

TOXICOLOGY AND SUBSTANCE

ABUSE

Primary Care Paramedicine

Module: 20

Section: 01



- Introduction
- Routes of toxic exposure
- Assessment and management
- Ingested toxins
- Inhaled toxins
- Surface-absorbed toxins
- Surface toxins
- Injected toxins
- Substance abuse and overdose

- Toxicology
 - Study of toxins (drugs and poisons) and antidotes and their effects on living organisms
- Poisoning
 - Exposure to non-pharmacological substances (for this discussion)
- Overdose
 - Exposure to pharmacologic substances
 - Intentional or unintentional

- 10% of ED visits and EMS responses involve toxic exposures.
- 70% of accidental poisonings occur in children under 6 years old.
- A child experiencing an accidental ingestion has a 25% chance of similar ingestion within the next year
- 80% of attempted suicides involve a drug overdose.



- Setup across Canada and the United States
 - Assist in treatment
 - Provide information on new products
- Accessed by phone
- Advantages
 - Determine potential toxicity
 - Most current definitive treatment can occasionally be started in the field

- In order to have a destructive effect, poisons must gain entrance into the body
- Effects can be immediate and delayed

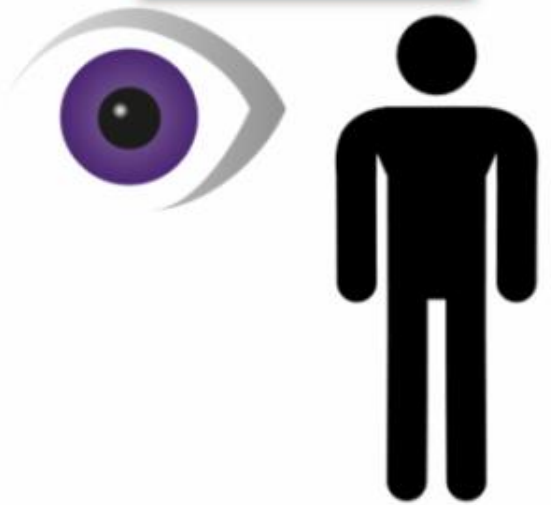
Inhalation



Ingestion



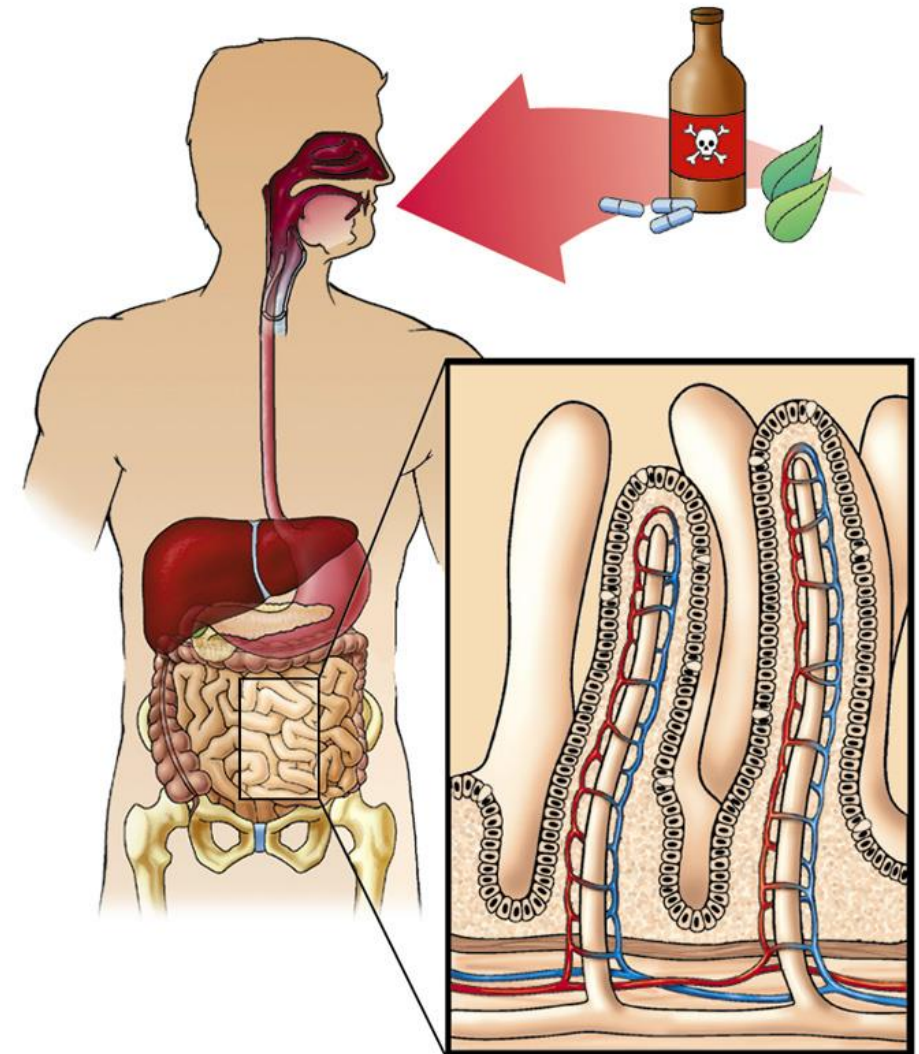
Absorption



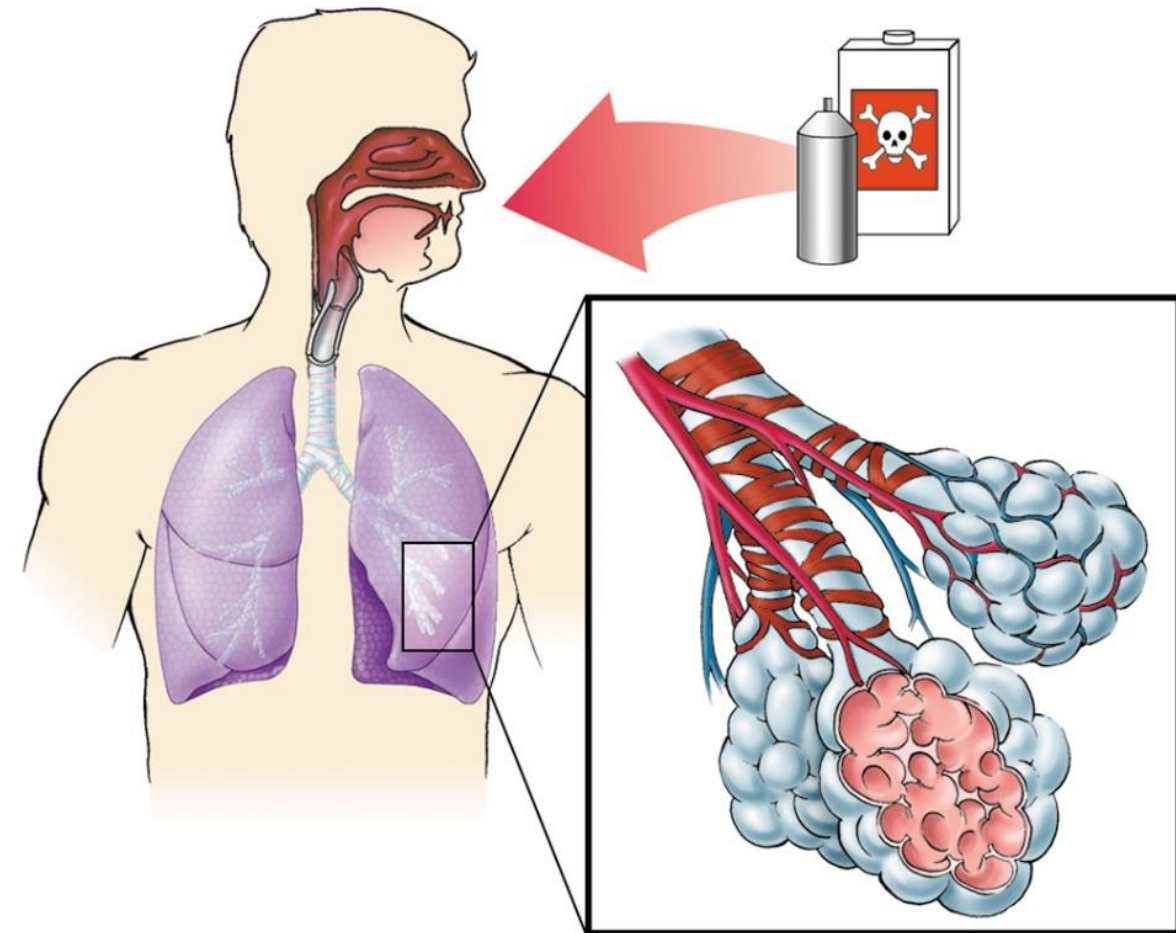
Injection



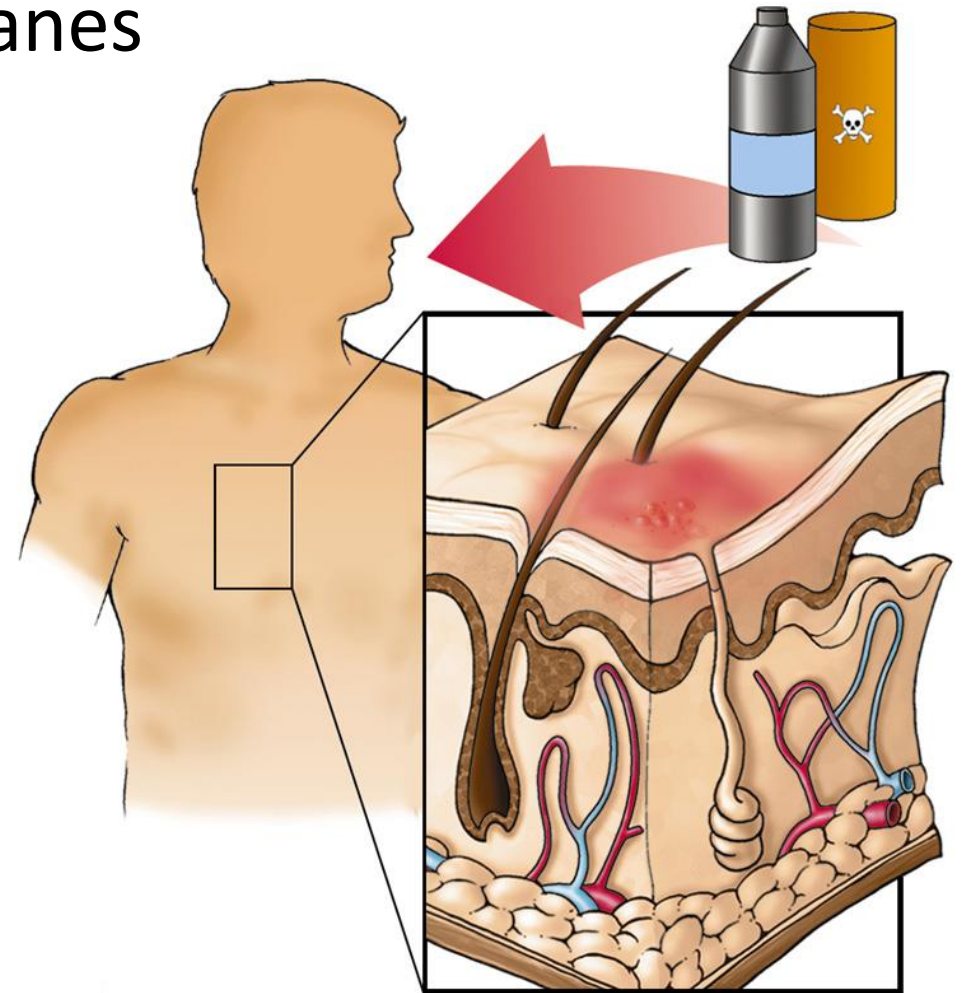
- Most common route of entry
- Absorption occurs in GI tract
 - Household products
 - Petroleum-based agents
 - Cleaning agents
 - Cosmetics
 - Drugs, plants or foods



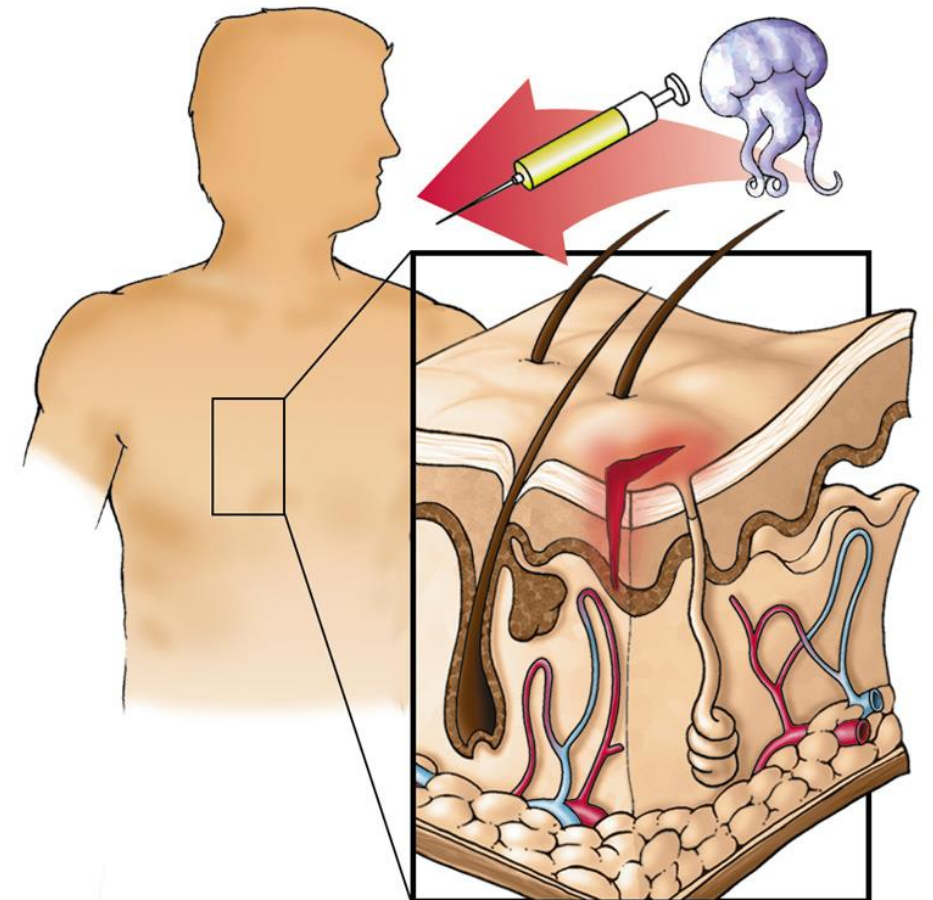
- Absorption through alveolar-capillary membrane
- Inhaled toxins
 - Irritate pulmonary passages
 - Edema
 - Tissue destruction
 - Systemic effects



- Entry through skin or mucous membranes
- Contact with poisonous plants
- Pesticides
 - Organophosphates



- Toxins enter directly into body through a break in the skin
- Local and systemic effects
- Animal and insect bites
- Licit and illicit drugs

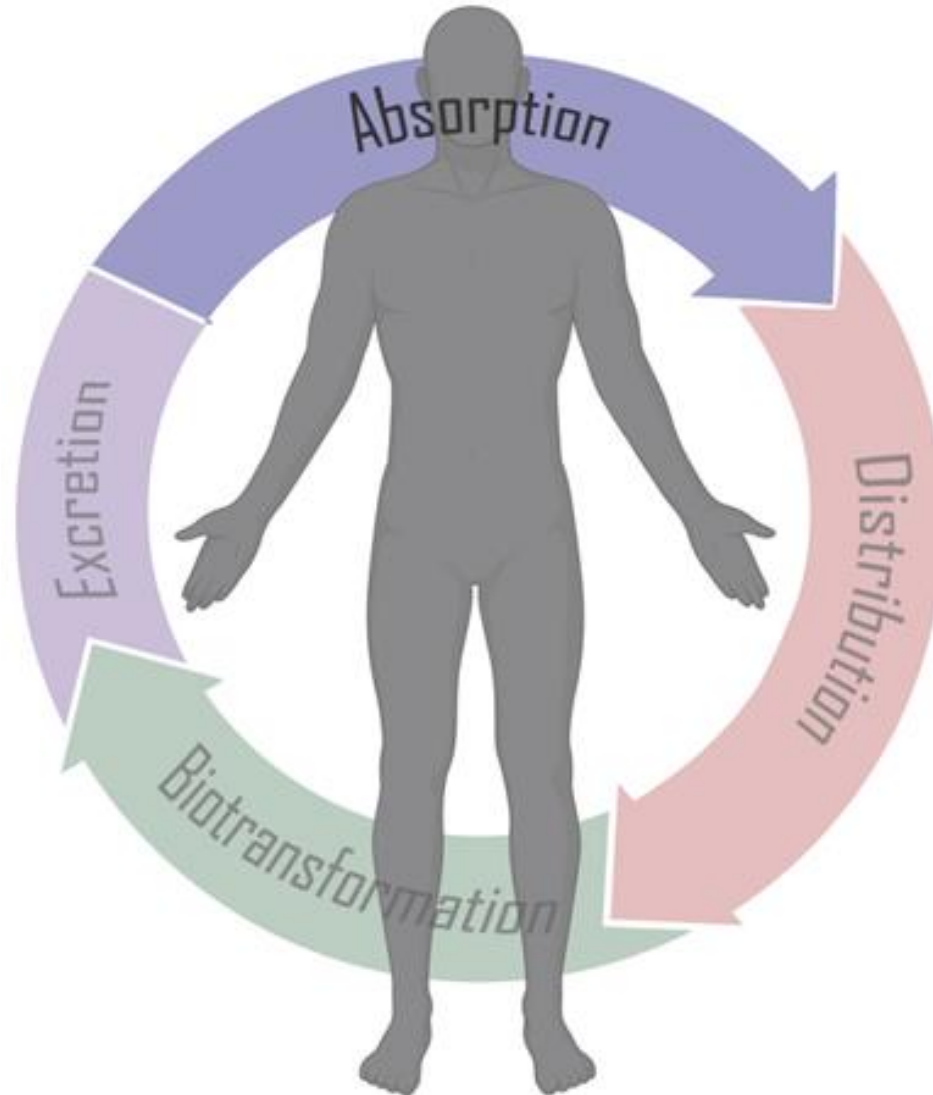


Distribution

- Once absorbed it passes into the blood and distributes throughout the body.

Absorption

- The process how the chemical enters the body.
- Speed depends on route, concentration, duration of exposure.



Excretion

- Many chemicals are not metabolized and are just eliminated.
- The liver excretes nonpolar metabolites into the bile, kidneys eliminate polar water soluble metabolites into the urine.

Biotransformation

- Typically taking place in the liver and involves anabolism (building metabolism) and catabolism (degrading metabolism)

- Recognize a poisoning promptly
- Assess the patient thoroughly to
 - Identify the toxin
 - Measures required to control it
- Initiate standard treatment procedures
 - Protect rescuer safety
 - Remove the patient from the toxic environment
 - Support ABCs
 - Decontaminate the patient
 - Administer antidote if one exists

- Scene assessment
 - Be alert to the potential for violence
 - Look for signs of hazardous-material involvement
 - Enter a hazardous-materials scene only if properly trained and equipped to do so
- Primary assessment
 - Airway and respiratory compromise are common
 - Manage life-threatening conditions

- History, physical exam, and ongoing assessment
 - Identify the toxin and length of exposure.
 - Contact poison control and medical direction according to local policy.
 - Complete appropriate physical exams.
 - Monitor vital signs closely.

General Management

- Initiate supportive treatment
- Decontamination
 - Reduce intake of the toxin
 - Remove the individual from the toxic environment
 - Reduce absorption of toxins in the body
 - Use gastric lavage and activated charcoal
- Enhance elimination of the toxin
 - Use cathartics

General Management

- Suicidal patients and protective custody
 - Beware of the patient who was “just kidding”
 - Consider medical, legal and ethical ramifications
 - Involve law enforcement

- Useful only if the substance is known
- Rarely 100% effective
- Used in conjunction with other therapies to ensure effectiveness

Table 34-1 ANTIDOTES FOR TOXICOLOGICAL EMERGENCIES

Toxin	Antidote	Adult Dosage (Pediatric Dosage)
Acetaminophen	N-Acetylcysteine	Initial: 140 mg/kg
Arsenic	see Mercury, Arsenic, Gold	
Atropine	Physostigmine	Initial: 0.5–2 mg IV
Benzodiazepines	Flumazenil	Initial: 0.2 mg q 1 min to total of 1–3 mg
Carbon Monoxide	Oxygen	
Cyanide	Amyl nitrite	Inhale crushed pearl for 30 seconds, then oxygen for 30 seconds
	then sodium nitrite	10 mL of 3% sol'n over 3 min IV (Pediatric: 0.33 mL/kg)
	then sodium thiosulfate	50 mL of 25% sol'n over 10 min IV (Pediatric: 1.65 mL/kg)
Ethylene glycol	Fomepizole (or as methyl alcohol)	Initial: 15 mg/kg IV
Gold	see Mercury, Arsenic, Gold	
Iron	Deferoxamine	Initial: 10–15 mg/kg/hr IV
Lead	Edetate calcium disodium or Dimercaptosuccinic acid (DMSA)	1 amp/250 mL D5W over 1 hr 250 mg PO
Mercury, Arsenic, Gold	BAL (British anti-Lewisite) DMSA	5 mg/kg IM 250 mg PO
Methyl alcohol	Ethyl alcohol +/- dialysis	1 mL/kg of 100% ethanol IV
Nitrates	Methylene blue	0.2 mL/kg of 1% sol'n IV over 5 min
Opiates	Naloxone	0.4–2.0 mg IV
Organophosphates	Atropine	Initial: 2–5 mg IV
	Pralidoxime (Protopam)	Initial: 1 g IV

Classification

- Narcotic antagonist

Mechanism of Action

- Displaces opioids from receptors, reversing the effects of narcotic overdose

Indications

- Decrease LOC and/or respiratory depression in a suspected opioid OD (unable to manage A/W with BLS skills)



Contraindications

- Hypersensitivity

Dosage

- Adult
 - 0.4 – 2.0 mg IV/IN/IM/SC q 2 – 3 min PRN
- Pediatric
 - 0.1 mg/kg IV/IN/IM/SC q 2 – 3 min PRN max 2.0 mg



- A group of signs and symptoms consistently associated with a particular toxin
 - Similar toxins typically have similar signs and symptoms
 - In some cases it may be difficult to identify a specific toxin
- Major toxidromes:
 - Narcotics
 - Cholinergics
 - Anticholinergics
 - Sympathomimetics
 - Stimulants
 - Sedative-hypnotics

Table 36-1**Major Toxidromes**

Toxidrome	Drug Examples	Signs and Symptoms
Narcotic (opiate and opioid)	Heroin, opium, morphine, hydromorphone (Dilaudid), fentanyl and its analogues, oxycodone-aspirin combination (Percodan)	Constricted (pinpoint) pupils, marked respiratory depression, needle tracks (intravenous drug abusers), drowsiness, stupor, coma
Cholinergic	Organophosphates, diazinon, orthene, parathion, sarin, tabun, VX	DUMBELS (diarrhea, urination, miosis and muscle weakness, bradycardia/bronchospasm/bronchorrhea, emesis, lacrimation, salivation), respiratory depression, apnea, seizures, coma, tachycardia early with bradycardia as toxicity progresses
Anticholinergic	Atropine, scopolamine, antihistamines, antipsychotics, (tricyclic) antidepressants	Dry, flushed skin; hyperthermia; dilated pupils; blurred vision; tachycardia; mild hallucinations; dramatic delirium
Sympathomimetic	Pseudoephedrine, phenylephrine, phenylpropranolamine, amphetamine, and methamphetamine	Hypertension, tachycardia, dilated pupils (mydriasis), agitation and seizures, hyperthermia
Stimulant	Amphetamine, methamphetamine, cocaine, diet aids, nasal decongestants	Restlessness, agitation, incessant talking, insomnia, anorexia, dilated pupils, tachycardia, tachypnea, hypertension or hypotension, paranoia, seizures, cardiac arrest
Sedative-hypnotic	Phenobarbital, diazepam (Valium), thiopental	Drowsiness, disinhibition, ataxia, slurred speech, mental confusion, respiratory depression, progressive central nervous system depression, hypotension



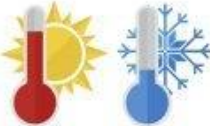













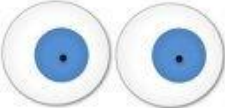






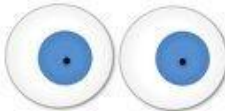
















Table 36-2**Common Signs and Symptoms of Poisoning**

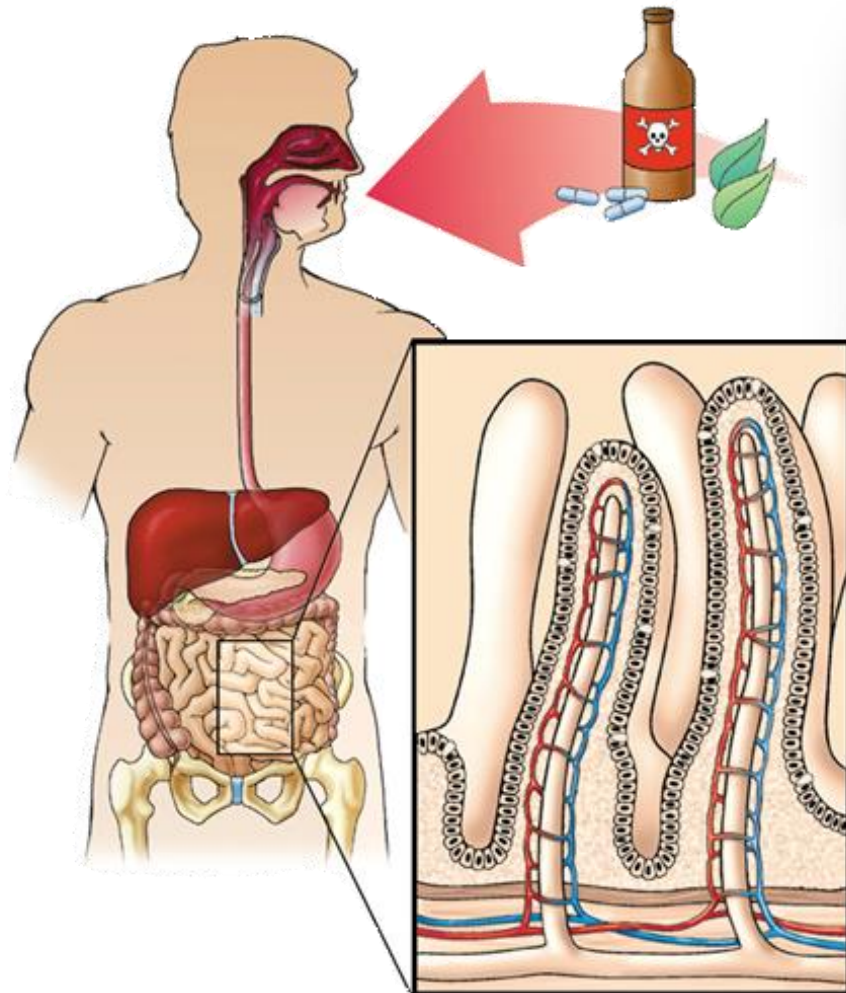
Sign or Symptom	Type	Possible Causative Agents
Odour	Bitter almonds Garlic Acetone Wintergreen Pears Violets Camphor Alcohol	Cyanide Arsenic, organophosphates, phosphorus Methyl alcohol, isopropyl alcohol, aspirin, acetone Methyl salicylate Chloral hydrate Turpentine Camphor Alcohol
Pupils	Constricted Dilated	Narcotics, organophosphates, jimsonweed, nutmeg Barbiturates, atropine, amphetamine, glutethimide, LSD, cyanide, CO
Mouth	Salivation Dry mouth Burns in mouth	Organophosphates, arsenic, strychnine, mercury, salicylates Atropine (belladonna), amphetamines, diphenhydramine (Benadryl), narcotics Formaldehyde, iodine, lye, toxic plants, phenols, phosphorus, pine oil, silver nitrate, acids
Skin	Pruritus Dry, hot skin Sweating	Jimsonweed, belladonna, boric acid Atropine (in belladonna), botulism, nutmeg Organophosphates, arsenic, aspirin, amphetamines, barbiturates, mushrooms, naphthalene
Respiratory	Depressed respirations Increased respirations Pulmonary edema	Narcotics, alcohol, propoxyphene, CO, barbiturates Aspirin, amphetamines, boric acid, cyanide, kerosene, methyl alcohol, nicotine Organophosphates, petroleum products, narcotics, CO

Sign or Symptom	Type	Possible Causative Agents
Cardiovascular	Tachycardia	Alcohol, amphetamines, arsenic, atropine, aspirin, cocaine, some antiasthma drugs
	Bradycardia	Digitalis, gasoline, nicotine, mushrooms, narcotics, cyanide, mistletoe, rhododendron
	Hypertension	Amphetamines, lead, nicotine, antiasthma drugs
	Hypotension	Barbiturates, narcotics, tranquilizers, house plants, mistletoe, nitroglycerin, antifreeze
Central nervous system	Seizures	Amphetamines, camphor, cocaine, strychnine, arsenic, CO, petroleum products, scorpion sting
	Coma	All depressant drugs (such as narcotics, barbiturates, tranquilizers, alcohol), CO, cyanide
	Hallucinations	Atropine, LSD, mushrooms, organic solvents, PCP, nutmeg
	Headache	CO, alcohol, disulfiram (Antabuse)
	Tremors	Organophosphates, CO, amphetamine, tranquilizers, poisonous marine animals
	Weakness or paralysis	Organophosphates, botulism, eel, hemlock, puffer fish, pine oil, rhododendron
Gastrointestinal	Cramps, nausea, vomiting, and/or diarrhea	Many, if not most, ingested poisons

Abbreviations: CO, carbon monoxide; LSD, lysergic acid diethylamide; PCP, phencyclidine.

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	HR & BP	Resp.	Temperature	Pupils	Bowel Sounds	Diaphoresis
						
Anticholinergic Anticholinergics – Atropine, scopolamine, glycopyrrolate, benzotropine, trihexyphenidyl Antihistamines – Chlorpheniramine, Cyproheptadine, Doxylamine, Hydroxyzine, Dimenhydrinate, Diphenhydramine, Meclizine, Promethazine	 	No change 		Dilated 		
Cholinergic Organic Phosphorous Compounds: Carbamates • Arecholine, Pilocarpine, Urecholine (Betanechol), Carbachol, Choline, Metacholine, Mushrooms	No change 	No change 	No change 	Pinpoint 		
Opioid Morphine • Codeine • Tramadol • Heroin • Meperidine • Diphenoxylate • Hydromorphone • Fentanyl • Methadone • Propoxyphene • Pentazocine • DXM • Oxycodone • Hydrocodone	 			Pinpoint 		
Sympathomimetic Caffeine, cocaine, amphetamines, methamphetamines, Ritalin, LSD, Theophylline, MDMA	 			Dilated 		
Sedative-Hypnotic anti-anxiety agents, muscle relaxants, antiepileptics and preanesthetic medications – Barbituates – Benzodiazepines	 			No change 		



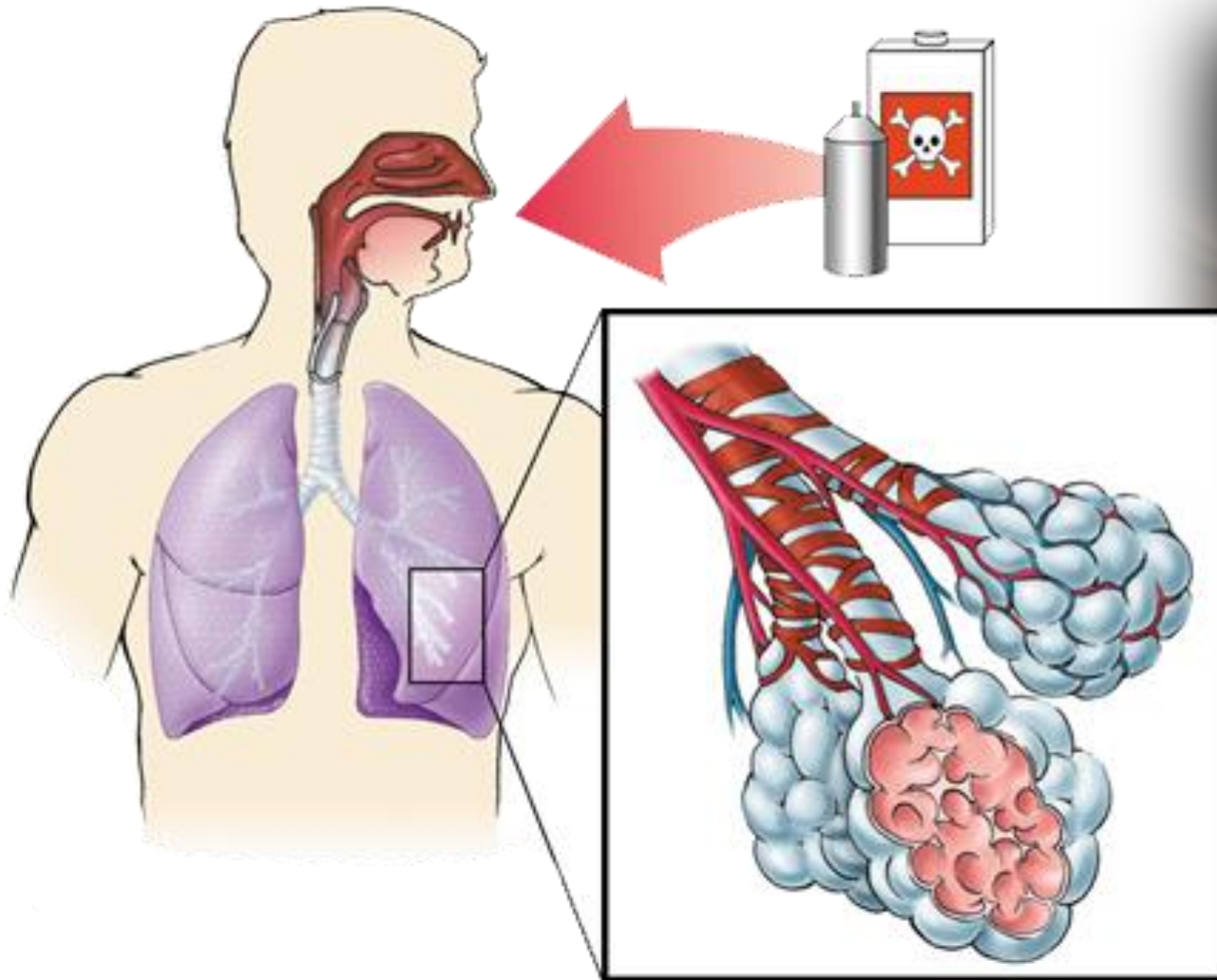
- What was ingested?
- When was it ingested?
- How much was ingested?
- Did you drink any alcohol?
- Have you attempted to treat yourself?
- Have you been under psychiatric care? Why?
- What is your weight?

- History often unreliable
 - Physical exam to confirm poisoning
 - Additional underlying illness
- Skin
 - Cyanosis, pallor, wasting, needle marks
- Eyes
 - Pupils, impaired vision, blurring or colouration of vision

- Mouth
 - Caustic ingestion, gag reflex, salivation, odours
- Chest
 - Aspiration, atelectasis, excessive pulmonary secretions
- Circulation
 - Dysrhythmias
- Abdomen
 - Pain pattern

Management

- Supportive ABCs
- Fluid administration
- Cardiac monitoring, vitals
- Medications
- As indicated, avoid coma cocktails
- Decontamination
- Do not induce vomiting
- Contact poison control and medical direction according to local protocol

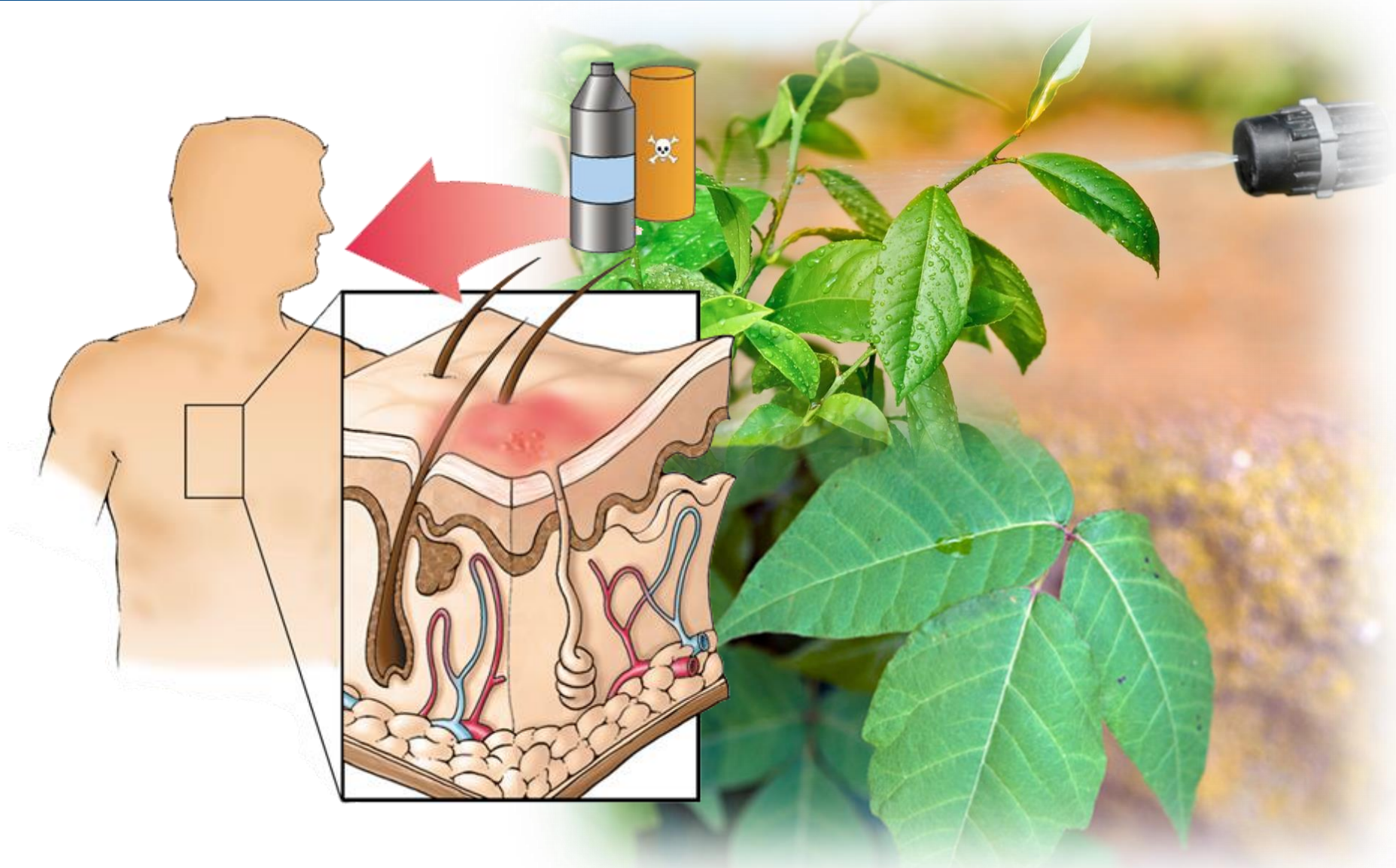


- Evaluate the scene
 - Safety, risk of exposure
 - Exposure produces respiratory symptoms
- Central nervous system
 - Dizziness, headache, confusion, seizure, hallucinations, coma
- Respiratory effects
 - Cough, hoarseness, stridor, dyspnea, retractions, wheezing, chest pain or tightness, rales, rhonchi
- Cardiac
 - Dysrhythmias

Management

- Ensure your personal safety
- Do not enter a hazardous scene unless properly trained and equipped to do so
- Remove the patient from the environment
- Remove the patient's contaminated clothing
- Initiate supportive measures
- Contact poison control and medical direction according to local protocol

Surface-Absorbed Toxins



- Ensure your personal safety
- Remove the patient from the environment
- Remove the patient's contaminated clothing
- Perform the initial assessment, history and physical exam
- Initiate supportive measures
- Contact poison control and medical direction according to local protocol

- Organophosphates and carbamate are commonly used in agriculture.
- Solid or liquid at room temperature and often mixed with xylene or toluene prior to use.
- Exposure typically inhalation, dermal or ingestion
- Both substances bind with acetylcholinesterase
 - Acetylcholinesterase inhibitors exerted at synapses of the nerve cells of the autonomic nervous system
 - Release of acetylcholine

Systemic manifestations (SLUDGE)

Salivation

Lacrimation

Urination

Diarrhea

Gastrointestinal distress

Emesis

Peripheral manifestations (DUMBELS)

Diarrhea

Urination

Miosis

Bradycardia

Bronchospasm

Excitation of skeletal muscle & CNS

Lacrimation

Salivation

Sweating

Management

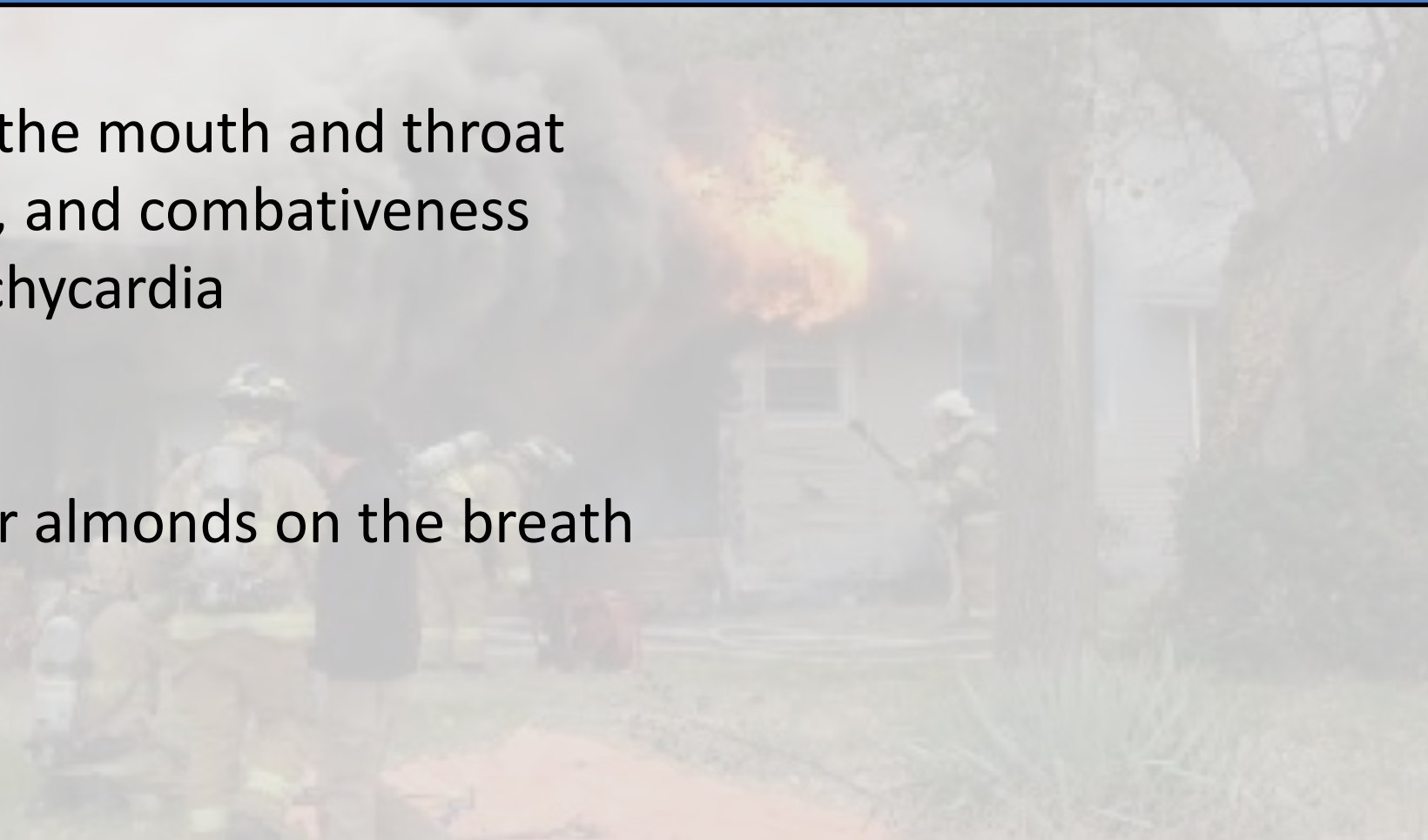
- Decontamination and removal of contaminated clothing (hazmat)
- PPE
- Scrub with soap and water.
- Establish and maintain an airway.
- Suction as needed.
- High-flow supplemental oxygen
- ALS support if available
 - May treat with Atropine for SLUDGE effects
 - May treat seizure, if any, with benzodiazepine

- Extremely fast acting
- Cellular asphyxiant
 - Inhibits enzyme vital to cellular use of oxygen
- Ingested or absorbed
 - Variety of commercial and household items
 - Burning plastics, silks or synthetics
 - Long term sodium nitroprusside therapy



Signs and Symptoms

- Altered mental state
- Burning sensation in the mouth and throat
- Headache, confusion, and combativeness
- Hypertension and tachycardia
- Seizures and coma
- Pulmonary edema
- Classic odour of bitter almonds on the breath



Management

- Remove the patient from the source of cyanide.
- Establish an airway and administer supplemental oxygen.
- Establish intravenous access.
- Administer antidote
 - Cyanide antidote kit: Containing amyl nitrite, sodium nitrite and sodium thiosulfate
 - Newer treatment: Hydroxocobalamin
 - For patients who are hypotensive, have altered mental status, or are in cardiac arrest
- Notify the receiving hospital.
- Contact your provincial Poison Centre.
- Ensure rescuer safety, initiate supportive care

- Odourless, colourless, tasteless gas
- More than 200 times affinity for hemoglobin as oxygen
 - Resistant to removal
 - Causes effective hypoxia
- Improperly vented heating systems
- Confined space



Signs and Symptoms

- Signs of cerebral hypoxia
 - Headache
 - Nausea and vomiting
 - Confusion or other altered mental status
- Tachypnea
- Early signs similar to the flu
 - Often ignored until highly toxic levels are reached
 - Beware of multiple patients who live together complaining of the flu

Management

- Remove the patient from the exposure.
- Establish and maintain the airway.
- Give high-flow oxygen.
- Maintain maximal inspired oxygen concentration.
- Establish vascular access.
- Keep the patient quiet and at rest.
- Monitor the ECG rhythm and LOC.
- Transport to your nearest medical facility.

- Be aware of the location of facilities with a hyperbaric chamber

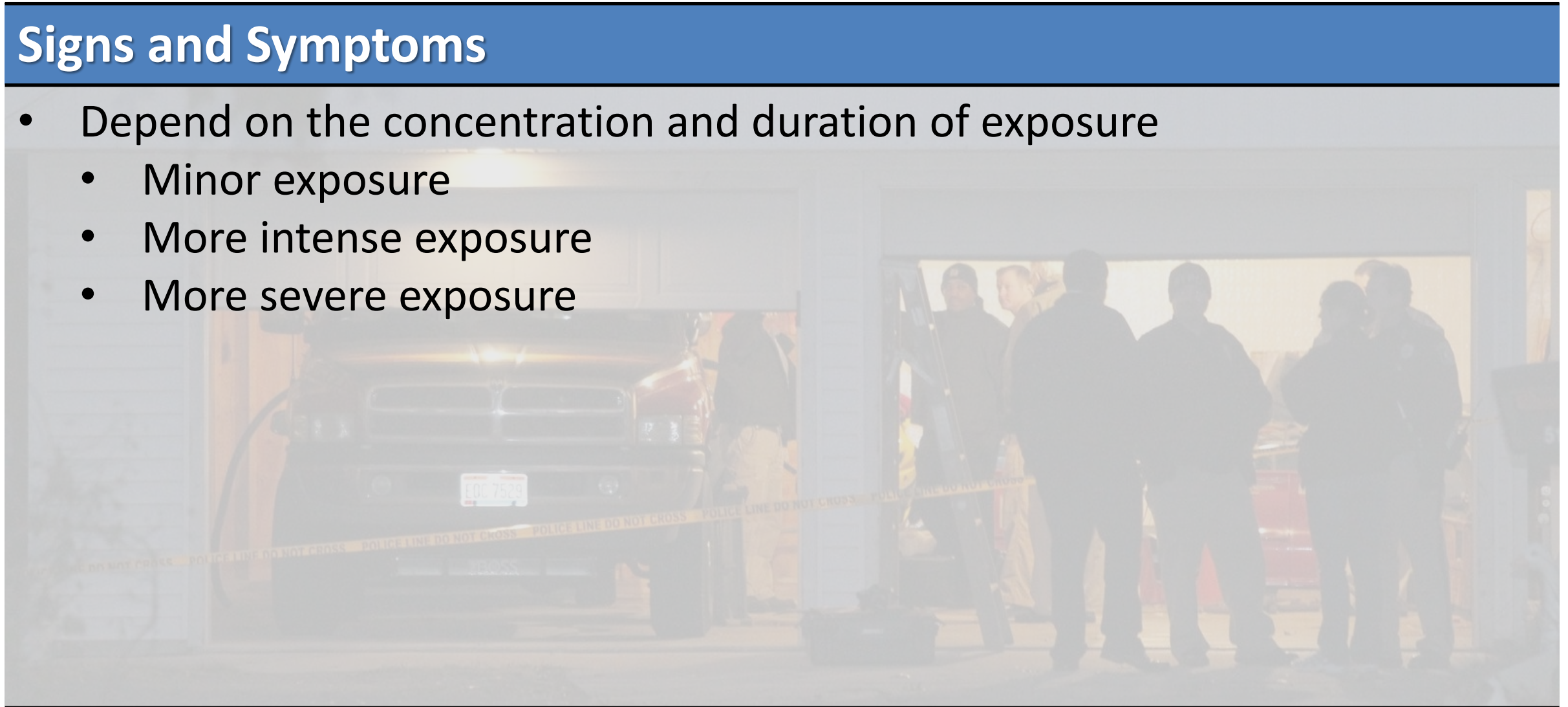


- Widespread use in the home and occupational settings
 - Household exposures due to mixing cleaning agents
 - Chlorination of large swimming pools
 - Leakage from an industrial storage tank, truck, or rail car



Signs and Symptoms

- Depend on the concentration and duration of exposure
 - Minor exposure
 - More intense exposure
 - More severe exposure



Management

- First priority is to remove the patient from the area of exposure.
- Take same precautions as hazmat situation.
- Triage patients.
- People with respiratory distress are priority patients.
- Nebulized bronchodilators may ease wheezing.
- Continuous positive airway pressure for patients with a significant exposure (noncardiogenic pulmonary edema)

- List of medications expanding daily
- Generally regulate heart function by:
 - Decreased heart rate
 - Suppress automaticity
 - Reduce vascular tone
- Overdoses usually accidental

Major classes of drugs

- Antiarrhythmics
- Beta blockers
- Calcium channel blockers
- Cardiac glycosides
- Combination

Signs and Symptoms

- Nausea and vomiting
- Headache, dizziness, confusion
- Profound hypotension
- Cardiac dysrhythmias
 - Especially bradycardias
 - Heart conduction blocks
- Bronchospasm, pulmonary edema
 - Especially beta blockers



Management

- Standard toxicological emergency procedures
- Presentations may not respond to standard therapies
 - Bradycardia may not respond to Atropine
- Antidotes for some medications

- Used in industry, agriculture, and the home
- Most involve accidental dermal or ocular exposure
- Occasionally oral ingestion
- Acid
 - E.g. plumbing liquid
 - Strong acid has a $\text{pH} < 2$
- Alkali
 - Solid or liquid form
 - Strong base has a $\text{pH} > 12.5$



Table 36-6 **Common Caustic Substances**

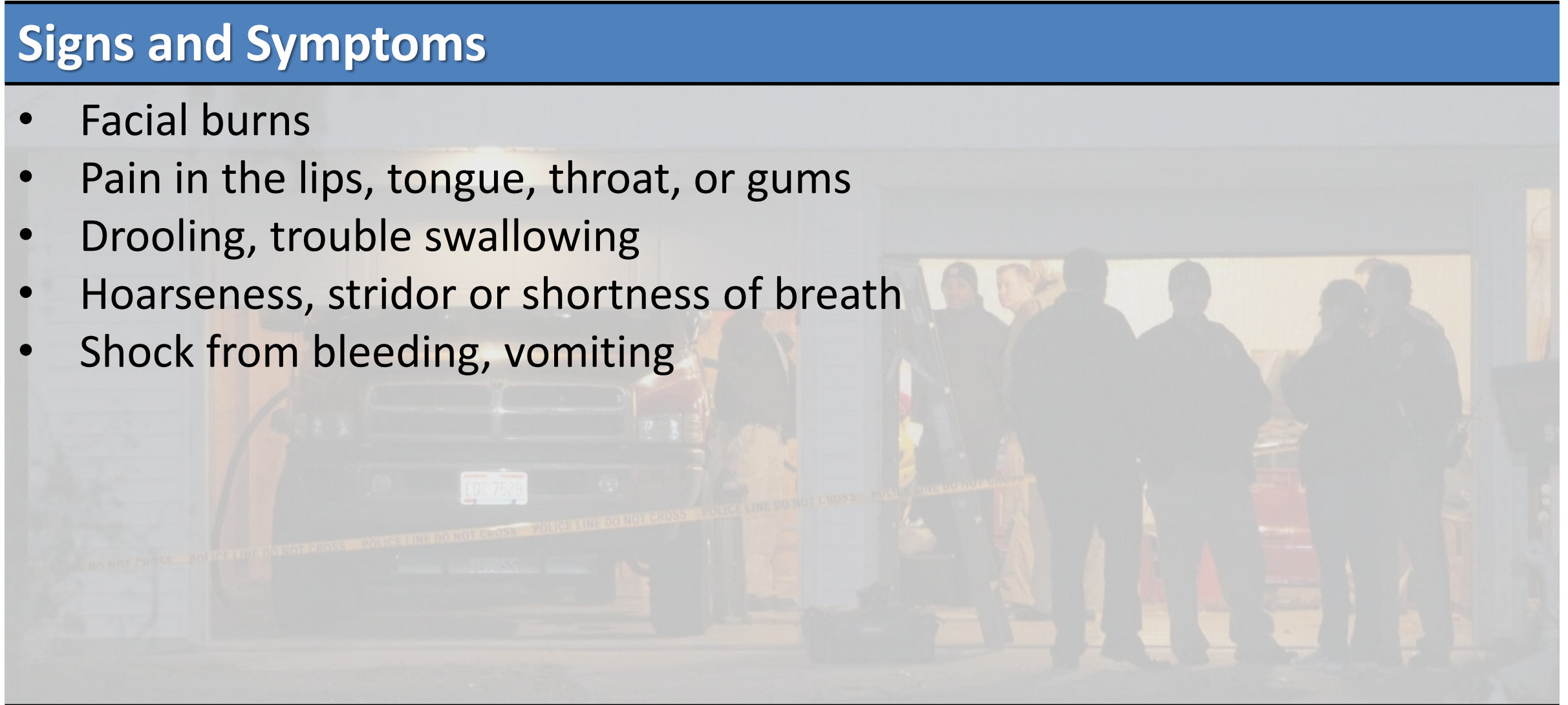
Substance	Example	Source
Acids	Hydrochloric acid	Toilet bowl cleaners, swimming pool cleaners
	Sulfuric acid	Battery acid, toilet bowl cleaners (as bisulfate)
	Others	Bleach disinfectants, slate cleaners
Alkalis	Lye (sodium or potassium hydroxide)	Paint removers, washing powders, drain cleaners (such as Drano, or Liquid-Plumr), button-shaped batteries, Clinitest tablets
	Sodium hypochlorite	Bleach (Clorox)
	Sodium carbonate	Bleach (Purex), nonphosphate detergents
	Ammonia	Hair dyes, jewellery cleaners, metal cleaners or polishes, antirust agents
	Potassium permanganate	Electric dishwasher detergents

- Contact
 - Immediate and severe pain
 - Tissue coagulation and necrosis
 - May produce eschar (prevents deeper burning)
- Ingestion
 - Local burns to mouth and throat
 - Stomach lining injured
 - Pain and spasm
 - Absorption may result in acidemia

- Contact
 - Liquifaction necrosis
 - Pain often delayed
 - Longer contact, deeper injury
- Ingestion
 - Solid agents often stick to mouth and esophagus
 - Liquids injure stomach
 - Complete loss of mucosal tissue in 2-3 days

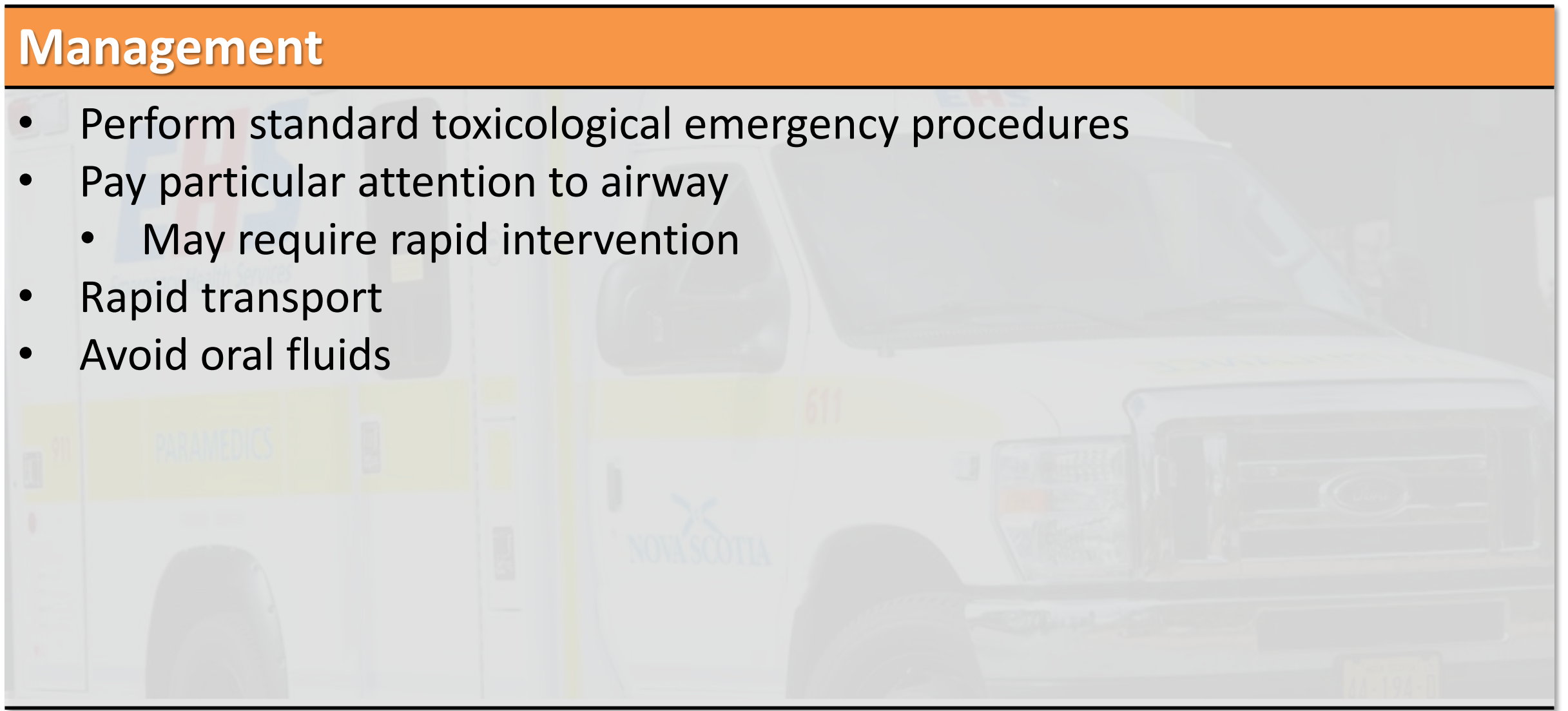
Signs and Symptoms

- Facial burns
- Pain in the lips, tongue, throat, or gums
- Drooling, trouble swallowing
- Hoarseness, stridor or shortness of breath
- Shock from bleeding, vomiting



Management

- Perform standard toxicological emergency procedures
- Pay particular attention to airway
 - May require rapid intervention
- Rapid transport
- Avoid oral fluids

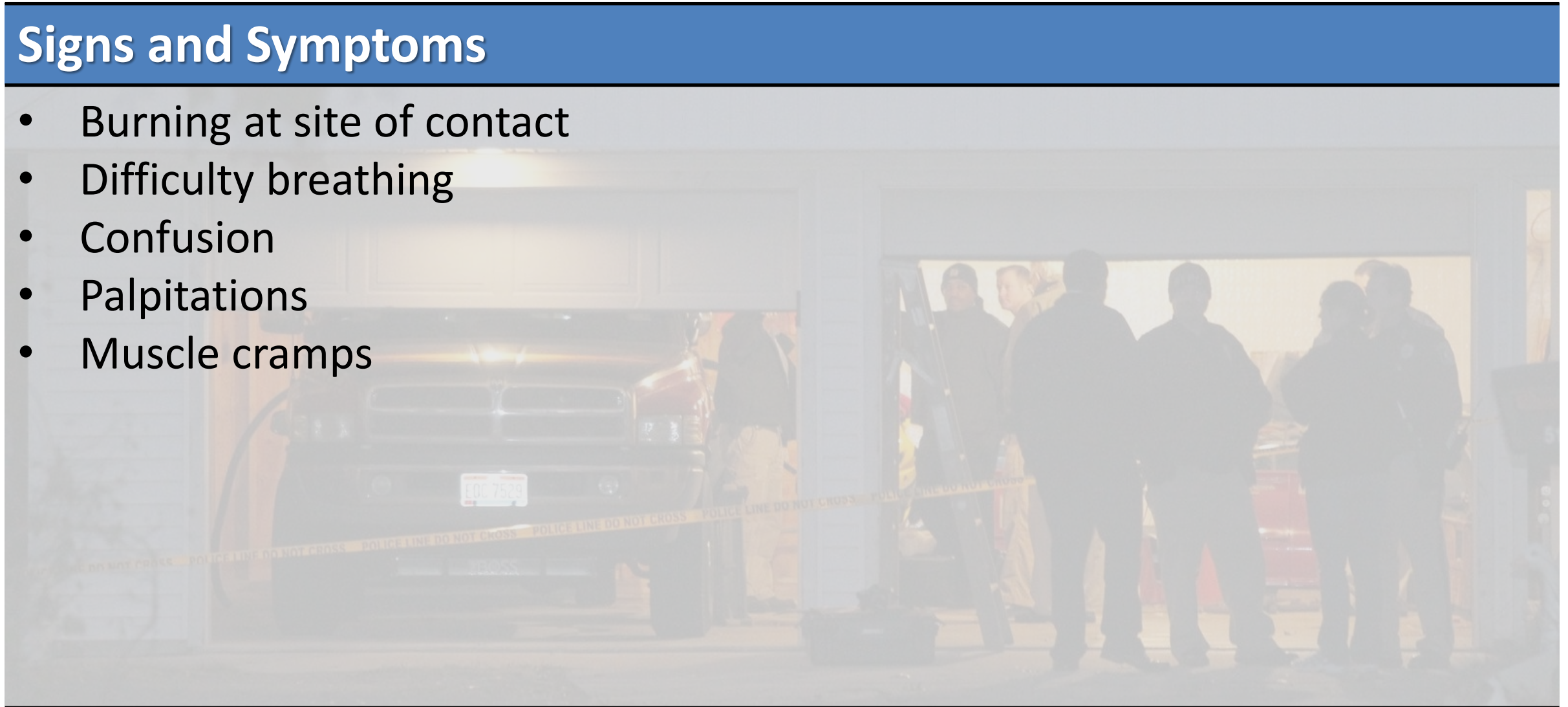


- Extremely toxic and lethal
 - Appears only as minor burns
 - Penetrates deeply into tissue
- Inactivated by calcium ions
 - Settles into tissue as a salt
 - Removes calcium from cells and bones
 - Impairs cellular function
- Death reported with exposure <2.5% BSA



Signs and Symptoms

- Burning at site of contact
- Difficulty breathing
- Confusion
- Palpitations
- Muscle cramps



Management

- Ensure safety of rescue personnel
- Initiate supportive measures
- Remove exposed clothing
- Irrigate affected area thoroughly
- Immerse the affected limb in ice water
- Rapid transport to appropriate facility

- Organic compounds composed mostly of carbon and hydrogen
 - Found in many household and industrial products
 - Turpentine
 - Kerosene
 - Lighter fluid
 - Paint
 - Lubricants
 - Toxicity can occur from any route
- Vast majority are recreational
 - Long-term inhalant abuse can lead to permanent loss of mental function.
 - Modern epidemic began in the early 1960s.

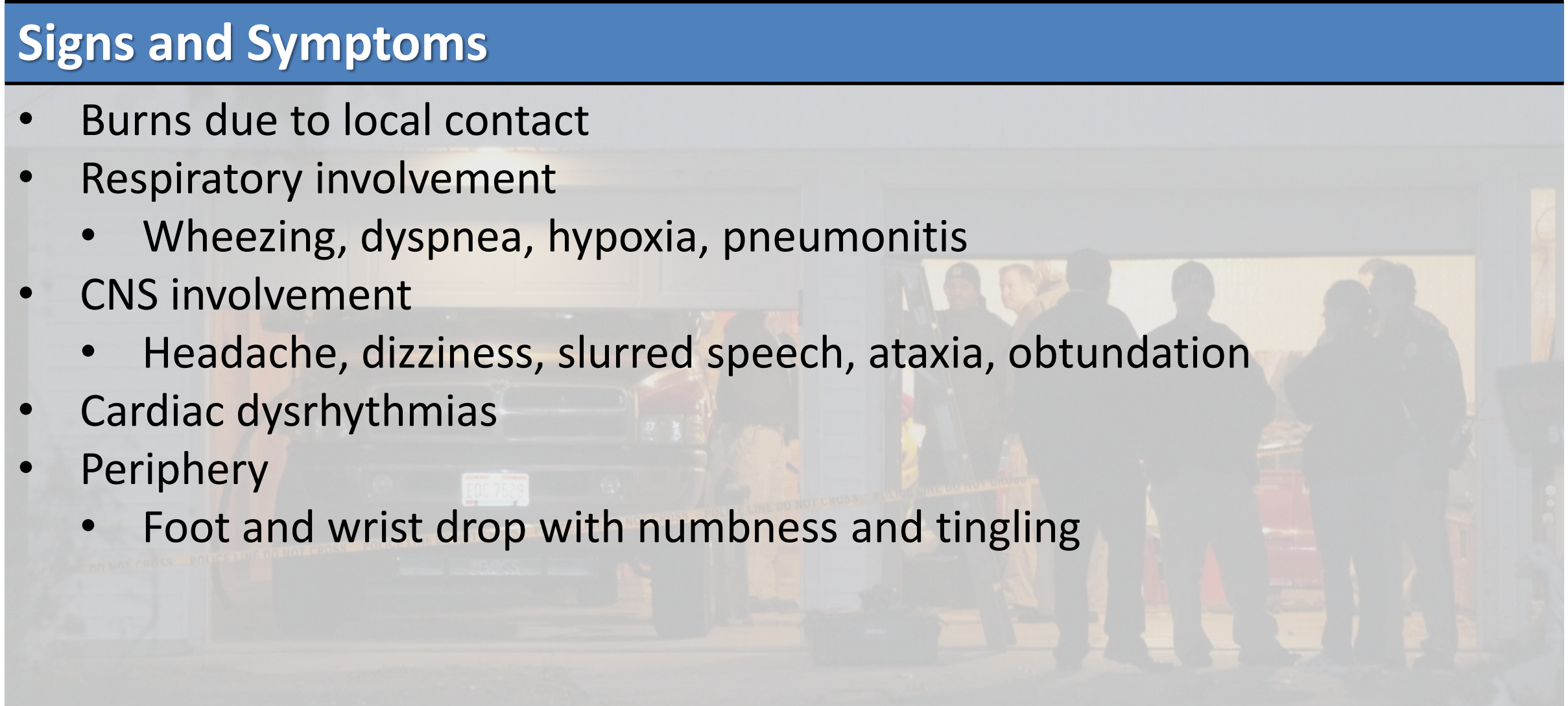
Table 36-7 Compounds Commonly Abused by Sniffing and Bagging

Example	Sources	Signs and Symptoms of Toxicity
Halogenated Hydrocarbons		
1,1,1-Trichloroethane (methyl chloroform)	Cleaning solvents, typewriter correction fluid, aerosol propellant	Eye irritation, light-headedness, incoordination, CNS depression, respiratory failure, cardiac dysrhythmias, sudden death
Trichloroethylene	Degreasing solvent, aerosol propellant, rubber cement, plastic cement	Euphoria, anaesthesia, weakness, vomiting, abdominal cramps, loss of coordination, neuropathy, blindness, cardiac dysrhythmias, "degreaser's flush" (flushed face, neck, and shoulders when taken along with alcohol)
Tetrachloroethylene (perchloroethylene)	Solvent, dry cleaning agent	Drunken behaviour, dizziness, light-headedness, difficulty walking, numbness, sleepiness, visual disturbances, memory impairment, eye irritation, cutaneous flushing, sudden death
Methylene chloride (dichloromethane)	Refrigerant, paint remover, aerosol propellant	Fatigue, weakness, chills, sleepiness, nausea, dizziness, incoordination, pulmonary edema
Carbon tetrachloride	Cleaning fluid	Narcosis, sudden death
Petroleum Hydrocarbons		
Benzene	Cable cleaner, industrial solvents, rubber cement	Delirium, agitation, seizures, sudden death
Toluene	Spray paint, model and plastic cements, lacquer thinner	Narcosis; hallucinations; mania; impulsive, destructive, accident-prone behaviour; sudden death
Gasoline	Gas tank	Sudden death

Abbreviation: CNS, central nervous system
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Signs and Symptoms

- Burns due to local contact
- Respiratory involvement
 - Wheezing, dyspnea, hypoxia, pneumonitis
- CNS involvement
 - Headache, dizziness, slurred speech, ataxia, obtundation
- Cardiac dysrhythmias
- Periphery
 - Foot and wrist drop with numbness and tingling



Management

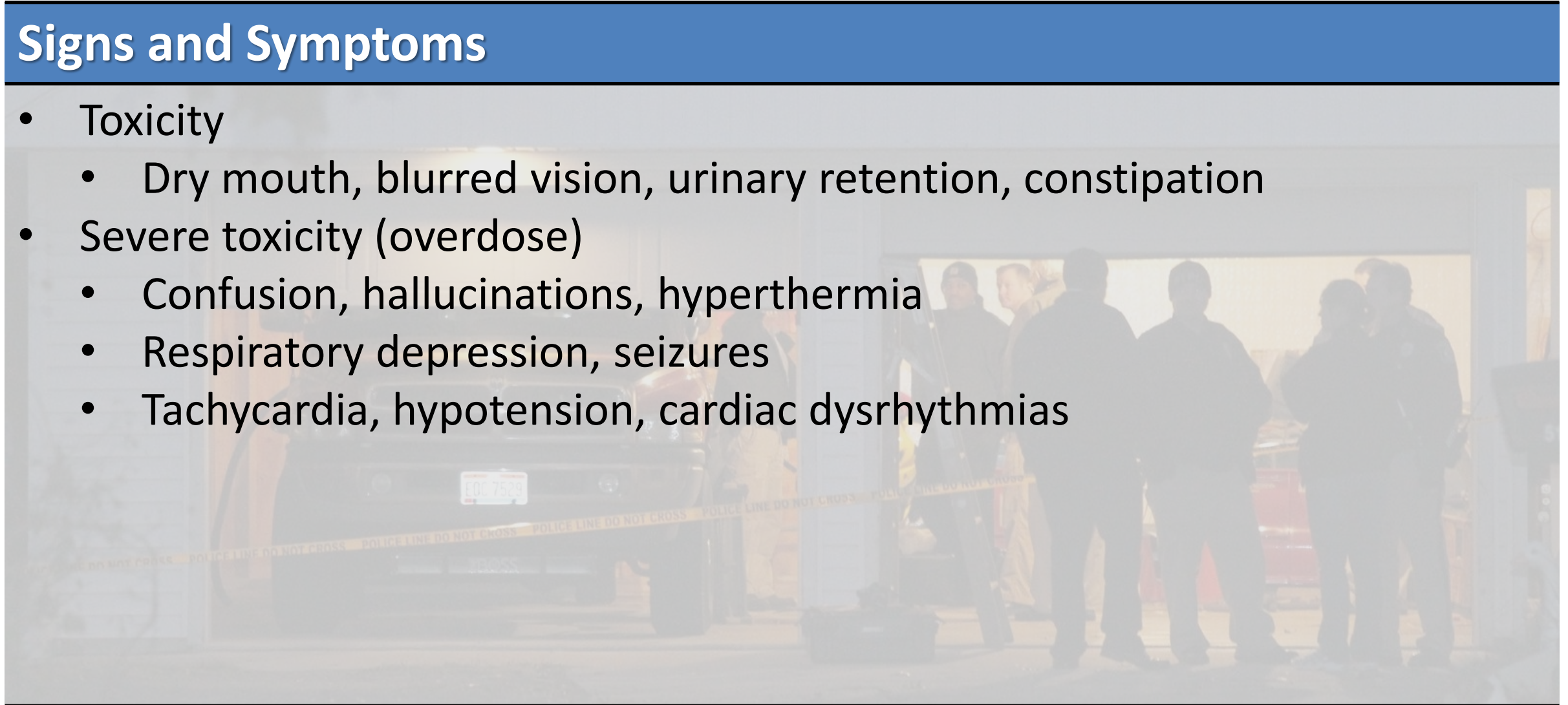
- Rarely serious if patient is asymptomatic
- Symptomatic patient
 - Standard toxicological emergency procedures
- Hydrocarbons do not bind to activated charcoal
 - Gastric lavage

- Once commonly used to treat depression
- Narrow therapeutic index
- Patient that need them, most likely to attempt overdose
- Still used to manage chronic pain and migraine prophylaxis



Signs and Symptoms

- Toxicity
 - Dry mouth, blurred vision, urinary retention, constipation
- Severe toxicity (overdose)
 - Confusion, hallucinations, hyperthermia
 - Respiratory depression, seizures
 - Tachycardia, hypotension, cardiac dysrhythmias



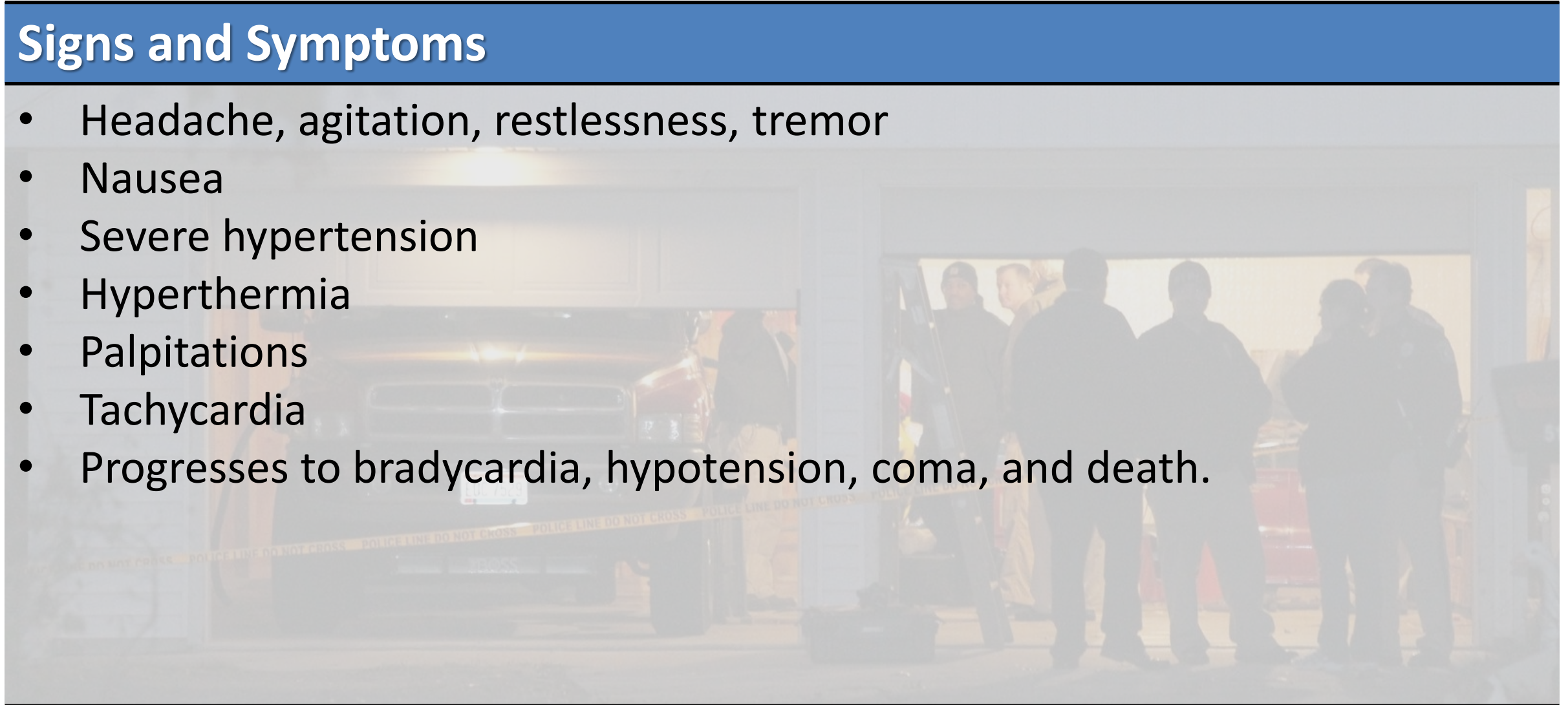
Management

- Perform standard toxicological emergency procedures.
- ALS Support may be required.
- Monitor and treat cardiac dysrhythmias.
- Monitor and treat respiratory depression

- Rarely used to treat depression
- Relatively unpopular
 - Narrow therapeutic index
 - Multiple drug and food interactions
 - Inhibit and breakdown neurotransmitters
- Symptoms may not appear for up to 6 hours

Signs and Symptoms

- Headache, agitation, restlessness, tremor
- Nausea
- Severe hypertension
- Hyperthermia
- Palpitations
- Tachycardia
- Progresses to bradycardia, hypotension, coma, and death.



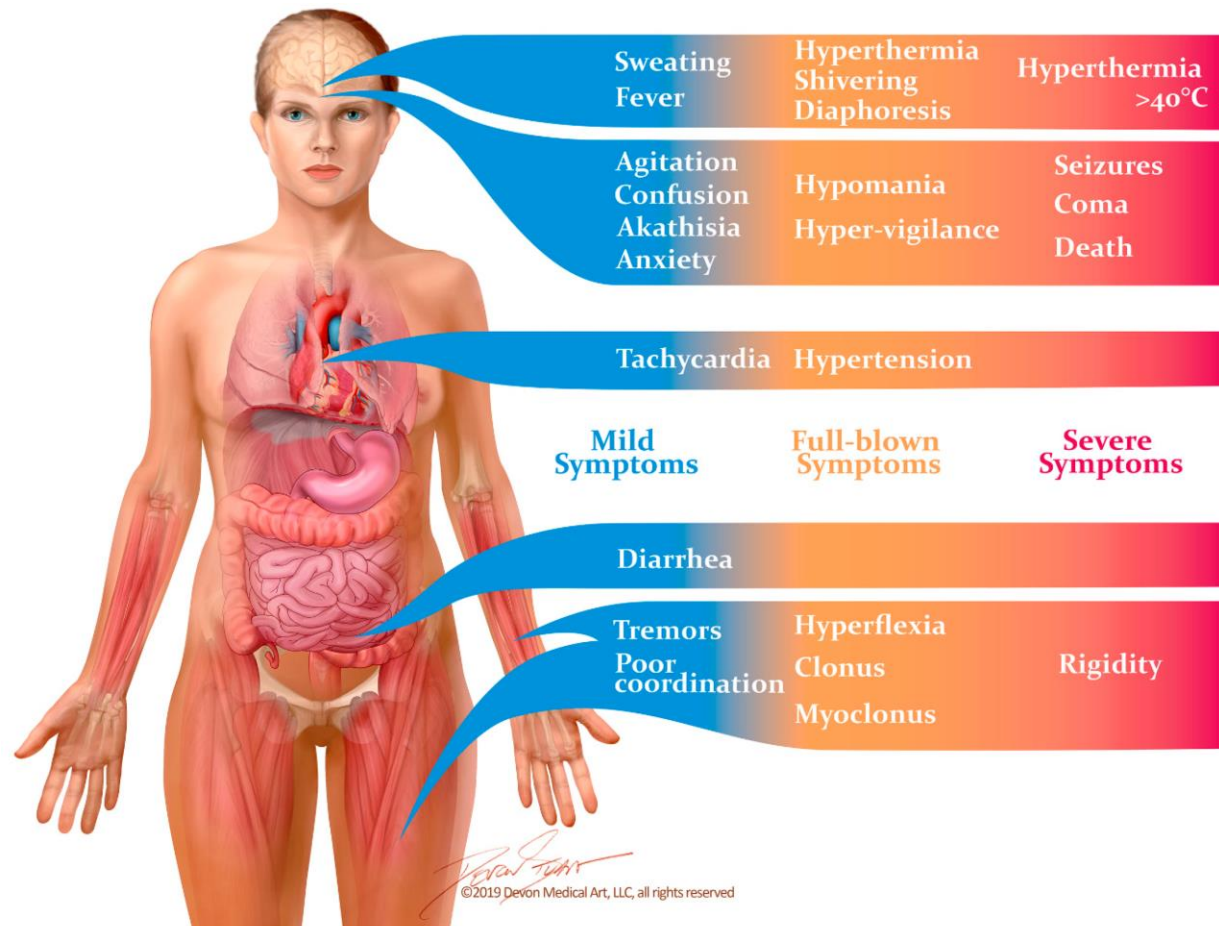
Management

- Standard toxicological emergency procedures
- No antidote available
- Symptomatic support
 - Seizures
 - Hypotension
 - Hyperthermia

- Trazodone and Bupropion
- Selective serotonin reuptake inhibitors (SSRIs)
 - Prevent reuptake of serotonin
 - Theoretically makes it more available
- Higher safety profile
- Virtually replaced tricyclics
- True mechanism of action unclear

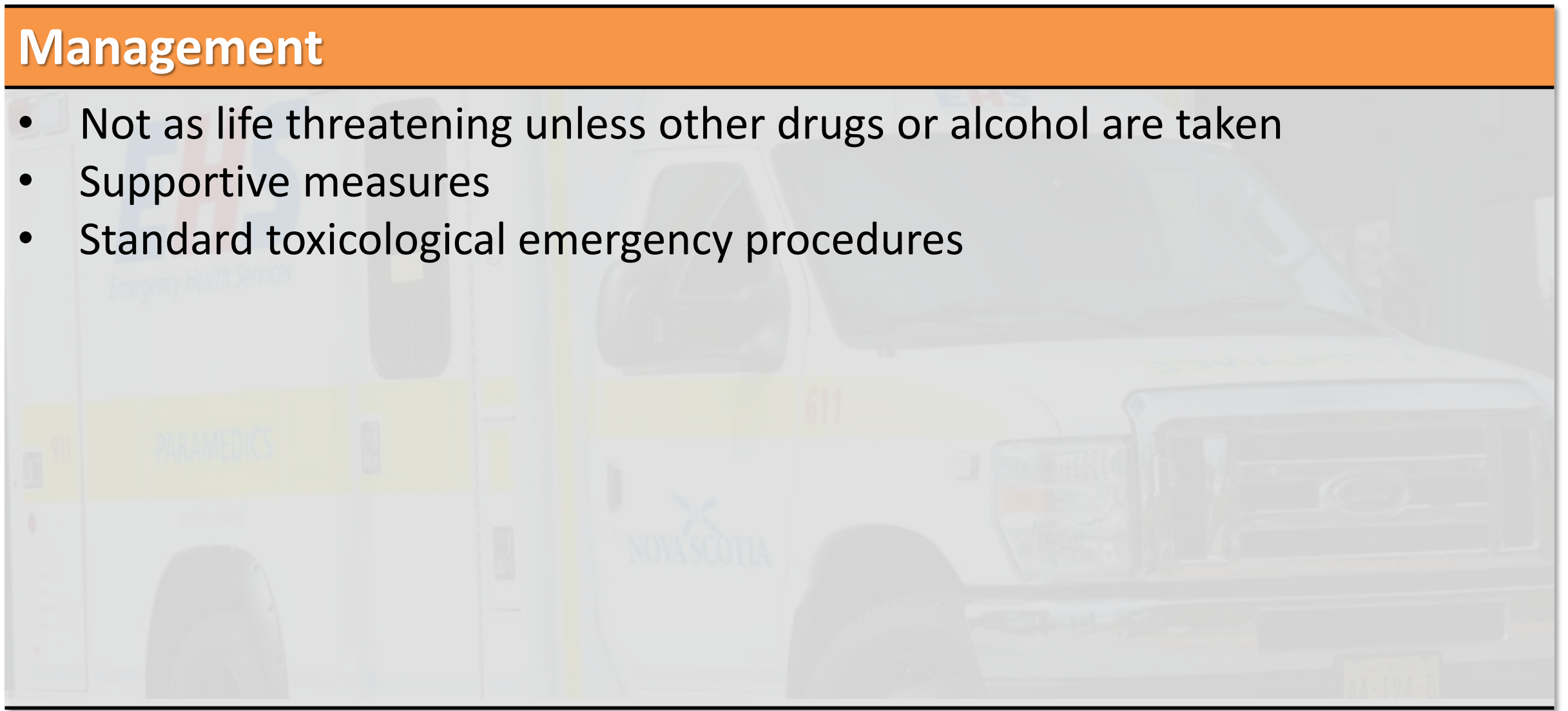
- Drowsiness
- Tremor
- Nausea and vomiting
- Tachycardia

- Triggered by increasing the dose or by adding selected drugs



Management

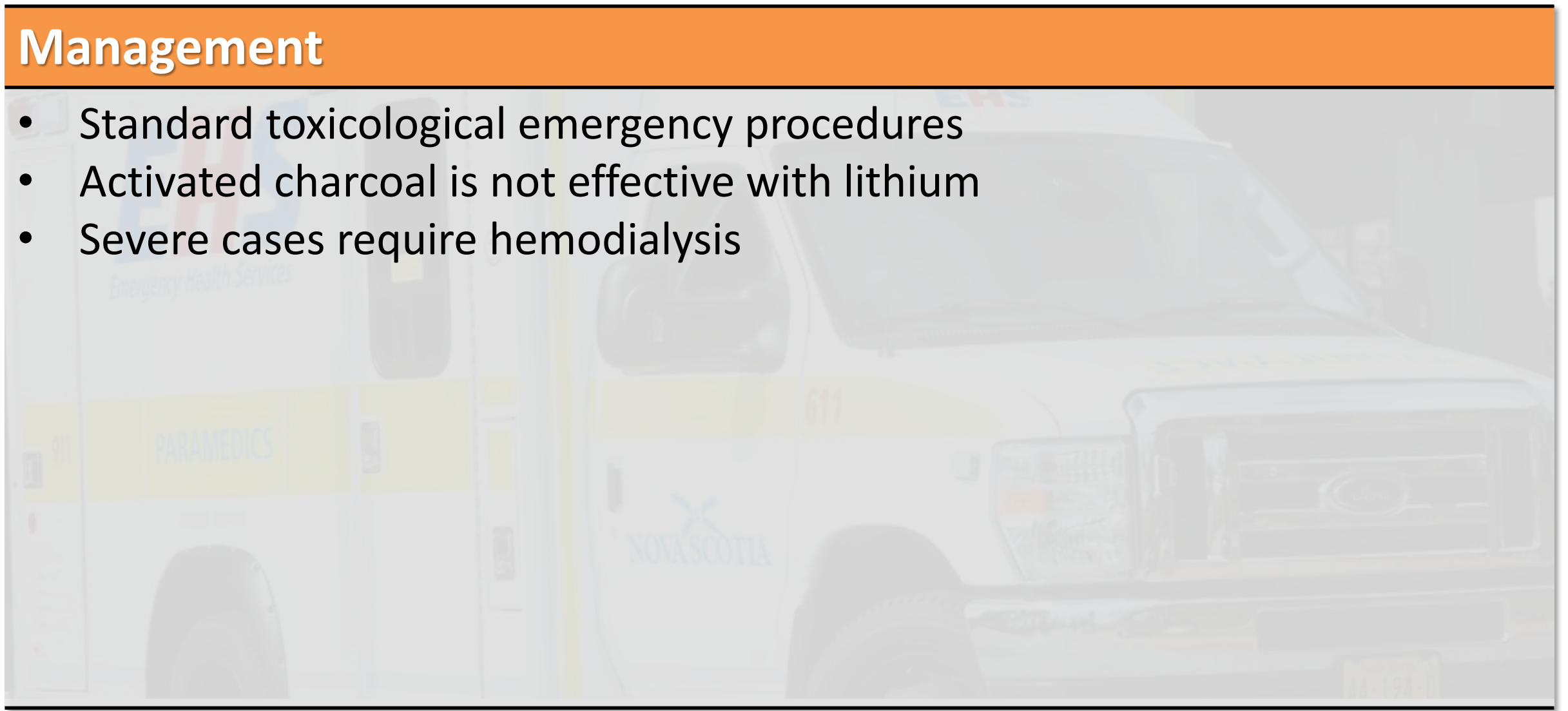
- Not as life threatening unless other drugs or alcohol are taken
- Supportive measures
- Standard toxicological emergency procedures



- Prescribed to treat bipolar disorder
 - Narrow therapeutic index
- Presentation
 - Thirst, dry mouth
 - Tremors, muscle twitching, and increased reflexes
 - Confusion, stupor, seizures, coma
 - Nausea, vomiting, diarrhea
 - Bradycardia and dysrhythmias

Management

- Standard toxicological emergency procedures
- Activated charcoal is not effective with lithium
- Severe cases require hemodialysis



- Most common drug taken in overdose
- Readily available over the counter
 - Aspirin
 - Oil of Wintergreen
 - Prescription combinations
- Large doses (300 mg/kg)
 - Inhibit energy production and acid buffering
 - Metabolic acidosis

Signs and Symptoms

- Tachypnea
- Direct effect of salicylates on brain stem
- Hyperthermia
- Confusion, lethargy, coma
- Cardiac failure, dysrhythmias
- Abdominal pain
- Pulmonary edema, ARDS
- Chronic overdose does not usually include abdominal pain

Management

- Standard toxicological emergency procedures
- Time of overdose necessary
 - Predicts degree of anticipated symptoms
- Fluid resuscitation
- Extreme cases require dialysis

- One of the most common drugs in use
- Few side effects in normal doses
- In high doses
 - Detoxification overwhelmed
 - Toxic metabolite left in circulation
 - Hepatic necrosis

Stage 1	½ - 24 hours	Nausea, vomiting, weakness, and fatigue
Stage 2	24 – 48 hours	Abdominal pain, decreased urine, elevated liver enzymes
Stage 3	72 – 96 hours	Liver function disruption
Stage 4	4 – 14 days	Gradual recovery or progressive liver failure

Management

- Standard toxicological emergency procedures
- Blood levels can predict potential for injury
- Antidote
 - N-acetylcystiene, mucomyst
 - Available and highly effective
 - Rarely given prehospital

- Non-steroidal Anti-inflammatory Drugs
 - Ibuprofen, ketorolac, naproxen sodium.

Signs and Symptoms

- Headache, tinnitus, nausea, vomiting, abdominal pain, drowsiness
- Dyspnea, wheezing, pulmonary edema, swelling of extremities, rash, itching

Management

- Standard toxicological emergency procedures

- Bronchodilator
 - Prescribed for chronic respiratory problems

Signs and Symptoms

- Agitation, tremors, seizures, cardiac dysrhythmias, nausea and vomiting

Management

- Standard toxicological emergency procedures

- Acute poisonings
 - Affect numerous enzyme activities
 - Variety of signs and symptoms
 - Initial symptoms include:
 - Nausea and vomiting
 - Hematemesis
 - Diarrhea
 - Melena
 - Multi-organ manifestations occur later.
 - Relatively rare except for iron

- Body only requires small amounts on a daily basis
 - Stored for enzyme and hemoglobin production
- Excess easily obtained
 - Non-prescription supplements
 - Pediatric ingestion
 - Multivitamins
- Systemic poisoning manifestations include cardiovascular collapse and hepatotoxicity.

Signs and Symptoms

- Vomiting (with hematemesis), diarrhea
- Abdominal pain, shock
- Liver failure
- Metabolic acidosis with tachypnea
- Eventual bowel scarring and obstruction

Management

- Standard toxicological emergency procedures

- Overdose often results from chronic environmental exposure



Signs and Symptoms

- Headache, irritability, confusion, coma
- Memory disturbances
- Tremors, weakness, agitation
- Abdominal pain

Management

- Standard toxicological emergency procedures

- Spectrum of factors
 - Bacteria, viruses, toxic chemicals
 - Produce varying level of GI distress
- Bacterial toxins
 - Symptoms worsen with multiple bacteria
- Seafood poisonings
 - Specific toxins found in shellfish
 - Incidence increased with increased consumption



Signs and Symptoms

- Nausea, vomiting, diarrhea and abdominal pain
- Facial flushing and respiratory distress

Management

- Collect samples of the suspect food source
- Maintain the airway and support breathing
- Establish IV access
- Consider medications
- Antihistamines, antiemetics

- Contribute heavily to number of accidental toxic ingestions
 - Children especially
- Vast numbers and variety of names
 - Difficult to categorize
 - Only a few of the thousands of plant species are truly poisonous.
 - Many varieties of plants can cause contact dermatitis.
 - Plants are one of the top 10 exposures in both adults and children according to Ontario's Poison Centre.
- Mushrooms particularly hard to identify
 - Foraging
 - Accidental ingestion

- Poison Centre
 - What plant and plant parts were eaten?
 - If seeds were ingested, were they chewed?
 - When was the ingestion?
 - What symptoms have developed?
- Treatment
 - Most plant exposures require no treatment.
 - Direct medical control
 - Provincial Poison Centre

- People likely to be victims
 - People who forage for their own mushrooms
 - People looking for hallucinogenic mushrooms
 - Young children



- Factors of toxicity
 - Age of the mushroom
 - Season in which it was gathered
 - Amount ingested
 - Preparation method
 - Classification
 - Almost all deaths involve the Amanita or Lepiota species.



Signs and Symptoms

- Time of onset
- Within 2 hours
- Greater than 6 hours

Management

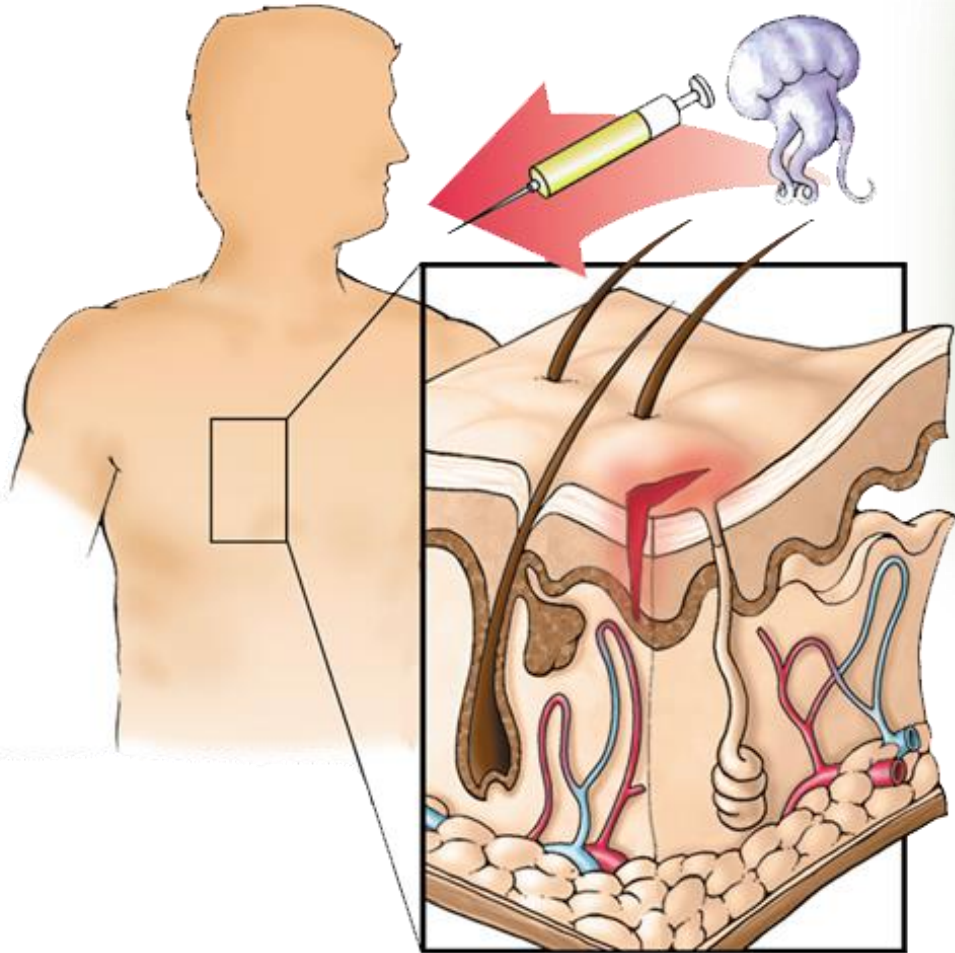
- Establish and maintain the airway.
- Obtain vascular access.
- Consider fluid boluses.
- Contact Poison Centre and direct medical control.
- Transport to the hospital.



- Ethanol
 - Form of alcohol consumed by humans in alcoholic beverages
 - Not conventionally recognized as a poison

- Ethylene glycol
 - Colourless, odourless liquid
 - Found in a variety of commercial products
 - Several toxic metabolites
 - Toxic manifestations may not be evident for many hours after ingestion.
 - Toxicity occurs in stages, so signs and symptoms vary.

- Methyl alcohol
 - Wood alcohol or methanol
 - Not harmful in itself
 - Metabolic products (formaldehyde and formic acid) are responsible for the signs and symptoms.
 - Prehospital care is primarily supportive.



- Protect rescuers.
- Remove the patient from danger.
- Identify the organism that caused the injury.
- Perform an initial assessment and rapid physical exam.

- Prevent or delay absorption of the poison.
- Initiate supportive measures as indicated.
- Watch for anaphylactic reactions.
- Transport the patient rapidly.
- Contact poison control and medical direction

- In most cases, local treatment is all that is necessary
- Hymenoptera stings
 - Common source of anaphylaxis
 - Only honeybee leaves stinger in
 - Wasps, hornets and fire ants will sting repeatedly

Signs and Symptoms

- Localized pain
- Redness
- Swelling
- Skin wheal
- Monitor for signs of anaphylaxis

Management

- Wash the area
- Remove stingers, if possible
- Apply cool compresses to the injection site
- Observe for and treat allergic reactions and/or anaphylaxis.

Brown Recluse Spider

- Rare
- Found in imported fruit
- No spiders native to Canada have venom potent enough to cause medical illness.
 - Southern and midwest USA
- Lives in dry, dark locations



Signs and Symptoms

- Bite usually painless
- Localized, white-ringed macule
- Progresses to localized pain, redness, and swelling over next 8 hours
- Tissue necrosis occurs over 2-3 days
- In severe cases, hemorrhage and DIC

Management

- No antidote, supportive therapy
- Attention to the airway and breathing
- High-flow oxygen as needed
- Establishing IV access



- 24 hours after bite



- 4 days after bite





- Live in all parts of North America
- Usually found in woodpiles or brush
- Venom very potent
 - Causes excessive neurotransmitter release at synaptic junctions

Signs and Symptoms

- Immediate pain, redness, and swelling
- Progressive muscle spasms of all large muscle groups
- Nausea, vomiting, sweating
- Seizures, paralysis and altered LOC

Management

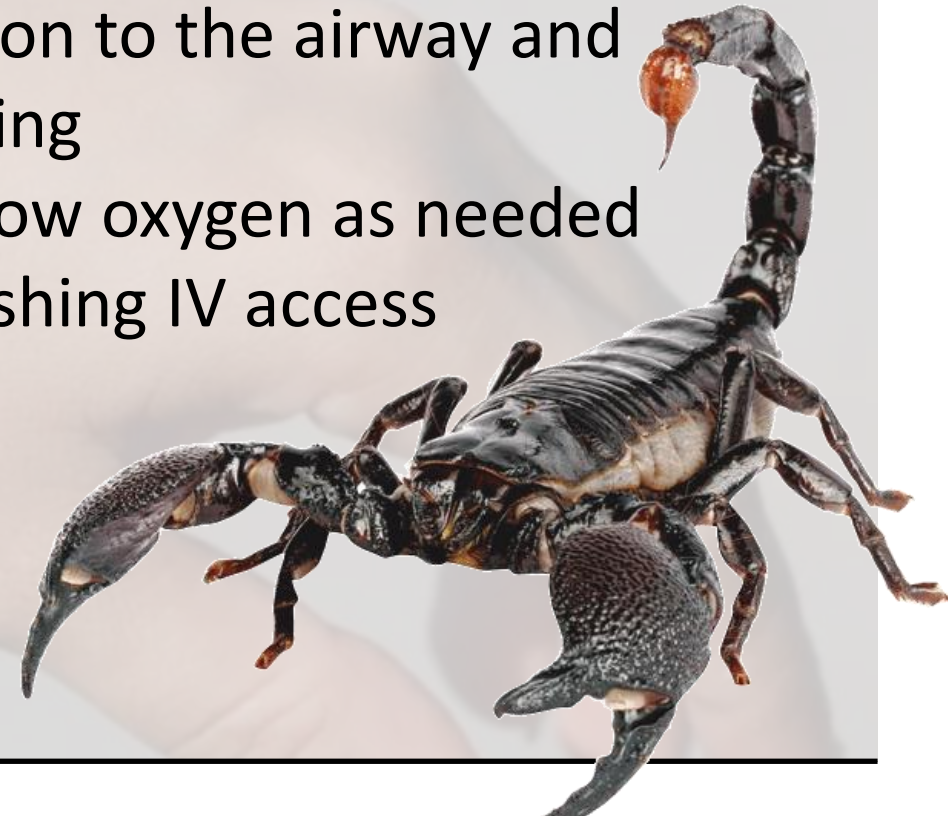
- Mostly supportive
- Anti-venom available
- Attention to the airway and breathing
- High-flow oxygen as needed
- Establishing IV access

Signs and Symptoms

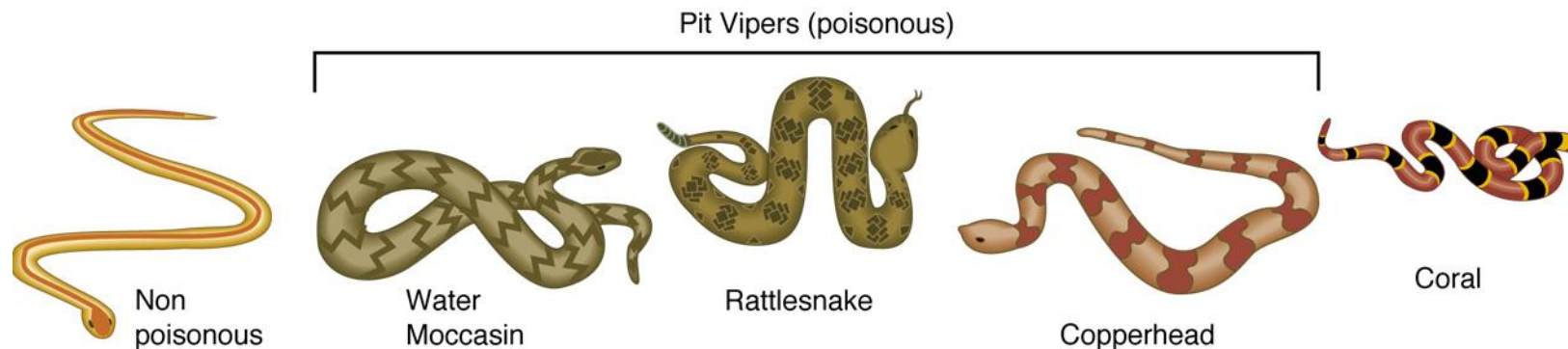
- Localized burning and tingling sensation
- Slurred speech
- Restlessness
- Muscle twitching
- Salivation
- Nausea and vomiting
- Seizures

Management

- Mostly supportive
- Apply constricting band.
- Attention to the airway and breathing
- High-flow oxygen as needed
- Establishing IV access



- Pit Viper Bites
 - Venom destroys proteins and other tissue components
- Coral Snake Bites
 - Venom is a neurotoxin that results in paralysis
 - Found in southwestern USA



Signs and Symptoms

- Fang marks
- Swelling and pain at site
- Oozing
- Weakness, dizziness, faintness
- Sweating, chills, thirst
- Nausea and vomiting
- Tachycardia and hypotension
- Hemorrhage and necrosis
- Respiratory failure

Management

- Keep the patient supine.
- Immobilize the injured limb and maintain it in a neutral position.
- Apply high-flow oxygen.
- Establish IV access.
- Transport.
- Do not apply constricting bands, ice, cold packs, tourniquets or electrical stimulation to the wound.



Signs and Symptoms

- Localized numbness, weakness, drowsiness
- Ataxia, slurred speech, excessive salivation
- Paralysis of the tongue and larynx
- Drooping of the eyelids, double vision, dilated pupils
- Abdominal pain, nausea, vomiting
- Loss of consciousness, seizures
- Respiratory failure
- Hypotension

Management

- Wash the wound with large amounts of water
- Maintain the immobilized extremity at the level of the heart
- IV access
- Rapid transport



Signs and Symptoms

- Intense local pain and swelling
- Nausea and vomiting
- Dyspnea
- Tachycardia
- Hypotension or shock in severe cases

Management

- Establish and maintain the airway
- Apply a constricting band above the site
- Apply heat or hot water
- Inactivate or remove any stingers

Toxicology and Substance Abuse

SUBSTANCE ABUSE AND OVERDOSE

Substance abuse

- Use of pharmacologic substances for purposes other than medical
- Recreational
- No strong physical or psychological desire to use
- Can stop

Addiction

- Compulsive overwhelming dependence
- Physical and psychological (everything in life is 2nd to drug use)
- Unable to stop despite negative consequences



- Alcohol
 - May require thiamine and dextrose for hypoglycemia
- Cocaine
 - May require benzodiazepines
- Narcotics
 - Naloxone will reverse effects but may initiate withdrawal

- Amphetamines and hallucinogens
 - May use benzodiazepines for seizures
 - Haloperidol for hyperactivity
- Benzodiazepines
 - Use flumazenil to combat effects
- Barbiturates
 - May require forced diuresis and alkalinization

Table 34-3 COMMON DRUGS OF ABUSE

Drug	Signs and Symptoms	Routes	Prehospital Management
Alcohol beer whiskey gin vodka wine tequila	CNS depression Slurred speech Disordered thought Impaired judgment Diuresis Stumbling gait Stupor Coma	Oral	ABCs Respiratory support Oxygenate Establish IV access Administer 100 mg thiamine IV ECG monitor Check glucose level Administer D ₅₀ W, if hypoglycemic
Barbiturates thiopental phenobarbital primidone	Lethargy Emotional lability Incoordination Slurred speech Nystagmus Coma Hypotension Respiratory depression	Oral IV	ABCs Respiratory support Oxygenate Establish IV access ECG monitor Contact Poison Control—may order bicarbonate

Common Drugs of Abuse

Cocaine crack rock	Euphoria Hyperactivity Dilated pupils Psychosis Twitching Anxiety Hypertension Tachycardia Dysrhythmias Seizures Chest pain	Snorting Injection Smoking (freebasing)	ABCs Respiratory support Oxygenate ECG monitor Establish IV access Treat life-threatening dysrhythmias Seizure precautions: diazepam 5–10 mg
Narcotics heroin codeine meperidine morphine hydromorphone pentazocine Darvon Darvocet methadone	CNS depression Constricted pupils Respiratory depression Hypotension Bradycardia Pulmonary edema Coma Death	Oral Injection	ABCs Respiratory support Oxygenate Establish IV access

*With the advent of the opiate antagonist naloxone, narcotic overdose became easier to manage. It is possible to titrate this effective medication to increase respirations to normal levels without fully awakening the patient. In the case of narcotic addicts, this prevents hostile and confrontational episodes.

Common Drugs of Abuse

Drug	Signs and Symptoms	Routes	Prehospital Management
Marijuana grass weed hashish	Euphoria Dry mouth Dilated pupils Altered sensation	Smoked Oral	ABCs Reassure the patient Speak in a quiet voice ECG monitor if indicated
Amphetamines Benzedrine Dexedrine Ritalin "speed"	Exhilaration Hyperactivity Dilated pupils Hypertension Psychosis Tremors Seizures	Oral Injection	ABCs Oxygenate ECG monitor Establish IV access Treat life-threatening dysrhythmias Seizure precautions: diazepam 5–10 mg
Hallucinogens LSD STP mescaline psilocybin PCP**	Psychosis Nausea Dilated pupils Rambling speech Headache Dizziness Suggestibility Distortion of sensory perceptions Hallucinations	Oral Smoked	ABCs Reassure the patient "Talk down" the "high" patient Protect the patient from injury Provide a dark, quiet environment Speak in a soft, quiet voice Seizure precautions: diazepam 5–10 mg

**While PCP was originally an animal tranquilizer, it manifests hallucinogenic properties when used by humans. In addition to bizarre delusions, it can cause violent and dangerous outbursts of aggressive behavior. The rescuer is advised to remain safe when attempting to treat this type of overdose. PCP patients have been known to have almost superhuman strength and high pain tolerance.

Common Drugs of Abuse

Sedatives Seconal Valium Librium Xanax Halcion Restoril Dalmane Phenobarbital	Altered mental status Hypotension Slurred speech Respiratory depression Shock Bradycardia Seizures	Oral	ABCs Respiratory support Oxygenate Establish IV access ECG monitor Medical direction may order naloxone
Benzodiazepines*** Valium Librium Xanax Halcion Restoril Dalmane Centrax Ativan Serax	Altered mental status Slurred speech Dysrhythmias Coma	Oral	ABCs Respiratory support Oxygenate Activated charcoal as ordered by medical Direction Establish IV access ECG monitor Contact poison control

***Deaths due to pure benzodiazepine ingestion are very rare. Minor toxicity ranges are 500–1,500 mg. A benzodiazepine antagonist (Romazicon) is available. IV dosage is 1–10 mg, or an infusion of 0.5 mg/hr. It may cause seizures in a benzodiazepine dependent patient.

- Ecstasy (MDMA)
 - Signs and symptoms include anxiety, nausea, tachycardia and hypertension, followed by relaxation and euphoria.
 - Provide supportive care.
- Rohypnol (“date rape drug”)
 - Potent benzodiazepine, illegal in Canada.
 - Treat as a benzodiazepine overdose and sexual assault victim.

- Physiologic Effects
 - CNS depressant
 - Alcoholism
 - Peripheral vasodilation, diuresis
- General Alcoholic Profile
 - Drinks early in the day, alone, or secretly.
 - Binges, blackouts, GI problems, “green tongue syndrome,” chronic flushing of face and palms.
 - Cigarette burns, tremulousness and odor of alcohol.

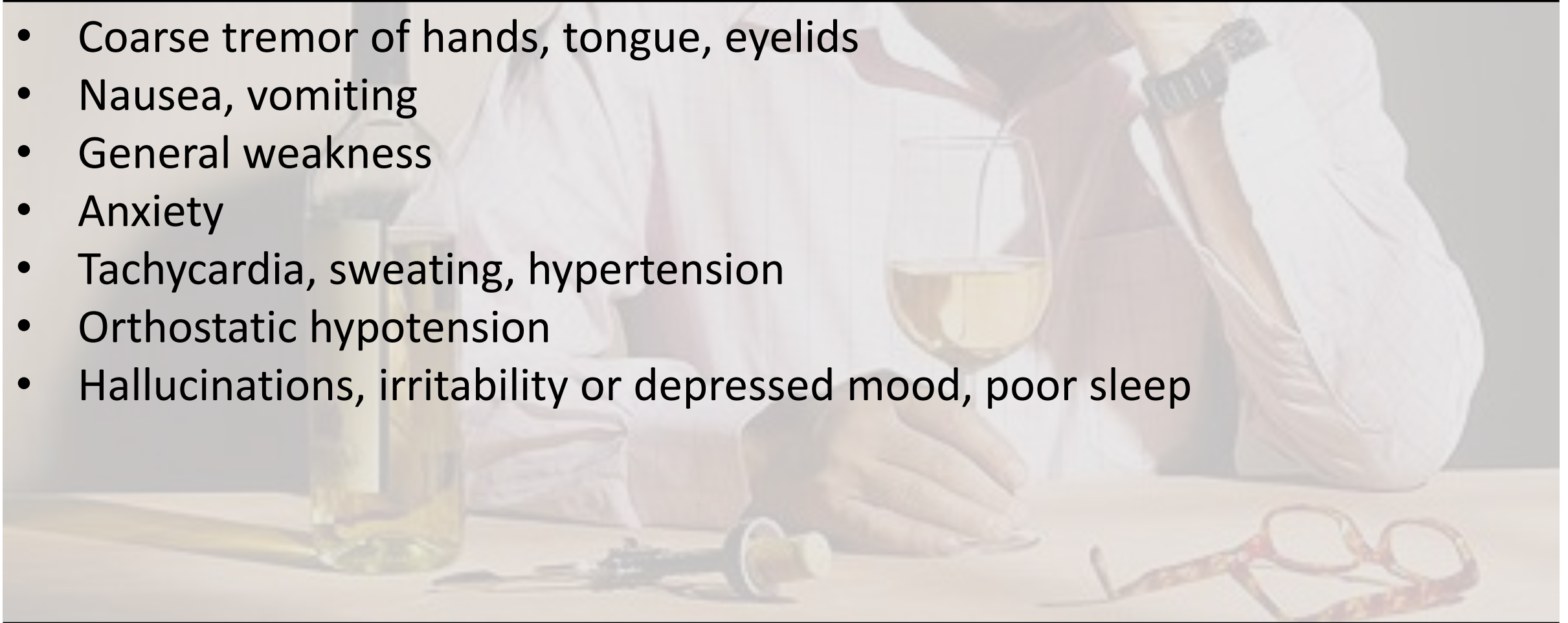
- Poor nutrition
- Alcohol hepatitis
- Liver cirrhosis, pancreatitis
- Sensory loss in hands/feet
- Loss of balance and coordination
- Upper GI hemorrhage
- Hypoglycemia
- Falls (fractures and subdural hematoma)



- Occurs from abrupt discontinuation after prolonged use
- Can occur hours to days after abstinence
- Lasts 5 to 7 days
- Delirium tremens (DTs)
 - Patients experience visual, tactile and auditory disturbances

Signs and Symptoms

- Coarse tremor of hands, tongue, eyelids
- Nausea, vomiting
- General weakness
- Anxiety
- Tachycardia, sweating, hypertension
- Orthostatic hypotension
- Hallucinations, irritability or depressed mood, poor sleep



Management

- Establish and maintain the airway.
- Determine if other drugs are involved.
- Intravenous access
- Consider medications.
- Dextrose and possibly thiamine
- Empathy and reassurance
- Transport

- Routes of toxic exposure
- Assessment and management
- Ingested toxins
- Inhaled toxins
- Surface absorbed toxins
- Specific toxins
- Injected toxins
- Substance abuse and overdose