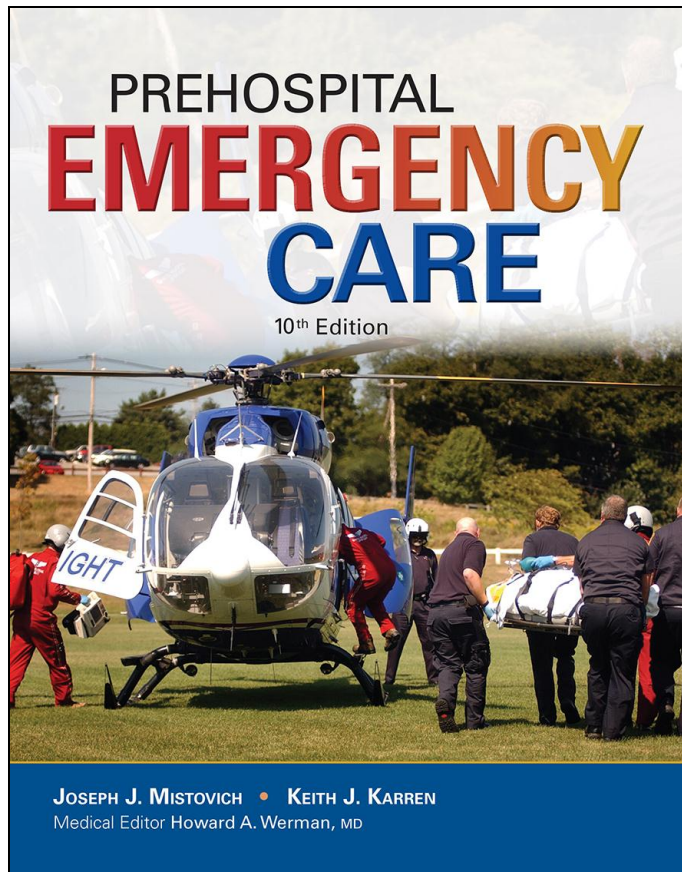


PREHOSPITAL EMERGENCY CARE

TENTH EDITION



CHAPTER 46

EMS Response to Terrorism Involving Weapons of Mass Destruction

Learning Readiness

- EMS Education Standards, text p. 1232

Learning Readiness Objectives

- Please refer to page 1232 of your text to view the objectives for this chapter.

Learning Readiness

Key Terms

- Please refer to page 1233 of your text to view the key terms for this chapter.

Setting the Stage

- Overview of Lesson Topics
 - Weapons of Mass Destruction
 - Prehospital Response to Terrorism Involving WMD
 - Conventional Weapons and Incendiary Devices
 - Chemical Agents

continued on next slide

Setting the Stage

- Overview of Lesson Topics
 - Biological Agents
 - Nuclear Weapons and Radiation
 - Personal Protection and Patient Decontamination

Case Study Introduction

EMTs Louis Fine and Alvin Hahn are called to a report of a sick person at a baseball stadium. Before they arrive, three more calls are reported to dispatch, for additional sick people at the baseball stadium. Dispatch advises all responding units to use caution and to stage outside the stadium. An EMS supervisor is en route to establish incident command.

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Case Study

- Why should arriving units use caution in this situation?
- What could be responsible for several reports of sick people at an event?
- What additional information is needed?

Introduction

- Weapons of mass destruction (WMD) are a possibility EMTs must be prepared to respond to to.
- WMD includes chemical, biological, nuclear, explosives, and incendiary devices, as well as unconventional weapons.

Weapons of Mass Destruction

- WMD are intended to cause widespread death and destruction.
- The mnemonics CBRNE and B-NICE can be used to remember types of WMD.

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Weapons of Mass Destruction

- **C** – Chemical
- **B** – Biological
- **R** – Radiological
- **N** – Nuclear
- **E** – Explosive

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Weapons of Mass Destruction

- **B** – Biological
- **N** – Nuclear/radiological
- **I** – Incendiary
- **C** – Chemical
- **E** - Explosive

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Weapons of Mass Destruction

- The general approach to a WMD incident is the same as for other disasters with multiple casualties.
- Because the nature of a disaster may not be clear initially, the general management takes an all-hazards approach.

The World Trade Center attack of September 11, 2001, required a massive coordinated effort for rescue and recovery operations. (© Suzanne Plunkett/AP Images)



Prehospital Response to WMD

- To ensure adequate equipment and response, there must be a community response to the disaster.
- Each type of WMD requires different specialty equipment and supplies.
- A plan must allow immediate deployment of individuals, equipment, and supplies.

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Coordinated community medical response to the World Trade Center attack.
(© Louis Lanzano/AP Images)



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Prehospital Response to WMD

- There must be a plan to establish medical direction and verify credentials of responders from outside areas.
- Communications may be unreliable, requiring reliance on standing orders.

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Prehospital Response to WMD

- As always, EMS provider safety is the highest priority.
- You must be aware of indications of weapons used and the potential for secondary effects of the attack or secondary attacks.

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Prehospital Response to WMD

- The earlier a WMD incident is recognized, the better.
- The incident command system is used in WMD attacks.
- Hazardous materials principles are used if the agent is a chemical.

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Prehospital Response to WMD

- Signs of a toxic and unsafe environment
 - Respiratory distress
 - Dyspnea
 - Cough
 - Burning chest
 - Burning eyes

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Prehospital Response to WMD

- Wear HEPA or N-95 masks, gloves, eye protection, and gowns for suspected communicable illnesses.
- Approach from upwind.
- Avoid confined spaces.
- Entry must be made only by those with specialized training and protection.

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Prehospital Response to WMD

- Recognize locations or events that may be terrorist targets and use caution when responding to those locations.
- Be aware that perpetrators may be among the injured.

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Prehospital Response to WMD

- To maintain security, there should be a single point of entry for rescuers and there should be a designated escape plan.

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Prehospital Response to WMD

- EMT roles at WMD incidents may include:
 - Initial incident command and scene size-up
 - Sector leader or officer, such as triage, treatment, or transportation
 - Providing care and transportation

Conventional Weapons and Incendiary Devices

- Conventional explosives and incendiary devices are the most widely used WMDs.

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Conventional Weapons and Incendiary Devices

- Explosives
 - Ignition of fuels that burn rapidly, causing hot gases to displace air, creating a shock wave
 - The blast moves out in all directions at supersonic speed, and causes blast injuries.
 - There are primary, secondary, and tertiary blast effects.

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Conventional Weapons and Incendiary Devices

- Primary effects are caused by the blast wave.
- Secondary effects result from flying debris, flames, and hot gases.
- Tertiary effects result from the patient being propelled by the blast wave.
- A wide variety of injuries may occur.

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Conventional Weapons and Incendiary Devices

- Lungs
 - Blast lung and pneumothorax may occur.
 - Look for altered mental status, dyspnea, bloody sputum, chest pain, stroke-like signs and symptoms.
 - Use caution with positive pressure ventilation to avoid creating air emboli and tension pneumothorax.

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Conventional Weapons and Incendiary Devices

- Abdomen
 - Bowel may bleed or leak contents into the abdomen.
 - Evisceration is possible.

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Conventional Weapons and Incendiary Devices

- Ears
 - The eardrum may rupture and the inner ear bones may be disrupted.
 - There may be temporary or permanent hearing loss.

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Conventional Weapons and Incendiary Devices

- Crush injuries
 - May occur from structural collapse and entrapment
 - Complications occur when the pressure on the crushed area is relieved.

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Conventional Weapons and Incendiary Devices

- Shrapnel injuries
 - Penetrating injuries can affect various tissues and organs and cause bleeding, hollow organ penetration, and fractures.

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Conventional Weapons and Incendiary Devices

- Incendiary devices primarily cause burns.
- Assess burns according to the rule of nines.
- Pay attention to airway and breathing.
- Dress the burned areas.

Chemical Agents

- Can be dispersed using munitions or aerosol devices
- The tendency of an agent to evaporate and create vapors is its volatility.
- Agents that do not evaporate are characterized as persistent.
- Evaporation is affected by temperature.

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Chemical Agents

- Chemicals in the form of liquid, solids, vapor, or gas can enter the body through the respiratory tract, skin, and eyes.
- Chemical exposure can cause local and systemic effects.

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Chemical Agents

- Types of chemical agents
 - Nerve agents
 - Vesicants
 - Cyanide
 - Pulmonary agents
 - Riot control agents
 - Toxic industrial chemicals

continued on next slide

Chemical Agents

- Nerve agents
 - Potent and easily made
 - Block an enzyme that breaks down the neurotransmitter acetylcholine (ACh), allowing accumulation of ACh
 - The result is overstimulation of the muscles, smooth muscles, glands, and nerves.

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TABLE 46-1

Nerve Agents

Tabun (GA)

Sarin (GB)

Soman (GD)

GF

Methylphosphonothioic acid (VX)

continued on next slide

TABLE 46-2 Signs and Symptoms of Nerve Agent Exposure

Vapor	Small Exposure	Large Exposure
	Runny nose, mild dyspnea, pupillary constriction	Sudden onset of unresponsiveness, seizures, apnea, copious secretions, pupillary constriction
Liquid	Small Exposure	Large Exposure
	Localized sweating, nausea, vomiting, fatigue	Sudden onset of unresponsiveness, seizures, apnea, paralysis, copious secretions

continued on next slide

Chemical Agents

- Pulmonary effects
 - Respiratory failure from paralysis of respiratory muscles
 - Copious airway secretions and bronchoconstriction

continued on next slide

Chemical Agents

- The SLUDGE mnemonic summarizes signs and symptoms.
 - **S** – Salivation
 - **L** – Lacrimation
 - **U** – Urination
 - **D** – Defecation
 - **G** – Gastric distress
 - **E** - Emesis

continued on next slide

Chemical Agents

- Nerve agent emergency care
 - Ensure an adequate airway and ventilation; be prepared to suction.
 - The medications atropine and pralidoxime are antidotes.

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The two-injector Mark I™ kit.



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Chemical Agents

- Vesicants
 - Cause blistering, burning, and tissue damage
 - Agents include sulfur and nitrogen mustards, lewisite, and phosgene oxime.

continued on next slide

Chemical Agents

- Vesicant exposure
 - Signs and symptoms
 - Burning, redness, blistering, necrosis of the skin
 - Stinging, tearing, and development of ulcers in the eyes
 - Shortness of breath, coughing, wheezing, pulmonary edema
 - Nausea and vomiting
 - Fatigue

continued on next slide

Chemical Agents

- Vesicant
 - Emergency medical care
 - Irrigation
 - Manage chemical burns

continued on next slide

Chemical Agents

- Cyanide
 - Rapidly disrupts the ability of the cells to use oxygen
 - May be inhaled and ingested
 - Death may occur in 6 to 8 minutes with high doses.

continued on next slide

Chemical Agents

- Cyanide exposure
 - Signs and symptoms
 - Anxiety
 - Weakness
 - Dizziness
 - Nausea
 - Muscular trembling
 - Tachycardia

continued on next slide

Chemical Agents

- Cyanide exposure
 - Signs and symptoms
 - Tachypnea
 - Pale, cyanotic, or normal color skin
 - Seizures
 - Apnea
 - Unresponsiveness

continued on next slide

Chemical Agents

- Cyanide exposure
 - Emergency treatment
 - Manage the airway, breathing, and oxygenation.
 - There are antidotes available.
 - Nitrites and sodium thiosulfate
 - Hydroxocobalamin

continued on next slide

Chemical Agents

- Pulmonary agents
 - Include phosgene, other halogen compounds, and nitrogen-oxygen compounds
 - Act primarily to cause lung injury

continued on next slide

Chemical Agents

- Pulmonary agent exposure
 - Signs and symptoms
 - Tearing
 - Runny nose
 - Throat irritation
 - Dyspnea
 - Wheezing

continued on next slide

Chemical Agents

- Pulmonary agent exposure
 - Signs and symptoms
 - Cough
 - Crackles
 - Stridor
 - Secretions

continued on next slide

Chemical Agents

- Pulmonary agent exposure
 - Emergency medical treatment
 - Manage the airway and breathing; be prepared to suction, administer oxygen.

continued on next slide

Chemical Agents

- Riot control agents
 - Tear gas and pepper spray
 - Cause extreme irritation of the eyes, nose, mouth, skin, and respiratory tract
 - Emergency medical care is supportive and may include irrigation of the eyes.

continued on next slide

Chemical Agents

- Toxic industrial chemicals
 - May be obtained from hijacking rail or truck transportation of chemicals or sabotage of chemical plants
 - The approach and treatment depends on the agent involved.

Case Study

The incident commander communicates with security officers inside the stadium and learns that now there are about two dozen individuals complaining of coughing, gagging, and irritation of the eyes, nose, and mouth. As they are communicating, there are additional reports of affected patients from other areas of the stadium.

continued on next slide

Case Study

- What should be the approach to this situation?
- Where should EMS units be located?
- What special resources are needed?

Biological Agents

- Consist of living organisms or their toxins
- Small amounts can cause widespread illness and may take days to detect.
- Dispersal methods vary.
- The respiratory tract is the most common portal of entry.

continued on next slide

Biological Agents

- Groups of biological agents
 - Pneumonia-like agents
 - Encephalitis-like agents
 - Biological toxins
 - Other agents

continued on next slide

Biological Agents

- Pneumonia-like agents present with fever and difficulty breathing, and include:
 - Anthrax
 - Plague
 - Tularemia

continued on next slide

Biological Agents

- Encephalitis-like agents cause fever, headache, and altered mental status, and include:
 - Smallpox
 - Venezuelan equine encephalitis

continued on next slide

Biological Agents

- Biological toxins
 - Botulinum
 - Descending paralysis
 - Double vision
 - Blurred vision
 - Dry mouth and throat
 - Difficulty speaking and swallowing
 - Dyspnea and respiratory failure

continued on next slide

Biological Agents

- Biological toxins
 - Ricin
 - Weakness
 - Fever
 - Cough
 - Hypothermia
 - Death

continued on next slide

Biological Agents

- Biological toxins
 - Staphylococcus enterotoxin 13
 - Fever
 - Chills
 - Headache
 - Body aches
 - Nonproductive cough

continued on next slide

Biological Agents

- Biological toxins
 - Epsilon toxin
 - Cough, wheezing, shortness of breath
 - Respiratory failure
 - Death

continued on next slide

Biological Agents

- Biological toxins
 - Trichothecene myotoxins
 - Pain
 - Itching
 - Lesions
 - Runny nose, sneezing

continued on next slide

Biological Agents

- Biological toxins
 - Trichothecene myotoxins
 - Sloughing skin
 - Dyspnea, wheezing
 - Chest pain
 - Hemoptysis

continued on next slide

Biological Agents

- Other biological agents
 - Cholera
 - Vomiting, abdominal distention, profuse diarrhea
 - Severe dehydration
 - Little or no fever

continued on next slide

Biological Agents

- Other biological agents
 - Brucellosis
 - Fever
 - Malaise
 - Body aches
 - Joint pain
 - Headache
 - Cough

continued on next slide

Biological Agents

- Other biological agents
 - Viral hemorrhagic fevers
 - Malaise
 - Body aches
 - Headache
 - Vomiting
 - Flushing and petechiae
 - Easy bleeding, hypotension, shock

continued on next slide

Biological Agents

- Emergency medical care for biological agent
 - Prehospital care is supportive.
 - Recognition and contacting public health officials is crucial.
 - Smallpox, plague, and Ebola are highly contagious; use appropriate personal protective equipment.

continued on next slide

Biological Agents

- Emergency medical care for biological agent
 - Hospital care includes antibiotics and antitoxin.
 - Immunizations and prophylactic treatment are used in some cases.

Click on the WMD agent below that is a biological agent.

A. Phosgene

B. Nerve agents

C. Ricin

D. Hydroxocobalamin

Nuclear Weapons and Radiation

- Three primary mechanisms of death
 - Radiation
 - Blast
 - Thermal burns

continued on next slide

Nuclear Weapons and Radiation

- Radiation
 - Energy released from radioactive atoms passes through and changes the structure of molecules in cells of the human body.
 - The cells may die, repair, or produce mutated cells.

continued on next slide

Nuclear Weapons and Radiation

- Radiation
 - X-ray/gamma radiation is the most penetrating type and can travel long distances.
 - Neutron radiation is a powerful, damaging particle associated with nuclear reactors and nuclear bombs.

continued on next slide

Nuclear Weapons and Radiation

- Radiation
 - Beta radiation is a low-speed, low-energy particle that is easily stopped by 6–10 feet of air, clothing, or the first few millimeters of skin, but poses a serious hazard if ingested.
 - Alpha radiation is heavy, slow-moving, and easily stopped, but poses a serious threat if inhaled or ingested.

continued on next slide

Nuclear Weapons and Radiation

- Radiation exposure associated with a nuclear explosion
 - Primary exposure
 - Fallout

continued on next slide

Nuclear Weapons and Radiation

- Primary exposure
 - Limited to blast proximity or near the source of radiation, such as a nuclear reactor
 - The source, duration of exposure, shielding, and distance affect the potential for injury and death.

continued on next slide

Nuclear Weapons and Radiation

- **Fallout**
 - Radioactive dust and particles that can be carried far from the blast site
 - The greatest danger occurs within 48 hours and within close proximity to the blast.
 - May damage cell DNA

continued on next slide

Nuclear Weapons and Radiation

- Blast injuries
 - Nuclear detonation causes a rapid heating of air and an explosively expanding gas cloud.
 - Injuries are the same as those from conventional explosives.

continued on next slide

Nuclear Weapons and Radiation

- Thermal burns
 - Causes most deaths and injuries from nuclear explosion
 - Heating is short duration, but very intense.
 - The eyes can be damaged from the intense light.

continued on next slide

Nuclear Weapons and Radiation

- Radiologic dispersal devices
 - "Dirty bomb"
 - A conventional explosive attached to radioactive materials
 - Risk of widespread radiation illness and contamination of the environment

continued on next slide

Nuclear Weapons and Radiation

- Nuclear detonation and radiation injury
 - Assessment and care
 - Most destruction and death is nearest the center of the blast.
 - There is less death and injury further from the blast.

continued on next slide

Nuclear Weapons and Radiation

- Nuclear detonation and radiation injury
 - Signs and symptoms
 - Nausea, fatigue, malaise, clotting disorders
 - Vomiting, loss of appetite, diarrhea, fluid loss

continued on next slide

Nuclear Weapons and Radiation

- Nuclear detonation and radiation injury
 - Signs and symptoms
 - Reddening of the skin
 - Rapid onset of incapacitation, cardiovascular collapse, confusion, burning sensation

continued on next slide

Nuclear Weapons and Radiation

- Nuclear detonation and radiation injury
 - Emergency medical care
 - Protect yourself and patients from further radioactive exposure.
 - Treat thermal and blast injuries.
 - Manage airway, breathing, and oxygenation.
 - Iodine tablets can help protect against long-term effects of radiation.

Personal Protection and Decontamination

- Personal protective equipment is required for chemical, biological, and radiological/nuclear exposure.
- Apply principles of hazardous material response.
- Apply principles of time, distance, and shielding for radiation exposure.

continued on next slide

Personal Protection and Decontamination

- Apply principles of decontamination as for hazardous materials exposure.
- Do not perform tasks you are not trained to perform.

Case Study Conclusion

Louis and Allan, along with other responding units are relocated to a position upwind from the stadium. Meanwhile, security reports that several of the affected patients reported seeing canisters that they thought might be tear gas or pepper spray.

continued on next slide

Case Study Conclusion

Incident command works with security to stage an orderly evacuation of the stadium, and orders a decontamination area to be set up at the stadium exit. Triage, treatment, and transport sectors are established.

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Case Study Conclusion

In all, nearly 100 people are decontaminated by hazardous materials personnel at the scene. Hazardous materials crews confirm that the substance involved was a riot control agent.

Ultimately 36 of the patients are transported for further treatment at area hospitals.

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Case Study Conclusion

The attack is later determined to be the work of a small domestic group staging a protest.

Lesson Summary

- WMD are intended to produce widespread death and destruction.
- WMD may be chemical, biological, radiological, nuclear, or explosive agents.
- Conventional explosive agents have the greatest likelihood of being used in an attack.

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Lesson Summary

- Preplanning is crucial to management of the incident and the patients.
- Preplanning must consider supplies and equipment, medical direction, provider education and preparation, response to the scene, and scene safety issues.