory muscle paralysis.

III. **INDICATIONS**:
Antidote in poisoning due to organophosphate pesticides and chemicals with anticholinesterase activity.

IV. **DOSAGE**:
- Adults: 1 gram IV, given over 5-10 minutes. Repeat dose after 1 hour if muscle weakness is not relieved.
- Pediatrics: 20-40 mg/kg to a max. dose of 1 gram.

V. **CONTRAINDICATIONS**:
- Hypersensitivity

VI. **HOW SUPPLIED**:
- 20 mg vial containing 1 gram of pralidoxime (powder) to be mixed with a 20cc vial of sterile water. We will carry 2 of each.

VII. **DRUG INTERACTIONS**:
- When Atropine and Pralidoxime are used together, the signs of atropinization may occur earlier than expected.
- Barbiturates are potentiated.
- Is not recommended to treat carbamate poisonings.

VIII. **ROUTES OF ADMINISTRATION**:
- IV
- IO

Methylene Blue

I. **CLASS**:
Antidote

II. **ACTIONS**:
This compound has an oxidation/reduction action and a tissue staining property. It has two opposite actions on hemoglobin:

- Low concentrations will reduce methemoglobin to hemoglobin.
- High concentrations oxidize iron in the ferrous state (Fe2+) to ferric iron (Fe3+) that results in the formation of methemoglobin. Only iron in the ferrous state can bind with oxygen.

**** We will be using the low concentration***.

III. **INDICATIONS**:

- Chemically induced methemoglobinemia

IV. **DOSAGE**:

- Adult: 1-2mg/kg over 5-10 minutes. Repeat hourly PRN at same dosage.
- Pediatric: Same as adults.

V. **CONTRAINDICATIONS**:

- History of glucose-6-phosphate dehydrogenase (G6PD) deficiency.

VI. **HOW SUPPLIED**:

- 100mg in 10cc ampules (10mg/cc)

VII. **DRUG INTERACTIONS**:

- Be cautious when using in the treatment of antidote induced methemoglobinemia in cyanide poisoning. Too much methylene blue may cause cyanide to be re-released into the system.
- Rapid administration may produce increased methemoglobinemia.
- Observe for elevated B/P, nausea, and disorientation.

VIII. **ROUTES OF ADMINISTRATION**:

- IV only

Sodium Nitrite

I. **CLASS**:
Antidote

II. **ACTIONS**:
Reacts with hemoglobin to form methemoglobin (oxidizes ferrous [Fe ++] iron in normal hemoglobin to ferric [FE +++] iron, or methemoglobin). The latter removes cyanide ions from various tissues and couples with them to become cyanmethemoglobin, which has relatively low toxicity.
Chemical Reaction: NaNo2 + Hemoglobin = Methemoglobin
CN + Methemoglobin = Cyanmethemoglobin

* Sodium Nitrite may induce a dangerous methemoglobin, may also cause hypotension.

III. **INDICATIONS**:
- Cyanide Poisoning
- Hydrogen Sulfide Poisoning

IV. **DOSAGE**:
- Adult: 300mg over 2.5-5 min., repeat at 1/2 of initial dose at 20 minutes if symptoms persist.
- Pediatric: 0.2cc/kg , not to exceed 10cc's, repeat at 1/2 of initial dose at 20 min. if symptoms
persist.

V. **CONSTRAINDICATIONS**:
- Absence of indications
- History of glucose-6-phosphodehydrogenase (G6PD) deficiency.

VI. **HOW SUPPLIED**:
- 300mg in 10cc ampule.

VII. **DRUG INTERACTION**:
- Must be followed by Sodium Thiosulfate in cyanide poisoning to get its maximal effect.
- Methylene Blue may reverse excessive methemoglobinemia, but should be used cautiously as
it may release CN back into the system.

VIII. **ROUTES OF ADMINISTRATION**:
- IV
- IO

Sodium Thiosulfate

I. **CLASS**:
Antidote

II. **ACTIONS**:
The function of Sodium Thiosulfate is to convert cyanmethemoglobin to thiocyanate, probably by an enzyme known as rhodanese. The thiocyanate is excreted by the kidneys.
Chemical reaction: Na2S2O3 + cyanmethemoglobin + O2 = HSCN

III. **INDICATIONS**:
- Cyanide poisoning

IV. **DOSAGE**:
- Adult: 12.5gm over 2.5-5 min., repeat at 1/2 initial dose at 20 minutes if symptoms persist.
- Pediatric: 1.65cc/kg, not to exceed 12.5gm, repeat at 1/2 initial dose at 20 min. if symptoms persist.

V. **CONTRAINDICATIONS**:
- Absence of indications
- History of glucose-6-phosphodehydrogenase (G6PD) deficiency.

VI. **HOW SUPPLIED**:
- 12.5gm in 50cc ampule

VII. **DRUG INTERACTIONS**:
- Is to be given immediately after Sodium Nitrite in CN poisoning.
- Is not used in Hydrogen Sulfide poisoning.
- Methylene Blue may reverse excessive methemoglobinemia, but should be used cautiously as it may release CN back into the system.

VIII. **ROUTES OF ADMINISTRATION**:
- IV
- IO

Calcium Gluconate

I. **CLASS**:
Cation

II. **ACTIONS**:
Supplies calcium to tissues. The calcium binds with fluoride to make calcium fluoride.

III. **INDICATIONS**:
- Mild to moderate skin burns resulting from exposure to hydrofluoric acid.
- QT prolongation, tetany, or cardiac arrest secondary to hydrofluoric acid exposure.

IV. **DOSAGE**:
Topical:
- Mix 1 gram 10% calcium gluconate with 5oz. water soluble lubricant (KY or Surgilube) and apply over painful areas. Cover with sterile dressings.

Intravenous:
- Adult:1 gram over 5 minutes (10% solution).
- Pediatric: 0.5 gram over 5 minutes (10% solution).

V. **CONTRAINDICATIONS**:
- Hypercalcemia
- V-fib
- digitalized patients

VI. **PRECATIONS**:
- Mild necrosis and abscess formation may occur with topical administration.
- Rapid IV administration may cause vasodilatation, decreased B/P, cardiac arrhythmia's, syncope, and cardiac arrest.
- Use caution when administering to a pregnant woman.

VII. **HOW SUPPLIED**:
- 1 gram in 10cc's. Each gram includes 93mg (4.65mEq) calcium.

VIII. **DRUG INTERACTIONS**:
- Do not administer to digitalized patients.

IX. **ROUTES OF ADMINISTRATION**:
- Topically
- IV

Sodium Bicarbonate Breathing Treatment

I. **CLASS**:
Base electrolyte

II. **ACTIONS**:
Relieves symptoms of chest burning, throat irritation, and dyspnea due to chlorine gas inhalation.

III. **INDICATIONS**:
- Symptomatic chlorine gas inhalation exposure

IV. **DOSAGE**:
- Mix 3cc's of 8.4% Sodium Bicarbonate with 2cc's NS. To be given by nebulizer at 6lpm.

V. CONTRAINDICATIONS:
- none

VI. **HOW SUPPLIED**:
- 50mEq in 50cc preload

VII. **DRUG INTERACTIONS**:
- Do not mix with other drugs as it inactivates catecholimines.

VIII. **ROUTES OF ADMINISTRATION**:
- Inhalation

Solu-Cortef
(hydrocortisone sodium succinate)

I. **CLASS**:
Steroidal anti-inflammatory

II. **ACTIONS**:
This medicine is an anti-inflammatory adrenocortical steroid. It is a highly water-soluble sodium succinate ester of hydrocortisone permitting IV administration , particularly useful where high blood levels are required rapidly.

III. **INDICATIONS**:
- Chemically induced asthma

IV. **DOSAGE**:
- Adult- 100-500mg. over 30 seconds, dose depending on severity.
- Pediatric- dose is not based on the normal mg/kg basis, but based on severity.

V. **CONTRAINDICATIONS**:
- Hypersensitivity
- Not to be administered to premature because the benzyl alcohol contained in the solution may be associated with fatal " gasping syndrome ".
- Systemic fungal infections.

VI. **HOW SUPPLIED**:
- 250mg. two compartment single dose vial. The vial contains a compartment that contains powder and one with 2cc's bacteriostatic water. Directions on mixing the product found with vial.

VII. **PRECATIONS**:
- Average and large doses may cause elevation of B/P, sodium and water retention, and increased excretion of potassium.

VIII. **ROUTES OF ADMINISTRATION**:
- IV
- IM

KNOWLEDGE ASSESSMENT

In your own words, describe the actions you would take as the first arriving ambulance at the scene of a bombing.

In your own words, describe the actions you would take as the first arriving ambulance at the scene of a hazardous materials incident.

In your own words, describe your plan for mass decontamination of victims of a terrorist incident.

CHAPTER 5

EXPECTED OUTCOMES AND RECOMMENDATIONS

Anticipated Outcomes

There is no single defense against the threat of terrorists using weapons of mass destruction. Instead, it must be treated like a chronic disease. Responders must constantly be alert to the first signs and symptoms, and be ready and capable of employing a myriad of treatments. This project provides a systematic approach for Johnson County Medical Action to take in response to the growing threat from terrorism. Implementation of this project will give the first responders the knowledge to make wise decisions in the first minutes of a weapons of mass destruction incident. It is the emergency workers at ground zero who will most likely have the greatest effect on reducing morbidity and mortality. This project is cutting edge in the fact that it brings knowledge typically kept in the military to the front line civilian responder. It also utilizes medications and treatment modalities typically left for the hospital setting. If adapted appropriately, this project could serve as a model for other services similar to Johnson County Medical Action in preparation for terrorism in the local community.

Recommendations

The author recognizes that the problem of weapons of mass destruction is a national problem. The scope of the project was narrow focusing only on one specific public safety service. Future projects with a broader view would increasingly benefit the public safety community. It is

expected that this will be an ever-growing field of study, as the threat of terrorism becomes increasingly real. The author considers it to be exceedingly important that readers of this project actively seek to implement the concepts in this project as part of their own local domestic preparedness. Without competent first responders, citizens should not expect a good outcome in terrorist incidents. Federal resources alone cannot provide the level of response that our communities are counting on.

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Signature:	Printed Name/Position/Title:	
Jeff G. DeGraffenreid	Jeff G. DeGraffenreid Team Leader	
Organization/Address: 15503 S. Lindenwood Olathe Kansas 66062	Telephone: 913-764-7727	Fax: 913-764-7727
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