I. MARK I / DuoDote Kits (Atropine and 2-PAM Auto-Injectors)

1. Initiate General Patient Care.

2. Presentation

a) Nerve agents are a group of highly toxic chemicals that may be released in a WMD event. These agents act to inhibit cholinesterase, and therefore prolong the effects of acetylcholine. These agents are potent, long acting, and all bind to acetylcholine irreversibly unless an oxime is given.

b) Nerve agents include Tabun (GA), Sarin (GB), Soman (GD) and GF. There are also V agents such as VX.

c) The G-type agents evaporate (become vapor) or may be dispersed in the air by weapons. When a person inhales this vapor, effects begin within seconds to minutes.

d) The V-type agents are oily and evaporate very slowly. They persist on the ground, foliage, etc., for long periods. Exposure to this liquid on the skin causes effects to start as soon as 10 minutes or as long as 18 hours after contact. The vapor hazard from these is not as great as from the G-type agents.

e) Many insecticides currently in use are organophosphates and are chemically related to nerve agents. The organophosphate insecticides may have a slower onset and a longer lasting effect compared with nerve agents.

f) Characteristic signs and symptoms may identify nerve agent poisoning. After vapor exposure, early manifestations of poisoning occur in the eyes, nose, and airway. With liquid/dermal contact exposure, early manifestations occur in the skin and the GI tract. Thus, when looking at the chart below, consider the mechanism of release and the associated signs and symptoms (refer to the chart below with the mnemonic P-SLUDGE-MC). (NOTE: This mnemonic is used for all organophosphate toxicity. Pupillary response occurs only with vapor exposure and will not be seen unless there is direct liquid contact with the eye. Urinary incontinence is also very rare.)

Nerve Agents
Signs and Symptoms of Chemical Agents

			Vapor Exposure	Liquid Exposure
	P -	Pinpointing pupils	✓	Not Seen
	S -	Salivation	✓	Not Seen
Mild	**L -**	Lacrimation (tearing)	✓	Not Seen
Severe	**U -**	Urination	✓	✓
	D -	Defecation	✓	✓
	G -	Gastrointestinal; pain/gas	✓	✓
	E -	Emesis (vomiting)	✓	✓
	M -	Muscle twitching	✓	✓
	C -	Convulsions	✓	✓
	B -	Bradycardia	✓	✓
	B -	Bronchospasm	✓	✓
	B -	Bronchorrhea	✓	✓

g) EMS providers must know the following MILD, MODERATE, and SEVERE signs and symptoms of nerve agent poisoning. When providers recognize most or all of the symptoms listed below, they must IMMEDIATELY receive treatment (first aid or buddy aid).
   (2) MILD poisoning (self-aid). Casualties with mild symptoms may experience most or all of the following:
      (a) Unexplained runny nose
      (b) Unexplained sudden headache
      (c) Sudden drooling
      (d) Difficulty in seeing (dimness of vision, constricted pupil)
      (e) Tightness in the chest or difficulty in breathing
      (f) Wheezing and coughing
      (g) Localized sweating and muscular twitching in the area of the contaminated skin
      (h) Stomach cramps
      (i) Nausea without vomiting
   (2) MODERATE effects would be the above, but also include more severe effects such as diarrhea, moderate to severe difficulty breathing, and some skeletal-muscular twitching/fasciculations. The progression of symptoms from mild to moderate indicates either inadequate treatment or continuing exposure to the nerve agent.
   (3) SEVERE symptoms. Providers with severe symptoms will not be able to treat themselves and must receive prompt buddy aid and medical treatment. Casualties with severe symptoms may experience most or all of the MILD symptoms plus most or all of the following:
      (a) Impaired thinking
      (b) Increasing wheezing and increased difficulty breathing
      (c) Severe pinpoint pupils
      (d) Red eyes with tearing
      (e) Vomiting
      (f) Severe muscular twitching and general weakness
      (g) Involuntary defecation
      (h) Convulsions
      (i) Unconsciousness
      (j) Respiratory Failure
      (k) Bradycardia
h) Prevention of Poisoning
   (1) In the setting of an exposure to a nerve agent, the most rapid absorption occurs through the respiratory tract. When it is suddenly determined that providers are in the “hot zone,” do not look for the invisible vapor cloud. Providers should hold their breath until they don and clear their breathing apparatus or protective masks. Once masked, a provider will then give the alarm to other providers. This may be done with hand signals or through the mask. If a fellow provider is severely poisoned with altered consciousness in the hot zone, the initial, less-poisoned masked provider should mask the casualty.

(2) When the masked casualty is severely poisoned after exposure to vapor and liquid, they should be decontaminated by removing clothing, blotting the agent (if a liquid exposure), and diluting the agent by using a flush with large amounts of water. Decontamination should be done as soon as possible, but it will usually occur in the warm zone or a safe area.
(3) When treating a severely poisoned casualty, the treating provider should take care to avoid exposure to the liquid agent (which could occur when kneeling next to the casualty). Squatting next to the casualty while masking or treating him/her will help the caregiver to avoid exposure to liquid nerve agent.
(4) Do not administer nerve agent antidotes before actual exposure to nerve agents or development of clinical symptoms occurs. Nerve agent antidotes may degrade performance in the hot zone (creating a heat-stressed provider) and should be administered only when symptoms and signs of nerve agent poisoning are present.

3. Treatment

a) The ABC priorities of prehospital treatment require modification to AABCs (Antidote then ABCs). The antidote (Atropine and 2-PAM) should be given as soon as possible, because toxic exposure to the nerve agent will make ventilation difficult. If the antidote is not immediately available, prevent further exposure to the nerve agent, provide ABC support, and evacuate the patient to an area where the antidote is available.
b) Based on signs and symptoms in a mass casualty incident (MCI) or on-site chemical testing that confirms nerve or organophosphate agent presence in a mass casualty incident, a certified EMR or EMT may administer MARK I/DuoDote kits (up to total of three kits) as buddy care to public safety personnel or when directed to do so by an ALS provider. The midazolam 5 mg or diazepam 10 mg auto-injector (CANA) can only be administered by an ALS provider when three MARK I/DuoDote kits are administered in a severe exposure. Medical consultation is not required in these situations.

Adult Doses

MILD EXPOSURE: miosis, rhinorrhea, increased salivation, nausea

1 dose IM DuoDote® or Mark I kit (atropine 2 mg and pralidoxime chloride 600 mg)

MODERATE EXPOSURE: miosis, rhinorrhea, short of breath and/or vomiting and diarrhea

2 doses IM (one after another) DuoDote® or Mark I kit

SEVERE EXPOSURE: respiratory distress, respiratory arrest, cyanosis, extreme SLUDGE (salivation, lacrimation, urination, defecation, gastrointestinal distress, and emesis) seizures, unconsciousness, bronchorrhea, bronchospasm, bradycardia

3 doses IM (one after another) DuoDote® or Mark I kit and 1 dose Diazepam 10 mg IM or 5-10 mg IV

If MILD or MODERATE symptoms progress in the face of treatment, administer additional DuoDotes® or Mark I kits for a total of 3 kits.

MILD EXPOSURE

Pediatric Doses for Nerve Agent Exposure

Mild Exposure (AtroPen® only)

Wt. (kg)	Initial AtroPen® Dose[1]	Repeat AtroPen® Dose[1]
4-6	0.5 mg	0.5 mg
7-13	0.5 mg	1 mg
14-22	1 mg	2 mg
23-26	1 mg	2.5 mg
27-33	1.5 mg	3 mg
Over 33	0.05 mg/kg	0.1 mg/kg

May repeat every 5 minutes until secretions begin to dry or maximum 6 mg IM.

Color coding and unit amount for Pediatric AtroPens®

	0.5 mg auto-injector (blue)
	1 mg auto-injector (red)

[1] Atropine auto-injectors (AtroPen®) from CHEMPACK caches come in 0.5 mg and 1 mg devices. Initial dosage based off of 0.05 mg/kg; repeat dosage based off of 0.1 mg/kg.

MODERATE EXPOSURE

Pediatric Doses for Nerve Agent Exposure

Moderate Exposure

Wt. (kg)	Atropine[2]	Repeat Dosing		2PAM Chloride[3] 600 mg in 20 mL Multi-dose vial (50 mg/kg)
	AtroPen® Dose (IM only)	Multi-dose vial (0.1 mg/kg) (IM or IV)	Repeat AtroPen® Dose	
4	0.5 mg	0.4 mg	1 mg	200 mg
7	0.5 mg	0.7 mg	1 mg	350 mg
9	0.5 mg	0.9 mg	1 mg	450 mg
10	0.5 mg	1 mg	1 mg	500 mg
13	1 mg	1.3 mg	1 mg	650 mg
17	1 mg	1.7 mg	2 mg	850 mg
21	1 mg	2.1 mg	2 mg	1,050 mg (1,000 mg IV)
26	1.5 mg	2.6 mg	2.5 mg	1,300 mg (1,000 mg IV)
33	1.5 mg	3.3 mg	3 mg	1,650 mg (1,000 mg IV)
Over 33	0.05 mg/kg	0.1 mg/kg	0.1 mg/kg	50 mg/kg

May repeat every 5 minutes until secretions begin to dry or maximum 6 mg IM.

[2] Atropine auto-injectors (AtroPen®) from CHEMPACK caches come in 0.5 mg and 1 mg devices. Initial dosage based off of 0.05 mg/kg; repeat dosage based off of 0.1 mg/kg.

[3] 2PAM Chloride is supplied in 1 gram in 20 mL. This must be reconstituted in sterile water. See the back page for additional information.

Edition Date July 1, 2019

SEVERE EXPOSURE – PREFERRED TREATMENT

Pediatric Doses for Nerve Agent Exposure

Use only one of these modalities.
There are two treatment modalities for severe exposure:
1. Treatment with DuoDote®/Mark I auto-injectors
2. Treatment with atropine and 2PAM supplied in vials.

1. Severe Exposure Treated with DuoDote®/Mark I

SEVERE EXPOSURE: respiratory distress, respiratory arrest, cyanosis, extreme SLUDGE (salivation, lacrimation, urination, defecation, gastrointestinal distress, and emesis) seizures, unconsciousness, bronchorrhea, bronchospasm, bradycardia

In severe exposures, DuoDote® or Mark I kit can be given to any child, regardless of age or weight, as the initial antidote therapy when no other atropine or pralidoxime source is available.

Treatment for severe exposure with DuoDote®/Mark I

- **Children up to 21 kg, administer 1 DuoDote® or 1 Mark I kit.**
- **Children 22 to 33 kg, administer 2 DuoDote® or 2 Mark I kits.**
- **Over 33 kg, see adult dosage (page 1).**

Diazepam if Seizing

- **0.2 mg/kg, IV preferred route, but can also administer IM.**

SEVERE EXPOSURE

Pediatric Doses for Nerve Agent Exposure

Use only one of these modalities.
There are two treatment modalities for severe exposure:

1. Treatment with DuoDote®/Mark I auto-injectors
2. Treatment with atropine and 2PAM supplied in vials.

2. Severe Exposure Treated with Atropine and 2PAM (Diazepam if seizing)

Wt. (kg)	Atropine		Repeat Atropen® Dose[4]	2PAM Chloride[5] 600mg	Diazepam[6] Multi-dose vial IV or IM
	AtroPen® dose[4] (IM Only)	Multi-dose vial (IM or IV)		Multi-dose 50 mg/kg IV	0.2 mg/kg
4	0.5 mg	0.4 mg	0.5 mg	200 mg	0.8 mg
7	1 mg	0.7 mg	1 mg	350 mg	1.4 mg
9	1 mg	0.9 mg	1 mg	450 mg	1.8 mg
10	1 mg	1.0 mg	1 mg	500 mg	2.0 mg
13	1.5 mg	1.3 mg	1.5 mg	650 mg	2.6 mg
17	1.5 mg	1.7 mg	1.5 mg	850 mg	3.4 mg
21	2 mg	2.1 mg	2 mg	1,050 mg (1000 mg IV)	4.2 mg
26	3 mg	2.6 mg	3 mg	1,300 mg (1000 mg IV)	5.2 mg
33	3 mg	3.3 mg	3 mg	1,650 mg (1000 mg IV)	6.6 mg
Over 33	0.1 mg/kg	0.1 mg/kg	0.1 mg/kg	50 mg/kg	0.2 mg/kg

[4] Atropine auto-injectors (AtroPen®) in CHEMPACK caches come in 0.5 mg and 1 mg devices. Multi-dose vials can provide closer to ideal dosages, if available.

[5] Initial dose if only atropine has been given or repeat dose (60 minutes after initial DuoDote®/Mark I).

[6] IV preferred route but can administer IM, if no IV available. May repeat one time in 5 minutes; maximum total pediatric dose 5 mg all routes.

Use of Vial Medications - Instructions

Atropine 0.4 mg/mL in 20 mL

Adult dose: draw up medication in 5 mL syringe (2 mgs) for initial dose of 2 mgs.

Pediatric dose: determine dose based on chart above and draw up medication in 3, 5, or 10 mL syringe as indicated.

2PAM Chloride (Pralidoxime) 1 gm in 20 mL

For IV administration: Pralidoxime vials contain medication in a powder form. Draw up 20 mL of sterile water for injection and add to the 1 gm container of Pralidoxime; this results in a 50 mg/mL concentration.

For INTRAMUSCULAR injection: Reconstitute a single 1 gm vial adding 3.3 mL of sterile water for injection; this results in a concentration of 300 mg/mL. Do not exceed 2 mL per IM injection.

Adult dose: Draw up medication in 20 mL syringe for initial dose of 1 gm IVP (600 mg in 2 mL if IM).

Pediatric dose: Determine dose based on chart above and draw up medication (from 20 mL syringe containing reconstituted medication) in a 3, 5, 10, or 20 mL syringe as indicated. Dose is based on 50 mg/kg. Maximum 2 mL per injection.

Diazepam 5 mg/mL in 10 mL

Adult dose: draw up 1 mL in 1 or 3 mL syringe for IM administration for initial dose of 10 mg IM for patient who has active seizures. If IV is available, administer 2.5-10 mg IVP.

Pediatric dose: determine dose based on chart above and draw up medication in 1 or 3 mL syringe as indicated. Dose is based on 0.2 mg/kg IV or IM.