



NERVE AGENTS

Agent information:	Nerve agents are the most toxic of the known chemical warfare agents. They are chemically similar to organophosphate pesticides and exert their biological effects by inhibiting acetylcholinesterase enzymes. These include Sarin (GB), Tabun (GA), Soman (GD), and VX.
Transmission:	In a gas or aerosol state, exposure is primarily through the respiratory tract, but can also be absorbed through eyes or skin. In a liquid state, they can be ingested or absorbed through the skin.
Signs and symptoms:	<p>Signs and symptoms vary, depending on the route and level of exposure. Signs of aerosol exposure include pinpoint pupils (miosis), increased secretions, hyper-salivation, bronchoconstriction, respiratory arrest, diarrhea, decreased memory and concentration; and loss of consciousness.</p> <p>Symptoms from moderate aerosol exposure include diffuse muscle cramping, runny nose, dimmed vision, difficulty breathing, muscle tremors, sweating, and eye pain. (Note: Ocular findings may not be present in dermal exposure to liquids. Local sweating would be more pronounced on skin with liquid exposure).</p> <p>Symptoms of high-level aerosol exposure include the above, plus sudden loss of consciousness, seizures, and flaccid paralysis (late sign). Onset from aerosols is seconds to minutes; from liquids, the onset is minutes to hours.</p>
Protective measures:	Persons whose clothing or skin is contaminated with nerve agent can secondarily contaminate response personnel by direct contact or through off-gassing vapor. Removing patient clothing will eliminate any trapped gases, reducing risk of secondary contamination. Personal Protective Equipment (PPE) includes Powered-Air Purifying Respirator, chemical-resistant suit, gloves, and boots.
Evaluation:	Lab tests for confirmation only. Red blood cell or serum cholinesterase; whole blood (purple top tube).
Prophylaxis:	Appropriate PPE to avoid secondary contamination.
Treatment:	Supportive medical care. Antidotes are critical to treating a nerve agent victim. Mark I kits contain one auto-injector of atropine 2mg and one auto-injector of pralidoxime chloride (2-PAM Cl) 600mg. Diazepam is administered to actively seizing patients. A slurry of activated charcoal may be given to an alert patient after ingesting a nerve agent.

Emergency Medical Services and Preparedness Section
24/7 Emergency Contact Number: 1-888-295-5156
Contact Number: 302-223-2999



Reporting: Report suspect cases immediately to the Division of Public Health: 1-888-295-5156 (24/7 coverage).

Additional information: Visit the Agency for Toxic Substances and Disease Registry website: <https://www.atsdr.cdc.gov/>.

Table 1: Recommendations for Nerve Agent Therapy — Prehospital Management

Patient Age	Antidotes ¹		Other Treatment
	Mild/Moderate Symptoms ²	Severe Symptoms ³	
Infant (0 - 2 years)	Atropine: 0.05 mg/kg IM; 2-PAM Cl: 15 mg/kg IM	Atropine: 0.1 mg/kg IM; 2-PAM Cl: 25 mg/kg IM	<p>Assisted ventilation should be started after administration of antidotes for severe exposures.</p> <p>Repeat atropine (2 mg IM) at five-to-10-minute intervals until secretions have diminished and breathing is comfortable or airway resistance has returned to near normal.</p>
Child (2 - 10 years)	Atropine: 1 mg IM; 2-PAM Cl: 15 mg/kg IM	Atropine: 2 mg IM; 2-PAM Cl: 25 mg/kg IM	
Adolescent (>10 years)	Atropine: 2 mg IM; 2-PAM Cl: 15 mg/kg IM	Atropine: 4 mg IM; 2-PAM Cl: 25 mg/kg IM	
Adult	Atropine: 2 to 4 mg IM; 2-PAM Cl: 600 mg IM	Atropine: 6 mg IM; 2-PAM Cl: 1800 mg IM	
Elderly, frail	Atropine: 1 mg IM; 2-PAM Cl: 10 mg/kg IM	Atropine: 2 to 4 mg IM; 2-PAM Cl: 25 mg/kg IM	

¹**2-PAMCl solution needs to be prepared** from the ampule containing one gram of desiccated 2-PAMCl: inject 3 ml of saline, 5% distilled or sterile water into ampule and shake well. Resulting solution is 3.3 ml of 300 mg/ml.

²**Mild/Moderate symptoms** include localized sweating, muscle fasciculations, nausea, vomiting, weakness, dyspnea.

³**Severe symptoms** include unconsciousness, convulsions, apnea, flaccid paralysis.

Source: Medical Management Guidelines for Nerve Agents: Tabun (GA); Sarin (GB); Soman (GD); and VX: <https://wwwn.cdc.gov/TSP/MMG/MMGDetails.aspx?mmgid=523&toxid=93>.

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