PREPARING FOR A CHEMICAL TERRORIST EVENT — A PRIMER

The potential terrorist use of biological agents has several times been discussed in these pages. However, the recent instances of chemical agents used in terror attacks worldwide reminds us that chemical weapons are also terrifying and lethal. This issue of the CD Summary is a primer on potential agents of chemical terrorism.

GHOSTS FROM THE PAST

The use of chemicals to kill and terrorize was reported as early as 423 BC in the Peloponnesian War, when sulfur smoke was used to conquer a fort. The 7th-century Greeks combined naphtha, lime, sulfur, pitch and saltpeter in their naval operations. Venetian soldiers placed poisons in explosive mortar shells and also poisoned wells, crops and animals in the 15th and 16th centuries. Although during the 1800s there was much debate over proposals to use poisonous gases in wars, the use of chemicals as an “acceptable” military weapon really began with the notorious 1915 release of chlorine gas from 6000 cylinders in Belgium, which killed 800 in one afternoon. Chemical use was later expanded in WWI by the release of phosgene and chloropicrin by the British, and mustard gas by the Germans. U.S. chemical defoliants cleared tunnels and bunkers in Vietnam and Laos, and the Soviets used chemicals in Afghanistan. Iraq’s use of mustard, tabun and sarin gases in the Iraqi war and cyanide in the Kurds triggered the latest anxiety about military use of chemical weapons against populations.

TREATMENT

Treatment is based on identifying the chemical from an exposure history, or from recognizing a constellation of signs and symptoms that indicate a chemical family when the chemical agent is unknown. Initial treatment for all victims includes “ABCs,” rapid decontamination and fresh air. Treatment protocols may vary depending on training and the availability of antidotes. Call Oregon Poison Control (800/222-1222) for medical advice.

ABORT Report the following immediately to the Oregon Poison Center and your local health department:
- clusters of sudden onset of respiratory, neurological, gastrointestinal or dermatological symptoms;
- clusters with unusual age distribution (e.g. child chemical exposures);
- unexplained deaths in young or healthy people.

SHELTERING

Assign a staff person to provide patient information on what to do in case of a chemical attack, and how to shelter in place (http://www.wc.edu/planning/shelteringfacts.asp). Find out how to prepare your office to shelter in place at www.nicinfo.org/ SIP200Center.htm.

- Nerve agents (sarin, tabun, soman, VX) and pesticides manufactured and distributed for agricultural or home use (such as malathion and diazinon organophosphates or methyl-carbamates). These chemicals cause overstimulation of cholinergic muscarinic sites resulting in increased body fluid secretion, and of cholinergic neuromuscular sites resulting in fasciculations, weakness and muscular paralysis, and CNS symptoms. Nerve agents are readily absorbed through eyes, mucous membranes and result in systemic poisoning. One drop of concentrated sarin on the skin can be lethal. Nerve agents are volatile at ambient temperatures, and exposure to high levels of vapor can produce symptoms within seconds.

- Blister/vesicants (cyanides, sulfides, azides) are rapidly absorbed by inhalation and mucosal and dermal surfaces. They interfere with cellular oxygen utilization within seconds of exposure.

- Systemic asphyxiants (sulfur and nitrogen mustards, Lewisite, phosgene oxime) are rapidly absorbed through eyes, lungs and skin. They cause skin blisters and damage to eyes, mucosa, respiratory tract, and internal organs. Lewisite causes liver toxicity, and may cause systemic arsenic toxicity (contains trivalent arsenic). The onset of symptoms is generally immediate, although mustard agents can have a delayed onset.

- Pulmonary irritants (ammonia, chlorine, hydrogen fluoride, oxides of nitrogen, vinyl chloride, phosgene) are irritating and corrosive to the respiratory tract and cause severe pulmonary edema, eye and skin irrita-
Inhalation and dermal absorption
Treatment must counteract cholinergic excess in all three receptor sites. Maintain ventilation, oxygenation, ABCs.

Inhalation and dermal absorption
Maintain ventilation, oxygenation, ABC’s. Applications:

Glycopyrrolate: 0.02 mg/kg IV (IM okay if no IV access); use at least 0.1 mg; not to exceed adult dose.

Vesicants: sulfur and nitrogen mustards, Lewisite, phosgene oxime

Immediate decontamination is critical to prevent further exposure to patient and healthcare workers. Onset: Vapors—seconds to minutes. Liquid—minutes to hours. Note: Not all signs need to be present.

Pneumonitis from inhaled HF may be treated with oxygen and nebulized 2.5% calcium gluconate (mix 1.5 mL of 10% gluconate and 4.5 mL sterile water).

Organophosphate and methyl-carbamate pesticides.

Muscarinic: diaphoresis, salivation, nausea, abdominal cramps, vomiting, diarrhea, urination, lacrimation, miosis, blurred vision, bradycardia, bronchoconstriction, dyspnea, chest tightness.

Antidotes:
For hypersecretions, pulmonary edema, or bradycardia. Parenteral atropine should not be used to control rhinorrhea or to treat muscarinic effects. Adult: 1–2 mg IV/IM initial dose. 1–2 mg IV/IM may be continued q 5–10 min until bronchial secretions are dried, bradycardia resolved. If symptoms return, repeat dosing. Pediatric: 0.02 mg/kg IV (IM may only if IV access); use at least 0.1 mg; not to exceed adult dose q 5 to 60 min until symptoms resolved. Atropine may be used if bronchospasm (bradycardia: dry; bradycardia resolved: if symptoms return, repeat dosing scheme). Pralidoxime (PAM) for muscle weakness, fasciculations, severe toxicity. Adult: 1–2 g IV or IM. IV dose can be mixed in 100 mL NS and infused over 15–30 min. If symptoms recur or continue, repeat dose in one hour or start continuous infusion at 200–600 mg/hour. Pediatric: 25 to 50 mg/kg up to 1 g IV or IM. IV dose can be infused over 15–30 min. If symptoms recur or continue, repeat dose in one hour or start continuous infusion at 5–10 mg/kg/hour. May repeat in 1 hour if weakness not resolved, then again every 6 hours, or by continuous IV infusion at 5–10 mg/kg/hour.

Diazepam or equivalent dosing of another Benzodiazepine for seizures, agitation: Adult: 5–10 mg IV/IM. Pediatric: 0.1 mg/kg IV/IM

Onset: Cyanides—seconds. Other asphyxiants: No antidote; provide supportive care.

Cyanide: high anion gap metabolic acidosis, elevated lactate methemoglobin, and urinary thiosulfate levels.

Systemic Asphyxiants:
Adult: 1–2 mg IV/IM initial dose. 1–2 mg IV/IM may be continued q 5–10 mins. until bronchial secretions are dried, bradycardia resolved. If symptoms return, repeat dosing. Pediatric: 0.02 mg/kg IV (IM may only if IV access); use at least 0.1 mg; not to exceed adult dose q 5 to 60 mins until symptoms resolved. Atropine may be used if bronchospasm (bradycardia: dry; bradycardia resolved: if symptoms return, repeat dosing scheme). Pralidoxime (PAM) for muscle weakness, fasciculations, severe toxicity. Adult: 1–2 g IV or IM. IV dose can be mixed in 100 mL NS and infused over 15–30 mins. If symptoms recur or continue, repeat dose in one hour or start continuous infusion at 200–600 mg/hour. Pediatric: 25 to 50 mg/kg up to 1 g IV or IM. IV dose can be infused over 15–30 mins. If symptoms recur or continue, repeat dose in one hour or start continuous infusion at 5–10 mg/kg/hour. May repeat in 1 hour if weakness not resolved, then again every 6 hours, or by continuous IV infusion at 5–10 mg/kg/hour.

Diazepam or equivalent dosing of another Benzodiazepine for seizures, agitation: Adult: 5–10 mg IV/IM. Pediatric: 0.1 mg/kg IV/IM

Onset: Immediate. Other asphyxiants: No antidote; provide supportive care.

Supportive: oxygen, correct acidosis, treat eye and skin injuries as for burns.

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Pulmonary Irritants:
Signs and symptoms depend on the chemical agent, dose, and exposure routes. Sensitive individuals, those with pre-existing conditions such as cardiovascular and respiratory diseases and hypertension, and children are at higher risk.

For a larger, 11”x17” downloadable version of this chart, go to http://www.dhs.state.or.us/publichealth/bioterrorism/provider.cfm

Vesicants: sulfur and nitrogen mustards, Lewisite, phosgene oxime

No antidotes. Manage secretions, maintain ventilation, oxygenation, monitor heart, renal, liver functions. Treat pulmonary edema with PEEP to maintain PO2 above 60 mm Hg. Hydrogen Fluoride: Pneumonitis from inhaled HF may be treated with oxygen and nebulized 2.5% calcium gluconate (mix 1.5 mL of 10% calcium gluconate with 4.5 mL sterile water).

Skin burns may be treated with topical calcium gluconate. Do not inject or use calcium chloride for treating skin burns.

For hydrogen fluoride systemic toxicity, serum calcium, magnesium and potassium levels must be rapidly corrected with IV boluses of calcium gluconate and magnesium sulfate.

No specific therapy. Eye washing, remove particles. Ophthalmic exam.

Lacrimators/Riot Control: CN, CS tear gas, chloropicrin.

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Immediate decontamination is critical to prevent further exposure to patient and healthcare workers. Onset: Vapors—seconds to minutes. Liquid—minutes to hours. Note: children may exhibit different symptoms (CNS, stupor, fascicidity, dyspnea).

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