

# CHEMICAL AGENTS

- Objectives
  - Identify indicators that may cause the EMS provider to suspect a chemical incident
  - Identify signs, symptoms and management of common chemical agents
  - Ensure adequate protection for EMS providers in a chemical incident

## CHEMICAL AGENTS Terrorism

- Advantages
  - Easy to make
  - Available
  - Cheap
  - Immediate effect
  - Hard to detect
  - Easily spread
  - Tie up resources
  - Psychological impact
- Disadvantages
  - Requires large quantities
  - Production hazardous
  - Difficult to prepare for
- **CHEMICAL AGENTS CONSIDERATIONS**
  - Most are liquid and must be aerosolized or vaporized for maximum exposure
  - Small hot zone if no dissemination device
  - Slow steady winds best environment
  - Closed spaces result in higher concentrations

## TYPES OF CHEMICAL AGENTS

- Nerve
- Blister
- Blood
- Choking
- Irritant

### Nerve Agents

- Nerve agents disrupt nerve impulse transmissions.
  - All nerve agents are toxic at extremely small concentrations.
  - Normally liquids that are disseminated by spraying as an aerosol.
- Examples of nerve agents include:
  - Sarin
  - Soman
  - Taban
  - VX

### Symptoms of Nerve Agent/Organophosphate Poisoning

- **S** Salivation/Excessive Drooling
- **L** Lacrimation/Tearing
- **U** Urination/Incontinence
- **D** Defecation/Diarrhea
- **G** GI Upset/Cramps
- **E** Emesis/Vomiting
- **M** Muscle Twitching
- Other symptoms include
  - Excessive sweating
  - Runny nose and nasal congestion
  - Chest pressure
  - Coughing /Difficulty in breathing
  - Giddiness / Anxiety

- Routes of Exposure
  - Inhalation
  - Skin Absorption
  - Ingestion
  - Injection

## **Mark 1 Kits**

### **Contents of Mark 1 Kit**

- **The clip numbers indicate order of usage**
  - **#1 Atropine**
  - **#2 Pralidoxime Chloride (2-PAM CL)**

### **Simple Administration**

#### **Using the Mark 1 Kit**

- **Only to be used if:**
  - Recognition of the existence of a potential nerve agent or organophosphate release in the area
  - Some or all of the symptoms of the nerve agent poisoning are present

#### **Remember:**

- Atropine is the first drug used from a Mark 1 Kit
- Use the same number of 2-PAM CL auto injectors as you did Atropine auto injectors
- Effects of atropine may include:
  - Heart rate >90
  - Reduced bronchial secretions
  - Reduced salivation

## Mark 1 Kit Dosages based on Symptoms

### SELF-RESCUE

- **Threshold symptoms:**
  - Dim vision
  - Increased tearing
  - Runny nose
  - Nausea/vomiting
  - Abdominal cramps
  - Shortness of breath

(Note: many of the above may also be associated with heat related illness)

**Threshold Symptoms -and-  
Positive evidence of nerve agent or OPP on site 1 Kit**

## Mark 1 Kit Dosages based on Symptoms

- **Mild** = Threshold symptoms plus constricted pupils, muscle twitching, diaphoresis

**1 Kit**

- **Moderate** = Threshold symptoms plus constricted pupils, urinary incontinence, respiratory distress/wheezing

**2 Kits**

- **Severe** = Threshold symptoms plus constricted pupils, unconsciousness, seizures, severe respiratory distress

**3 Kits**

## Pediatric Dosing with Mark 1

**Mild**    Contact Medical Control

**Moderate**    Contact Medical Control

**Severe**  
**< Age 8**        **1 Kit**

**≥Age 8**        **3 Kits**

## Possible Additional Pharmacological Intervention

- Atropine 2-6 mg IV / IM per Mark I Kit Dosing Directive if Mark I Kit is not available (each Mark I Kit contains 2 mg of atropine)
  
- Treat seizures per Seizure Protocol
  - **Adult:**
    - Administer diazepam 2-10 mg IVP **OR**
    - Midazolam 0.05 mg/kg to max 5 IVP
    - Administer Midazolam 0.1 mg/kg to max 10 mg IM
    - If available, Valium auto-injector
  - **Pediatrics:**
    - Diazepam 0.2 mg/kg (maximum individual dose 10 mg) via intravenous route **or** 0.5 mg/kg (maximum individual dose 10 mg) via rectal route
    - Midazolam 0.15 mg/kg (maximum individual dose 5 mg) via intravenous or intramuscular route

## Blister Agents

Blister agents, also known as vesicants, cause severe burns to eyes, skin, and tissues of the respiratory tract. These agents are also referred to as mustard agents due to their smell. They readily penetrate layers of clothing and quickly damage the skin. All are very toxic, but much less so than nerve agents.

Examples of blister agents include:

- Lewisite
- Sulfur mustard
- Nitrogen mustard
- Phosgene oxime
  
- Symptoms include:
  - Reddening, tearing or painful eyes
  - Reddening, tender or burning skin with fluid-filled blisters
  - Burning sensation in the nose and throat, severe cough
  - Difficulty in breath
  - Abdominal pain, nausea/vomiting (blood-stained vomit)
  - Bloody diarrhea.

- Routes of Exposure
  - Inhalation
  - Skin Absorption
  - Ingestion
  
- Treatment
  - Immediate attention should be directed toward assisted ventilation, administration of 100 % oxygen, insertion of intravenous lines and institution of cardiac monitoring, if available.
  - Symptomatic treatment per protocol.

## **BLOOD AGENTS**

Blood agents interfere with the ability of blood to transport oxygen and therefore result in asphyxiation. All blood agents are toxic at high concentrations and lead to rapid death. Symptoms of those affected include respiratory distress, vomiting, diarrhea, vertigo, and headaches.

Examples of blood agents include:

- Cyanogen chloride (CK)
- Hydrogen cyanide (AC)
  
- Signs and Symptoms
  - Increased respirations
  - Dizziness
  - Headaches
  - Cardiac Symptoms
  - Odors:
    - Burnt Almonds
    - Peach Kernels
  
- Routes of Exposure
  - Inhalation
  - Skin Absorption
  - Ingestion
  - Injection
  
- Treatment
  - High flow oxygen
  - IV
  - Supportive care
  - Symptomatic treatment per Protocol

## CHOKING AGENTS

Choking agents severely stress respiratory system tissues. Common industrial agents, such as chlorine and phosgene, are considered choking agents.

Examples of choking agents include:

- Chlorine
- Cyanide
- Perfluroisobutylene
- Phosgene
- Red phosphorus

## CYANIDE POISONING

- **Signs and Symptoms**
  - **Shortness of Breath**
    - Possibly with chest pain
    - Generally NOT associated with cyanosis
    - Pulse Ox usually normal
    - Usually Increased respiratory rate and depth
    - Potential for Rapid Respiratory Arrest
  - **Confusion**
  - **Decreased Level of Consciousness**
  - **Coma**
  - **Seizures**
  - **Headache**
  - **Dizziness**
  - **Vertigo**
  - **Pupils dilate (late)**

### Cyanide Antidotes

- Amyl Nitrite Inhalants
- Sodium Nitrite Injection
- Sodium Thiosulfate

## **Amyl Nitrite Inhalers**

- Use first
- Break and place under the nose, inside the O<sub>2</sub> mask or over the intake valve of the BVM
- Inhale for 30 seconds of every minute
- Use a new inhalant every 3 minutes if sodium nitrite infusion will be delayed
- If the patient improves, therapy stops here

## **Sodium Nitrite Injection**

- If no response to Amyl Nitrite and O<sub>2</sub>, infuse Sodium Nitrite ASAP
- 10 mL (300mg)
  - Pediatric dose 0.15 mL/kg body weight
- Infuse over no less than 5 minutes
- Monitor BP
  - Slow rate of infusion if hypotension develops

## **Sodium Thiosulfate**

- 50 mL (12.5g) infused IV over 10 minutes
  - Pediatric dose 1.65 mL/kg IV over 10 minutes
- If cyanide exposure is not confirmed, may receive order for Sodium Thiosulfate without Sodium Nitrite

## **Remember:**

- Evaluate and maintain airway
- 100% O<sub>2</sub> should be used in addition to the antidotes
- Patients in respiratory arrest, but still having a pulse, have been found to respond to antidote therapy and should receive positive pressure ventilation when operationally feasible
- Avoid contact with vomit if ingestion suspected—off gassing possible
- **Signs and Symptoms**
  - Coughing
  - Choking
  - Chest tightness
  - Odors:
    - Chlorine bleach
    - Swimming pools
    - Newly mown grass or hay

- **Routes of Exposure**
  - Inhalation
  - Skin absorption
  
- **Treatment**
  - Respiratory chemical PPE
  - Assist ventilations, as necessary
  - 100% Oxygen
  - Symptomatic treatment per protocol
  - Eye irrigation
    - Remove contact lenses
    - Flush with 1000cc of NS each eye
    - Flush from nose-side outward

### **ADDITIONAL TREATMENT**

- If available, use Tetracaine hydrochloride 1-2 drops in each eye.
- Ensure that patient does not rub eyes after administration of Tetracaine as injury may result.
  
- For severe exposure consider early intubation and aggressive ventilatory support. (Evidence of non-cardiogenic pulmonary edema)
- Albuterol 2.5mg via nebulizer or 2-3 puffs from metered dose inhaler, if wheezing (May repeat x 1).

### **IRRITATING AGENTS**

- Unlike other chemical agents, which are used to produce casualties, irritating agents are more often used as “harassing” agents.
- Bring more discomfort than harm, although they can result in asphyxiation under certain circumstances.
- Often used for riot control purposes.
  
- Examples of irritating agents include:
  - MACE
  - Tear gas
  - Capsicum/pepper spray

## Irritating Agents Actions

- Irritating agents cause respiratory distress and tearing designed to incapacitate. They can also cause intense pain to the skin, especially in moist area of the body.
- Symptoms include
  - Burning or irritation in eyes and throat
  - Respiratory distress
  - Coughing /Choking
  - Nausea and vomiting (if exposed to high concentrations)
- Treatment
  - High flow oxygen for all symptomatic patients.
  - Symptomatic treatment per protocol (no specific antidote).
  - Eye irrigation
    - Remove contact lenses
    - Flush with 1000cc of NS each eye
    - Flush from nose-side outward
    - If available, use Tetracaine hydrochloride 1-2 drops in each eye.
    - Ensure that patient does not rub eyes after administration of Tetracaine as injury may result.
- Protection
  - Stage at a safe distance
  - Secure and isolate area
  - Watch for larger secondary chemical devices
  - PPE, SCBA, PAPR
  - Confine contaminated and exposed victims
  - Emergency decontamination prior to transportation