R7DHRE Hazardous Materials Guideline: Insecticides & Nerve Agents

Region VII Disaster Health Response Ecosystem

REGION VII DISASTER HEALTH RESPONSE ECOSYSTEM (R7DHRE)

CHEMICAL SPECIALTY TEAM

Call Your Poison Center for Immediate Assistance: 1-800-222-1222

Hazardous Materials Guideline: Organophosphate

This document is intended as a supplement for discussion with your local poison center or toxicologist.

1.0 BACKGROUND

1.1 Description: Organophosphate insecticides, carbamate insecticides, and military nerve agents are all acetylcholinesterase inhibitors. Insecticides are typically formulated in hydrocarbons and have the odor of garlic, sulfur, or volatile hydrocarbons. The G-type nerve agents such as tabun (GA), sarin (GB), and soman (GD) are clear, colorless, and volatile liquids. The V-type agents an oily liquid with VX having an amber color.

1.2 Novichok agents are a relatively newer category of nerve agents brought to more widespread attention following several high-profile poisonings. They are generally more potent than other agents, resist environmental degradation, and may have a delayed onset up to three days.

1.3 Mechanism of Injury: Inhibition of acetylcholinesterase enzymes leads to the accumulation of excessive acetylcholine and produces muscarinic, nicotinic, and central nervous system effects. Of note, some commercial insecticides require metabolic activation and onset of symptoms may be delayed for a few minutes to several hours after exposure.

1.4 Routes of Exposure: **Inhalation**, **Dermal,** Ingestion, Ocular

2.0 PROVIDER SAFETY

2.1 Personal Protective Equipment (PPE) – Decontamination Team: Personnel decontaminating patients must wear **full-body chemical-resistant clothing, butyl rubber gloves, and respiratory protection**. Respiratory protection may consist of either:

2.1.1 A positive pressure air or oxygen source, such as an air-line respirator or a Self-Contained Breathing Apparatus (SCBA) or

2.1.2 A filtered air respirator (including Powered Air Purifying Respirators (PAPRs)) with filters capable of adsorbing insecticides and nerve agents.

2.1.3 A positive pressure air or oxygen source is preferred if there is doubt as to the identity of the chemical in question or if there may be exposure to a level of insecticides and nerve agents which would overwhelm the filter.

2.2 Personal Protective Equipment (PPE) – Treatment Team: Personnel treating patients who have been adequately decontaminated need no additional PPE other than **universal precautions** since there is no serious risk of secondary contamination. The **vomit from persons who have ingested insecticides or nerve agents is hazardous because it can off-gas toxic vapors**. Prepare treatment areas for rapid clean up in case the patient vomits.

2.3 Patient Decontamination:

2.3.1 **Decontaminate ALL PATIENTS**. The patients' hair and clothes can trap off-gas vapors. Those patients contaminated with insecticide or nerve agent solutions pose a risk of secondary contamination from off-gassing of vapors and direct contact with the chemical.

2.3.2 **Remove ALL clothing and jewelry.** Double bag clothing and jewelry to prevent off-gassing.

2.3.3 **Rapid decontamination is critical** because insecticides and nerve agents are rapidly absorbed from the skin. **Decontamination is best accomplished by irrigation with copious amounts of water**. Wash skin and hair with plain water for a minimum of 5 minutes and then wash twice with soap & water after washing with plain water. Washing with water alone (for a longer time) is acceptable if soap is not available. Absorbent powders such as flour, talcum powder, or Fuller's earth, can be used to absorb liquid insecticides and nerve agents if water is not available.

2.3.4 Remove contact lenses if it can be done without additional trauma to the eye. **Irrigate eyes for a minimum of 15 minutes.** Continue irrigation until eye pH is neutral (7 to 8).

2.3.5 Watch for hypothermia (1) in children and the elderly, (2) when decontamination is done with un-heated water, or (3) during cold weather.

2.3.6 **Reactive Skin Decontamination Lotion**, in the form of a lotion impregnated sponge, may be available to facilitate the rapid removal and/or neutralization of chemical warfare agents. If used, traditional decontamination with water or soap and water should follow when feasible.

3.0 SIGNS & SYMPTOMS

3.1 Severity of symptoms will depend upon the dose patients are exposed to and the route of exposure. Severe toxicity presents with **diffuse secretions, bradycardia, constricted pupils, altered mental status, seizures, and death**. Symptoms are further delineated in the table below. Delayed toxicities in the form of resurgent muscle weakness (Intermediate Syndrome) and a peripheral polyneuropathy are possible.

3.2 Insecticide and nerve agent vapors and liquids are readily absorbed through the lungs and eyes, producing local and systemic effects within seconds to minutes. The liquid is readily absorbed through the skin though effects may be delayed from minutes to up to 18 hours.

3.3 Ocular effects may result from either direct contact of the insecticide or nerve agent with the eye or from systemic absorption of the insecticide or nerve agent. Abdominal pain, nausea and vomiting are common manifestations of exposure by any route and may be the first systemic effects from dermal absorption. If these symptoms occur within an hour of dermal exposure, severe intoxication is likely.

3.4 Exposure Grading:

3.4.1 Mild: Miosis, rhinorrhea, mild chest tightness, mild shortness of breath, sweating, lacrimation

3.4.2 Moderate: Vomiting, diarrhea, severe chest tightness, wheezing, profuse airway secretions, respiratory distress, muscle weakness, bradycardia

3.4.3 Severe: Unconsciousness, seizures, paralysis, cyanosis, respiratory failure, apnea

Effects	Muscarinic Effects	Nicotinic Effects	CNS Effects
Memory Aid	DUMBELS	MTWHFS (days of the week)	CLAS
Symptoms	**D**iaphoresis **D**efecation **U**rination **M**iosis **B**radycardia **B**ronchorrhea **B**ronchoconstriction **B**lurry & dim vision **E**mesis **E**ye pain **L**acrimation **S**alivation Rhinorrhea	**M**ydriasis **T**achycardia **W**eakness Leading to paralysis **H**ypertension **F**asciculations **F**laccid paralysis **S**eizures	**C**onfusion **C**oma **L**ethargy **A**gitation **A**pnea **S**eizures

4.0 DIAGNOSTICS

4.1 Organophosphate and carbamate poisoning are a clinical diagnosis. Diagnostic testing may be indicated based on clinical judgement and the patient's presentation and level of illness.

4.2 Blood collected in two lavender EDTA tubes can be sent for red blood cell cholinesterase and plasma cholinesterase activity measurement to confirm the diagnosis and monitor recovery.

5.0 TREATMENT

5.1 General: **Treatment emphasizes aggressive supportive care and prompt administration of antidotal therapy if indicated.** Patients may need airway management, respiratory support, cardiovascular support with IV fluids and vasopressors, treatment for severe acidemia, and treatment of seizures with benzodiazepines or other GABA agonists.

5.2 Avoid: Other anticholinesterase agents, succinylcholine, and drugs that may decrease respiratory drive.

5.3 Ocular: **Irrigate eyes**. Perform a thorough eye exam: test visual acuity, and perform fluorescein and slit lamp examinations. Ophthalmology consultation may be necessary. Immediately consult an ophthalmologist for patients who have corneal injuries.

5.4 Ingestion: **Do NOT induce emesis or give activated charcoal**.

5.5 ANTIDOTE: Atropine. Atropine is an antimuscarinic medication which reverses the DUMBELS symptoms of cholinergic toxicity. Atropine **should be titrated to resolution of bradycardia, bronchorrhea, and bronchospasm**.

5.5.1 Adults: Begin with 2-5 mg, IV push, every 5-10 minutes as needed while titrating dose as needed

5.5.2 Children: Begin with 0.05 to 0.1 mg / kg, IV push, every 5-10 minutes as needed while titrating dose as needed

5.5.3 In massive exposures, over 1 gram of atropine has been given in the first 24 hours.

5.6 ANTIDOTE: Benzodiazepines. Benzodiazepines such as diazepam or midazolam should be given in sufficient quantities to control any seizures, agitation, or restlessness that results from cholinesterase inhibitor exposures. Benzodiazepines should be given intravenously or intramuscularly. Doses up to 30-40 mg of diazepam have been required.

5.7 ANTIDOTE: Pralidoxime. Pralidoxime prevents the bond between organophosphates and the acetylcholinesterase enzyme from becoming permanent.

5.7.1 Adults: Bolus 1-2 grams, IV, over 15-30 minutes, then a continuous IV infusion of 250-500 mg / hour.

5.7.2 Children: Bolus 25-50 mg / kg, IV, over 15-30 minutes, then a continuous IV infusion of 10-20 mg / kg / hr.

5.8 Antidote Autoinjectors. There are several autoinjectors available on the market which administer atropine, pralidoxime, and benzodiazepines either alone or in a combination. Large quantities are regionally available for the treatment of anticholinesterase toxicity in a mass casualty event through the Strategic National Stockpile CHEMPACK program. Most notable is the **Duodote, a single auto-injector which delivers 2.1 mg atropine and 600 mg pralidoxime**. These can be used to rapidly treat a large number of patients quickly by administering **1 to patients with mild toxicity, 2 for moderate, and 3 for severe**.

Disclaimer: This guideline is intended to be an informational reference only and should not be used as a substitute for consultation with a poison center or toxicologist, and/or the clinical judgement of the bedside team.

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