Common antidotes and adult doses-I

Poison/syndrome	Antidote(s)	Adult dose
Acetaminophen	N-acetylcysteine (Mucomyst 20%)	Initial oral dose: 140 mg/kg, then 70 mg/kg q 4h x 17 doses
Anticholinergic agents	Physostigmine (Antilirium)	Initial dose: 0.5-2.0 mg slow IV over 3-5 min
Benzodiazepines	Flumazenil (Romazicon)	Initial dose: 0.1-0.2 mg IV over 30-60 sec, repeat 0.1-0.2 mg IV every minute prn up to 1.0 mg
Beta-blockers	1) Glucagon	1) Initial dose: 5-10 mg IV bolus, then 2-10 mg/hr IV infusion
	2) Calcium	2) Calcium chloride 10%: 1 gm (10 cc) IV; repeat as necessary
	3) Insulin + dextrose	3) Insulin load: 0.5 units/kg IV bolus, then 0.5-1.0 U/kg/h IV Dextrose 10% IV infusion (with KCl) - titrate to euglycemia
Calcium-channel blockers	1) Calcium	1) Calcium chloride 10%: 1-4 gm (10-40 cc) IV; repeat as necessary
	2) Glucagon	2) Initial dose: 5-10 mg IV bolus, then 2-10 mg/hr IV infusion
	3) Insulin + dextrose	3) Insulin load: 0.5 units/kg IV bolus, then 0.5-1.0 U/kg/h IV
Carbon monoxide	Oxygen ± hyperbaric chamber	100% oxygen by ventilator or NRB; high-flow oxygen by tight-fitting facemask
Crotalid snakebite	Wyeth polyvalent crotalidae antivenin (equine)	Mild: 3-5 vials; moderate: 6-10 vials; severe: 10-20 vials Mix reconstituted antivenin in 1000 ml NS over 4-6 hours
Cyanide	1) Amyl nitrate pearls	1) One ampule by inhalation for 15 sec every 3 min until IV access
	2) Sodium nitrite (3% solution)	2) 10 ml (300 mg) IV over 3 min
	3) Sodium thiosulfate (25%)	3) 50 ml (12.5 g) IV over 10 min
Digitalis	Digoxin immune Fab (Digibind)	1) (# mg ingested x 0.8) ÷ 0.6 = #vials needed 2) (Dig concentration [in ng/ml] x 5.6 x kg [weight]) ÷ 600 = #vials 3) Empiric dose: 10 vials (acute poisoning); 1-3 vials (chronic) 4) Reconstitute Digibind in NS and administer IV over 5-30 min
Ethylene glycol Methanol	1) Ethanol 10% in D5W ± hemodialysis	1) Initial load: 10 ml/kg IV of 10% ethanol over 30 min, then 1.5 ml/kg IV infusion (titrate drip to serum ethanol 100 mg/dL); double to triple infusion during hemodialysis
	2) Fomepizole [4-MP] (Antizol) ± hemodialysis	2) Initial load: 15 mg/kg IV over 30 min, then 10 mg/kg every 12 hours IV over 30 min (re-bolus during HD)

Common antidotes and adult doses-II

Poison/syndrome	Antidote(s)	Adult dose
Heparin	Protamine sulfate	1 mg neutralizes 90-115 U heparin; Initial dose: 1 mg/min to total dose 200 mg in 2 h
Hydrofluoric Acid	Calcium gluconate	1) Topical Ca gluconate gel 3 percent applied for 1-2 days; or 2) Intradermal or SQ Ca gluconate injection 5 percent at burn site (0.5 mL/cm2 burn area) 3) Regional intravenous (Bier block): 10 ml 10 percent in 40 mL NS injected locally in venous system x 20-30 min 4) Intraarterial Ca gluc 10 percent: 10-20 ml in 40 ml NS over 4 hrs; repeat as necessary until pain relief
Iron	Deferoxamine (Desferol)	15 mg/kg/h IV infusion until urine color clears or patient clinically well (not to exceed 6 gm/24 h)
Isoniazid	Pyridoxine (Vitamin B6)	Initial dose: 1 gm pyridoxine for every gm INH ingested or empiric 5 gm IV over 10 min if amount ingested unknown
Lead	2,3-dimercaptosuccinic acid [DMSA] (Succimer); 100 mg cpsl	30 mg/kg po in three divided doses x 5 days, then 20 mg/kg in twice daily doses x 14 days; repeat therapy prn after 2 week rebound
Mercury Arsenic Gold	British antilewisite, dimercaprol (BAL); in peanut oil	Initial dose: 4-6 mg/kg IM every 4-6 h x 2 days
Methemoglobinemia	Methylene blue (1 percent solution)	Initial dose: 1-2 mg/kg (0.1-0.2 mL/kg) IV over 5 min; repeat prn
Opiates	Naloxone (Narcan) Nalmefene, naltrexone	Initial dose: 0.1-2.0 mg IV push (opioid dependent patients should receive 0.1 mg IV every 30-60 sec until clinical response); synthetic opiates may need up to 10 mg for initial reversal dose
Organophosphates Carbamates Nerve agents	1) Atropine	1) Initial dose: 0.5-2.0 mg IV; repeat q 3-5 min until sweat and secretions clear
	2) Pralidoxime [2-PAM] (Protopam)	2) Initial dose: 1 gm IV over 15 min, then IV infusion of 3-4 mg/kg/h for 24-72 hrs or until clinical toxicity resolves
Sulfonylurea	Octreotide (Sandostatin) + dextrose	Initial dose: 50-100 mcg SQ or IV, then 50 mcg q 12 h until euglycemia maintained without supplemental dextrose
Tricyclic antidepressants	Sodium bicarbonate (NaHCO3)	Initial dose: 1-2 ampules (50-100 mEq) IV push, then IV infusion to maintain blood pH 7.45-7.55 and PCO2 ≈ 30 mmHg (Usual drip: 3 amps NaHCO3 in 1 L D5W infused at 200-250 mL/h)

Overview of aspirin intoxication

Clinical and laboratory features

Common: tachypnea, tinnitus, nausea, vomiting, acid-base abnormalities

Severe cases: hyperthermia, altered mental status, pulmonary edema

Diagnostic evaluation

Salicylate level, arterial blood gas, basic metabolic panel (Chem-7), chest radiograph

Repeat salicylate level every two hours until level declining

Repeat blood gas every two hours until acid-base status stable or improving

Treatment

Avoid intubation if possible

Administer supplemental oxygen as needed

Volume resuscitate unless cerebral or pulmonary edema is present

Administer multiple doses of activated charcoal (first dose: 1 g/kg up to 50 grams PO)

Administer supplemental glucose in patients with altered mental status, even if serum glucose concentration is normal

Alkalinize with sodium bicarbonate

- -Bolus therapy: $NaHCO_3$, 2-3 meq/kg IV push (adults)
- -Maintenance therapy: 132 meq $NaHCO_3$ in 1 L of D5W, run at 250 cc/h (adults) or 50 to 100 meq $NaHCO_3$ in 1 L D5W, run at 1.5 to 2 times maintenance (children)
- -DO NOT USE ACETAZOLAMIDE TO ALKALINIZE THE URINE

Alert nephrology team early in the patients clinical course; consider hemodialysis for:

- Profoundly altered mental status
- Pulmonary or cerebral edema
- Renal insufficiency that interferes with salicylate excretion
- Fluid overload that prevents the administration of sodium bicarbonate
- A plasma salicylate concentration >100 mg/dL (7.2 mmol/L)
- Clinical deterioration despite aggressive and appropriate supportive care

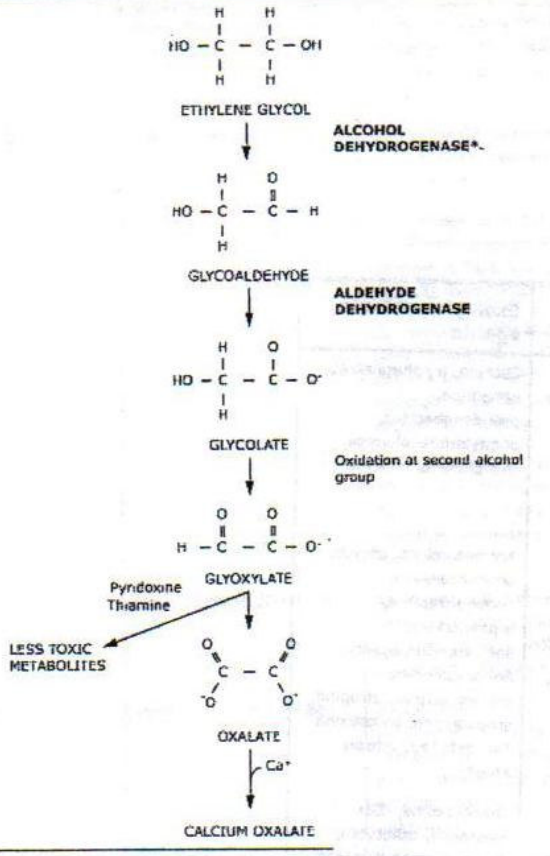
Drug-induced ocular abnormalities

Mydriasis	Miosis	Nystagmus
Sympathomimetics	Opioids	Barbiturates
Cocaine	Heroin	Carbamazepine
Caffeine	Morphine	Phencyclidine
Ephedrine	Hydromorphone	Phenytoin
Amphetamines	Oxycodone	Lithium
Methylphenidate	Hydrocodone	Ethanol
Anticholinergics	Codeine	Toxic alcohols
Atropine	Propoxyphene	Organophosphates
Scopolamine	Sedative-hypnotics	Strychnine
TCAs	Barbiturates	MAOIs
Antihistamines	Benzodiazepines	Serotonin syndrome
Antiparkinson agents	Alcohols (with deep coma)	Ketamine
Muscle relaxants	Zolpidem	
Antispasmodics	Cholinergics	
Phenothiazines (some)	Nerve agents	
Plants (with belladonna alkaloids)	Organophosphate insecticides	
Hallucinogens	Carbamate insecticides	
LSD	Pilocarpine	
Mescaline	Edrophonium	
Psilocybin	Physostigmine	
Designer amphetamines	Sympatholytics	
Miscellaneous	Clonidine	
Glutethimide	Oxymetazoline	
Alcohols	Tetrahydrazoline	
MAOIs	Antipsychotics	
Nicotine	Miscellaneous	
Serotonin syndrome	Phencyclidine	
Drug withdrawal states		

Drug-associated odors

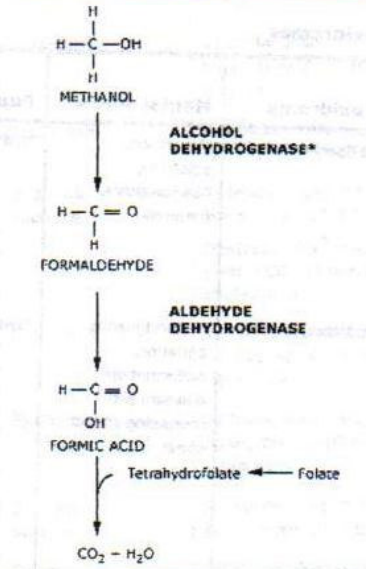
Odor	Agent(s)
Acetone (fruity)	Ethanol, isopropyl alcohol, chloroform, salicylates
Bitter almonds	Cyanide
Garlic	Arsenic, organophosphates, phosphorus, thallium, selenium
Mothballs	Naphthalene, paradichlorobenzene
Kerosene (petroleum distillate)	Organophosphates, parathion
Freshly mown hay	Phosgene
Rotten eggs	Hydrogen sulfide
Wintergreen	Methyl salicylate

Ethylene glycol metabolism



* Blocked by ethanol and fomepizole.

Methanol metabolism



* Blocked by ethanol and fomepizole.

Overview of carbon monoxide poisoning

History

Duration and mechanism of exposure

Assess for major symptoms: loss of consciousness, confusion, symptoms consistent with hypoxia (ie, chest pain)

Assess for minor symptoms: headache, nausea/vomiting

Assess pregnancy status

Physical examination

Careful evaluation of mental status

Physical examination usually unremarkable

Diagnostic evaluation

Check CO level via co-oximetry of arterial or venous blood

Check acid-base status on (preferably arterial) blood gas

Check ECG in all patients; check cardiac enzymes in patients ≥65, patients with significant cardiac risk factors, and younger patients with chest pain or symptoms suggestive of ischemia

Consider CNS imaging in patients with altered mental status to rule out other etiologies

Check cyanide level and consider empiric treatment in patients with smoke inhalation injury

Treatment

Secure airway, breathing, and circulation

- Intubate as clinically indicated
- Apply high-flow oxygen to all CO poisoned patients regardless of pulse oximetry or arterial pO2

Direct fire department to assess for environmental exposure and remove victims

We suggest hyperbaric oxygen (HBO) for:

- CO level >25 percent (>20 percent if pregnant)
- Loss of consciousness
- Severe metabolic acidosis (pH <7.1)
- Concern for end-organ ischemia (chest pain, ECG changes, altered mental status)

Toxidromes

Toxidrome	Mental status	Pupils	Vital signs	Other manifestations	Examples of toxic agents
Sympathomimetic	Hyperalert, agitation, hallucinations, paranoia	Mydriasis	Hyperthermia, tachycardia, hypertension, widened pulse pressure, tachypnea, hyperpnea	Diaphoresis, tremors, hyperreflexia, seizures	Cocaine, amphetamines, ephedrine, pseudoephedrine, phenylpropanolamine, theophylline, caffeine
Anticholinergic	Hypervigilance, agitation, hallucinations, delirium with mumbling speech, coma	Mydriasis	Hyperthermia, tachycardia, hypertension, tachypnea	Dry flushed skin, drymucous membranes, decreased bowel sounds, urinary retention, myoclonus, choreoathetosis, picking behavior, seizures (rare)	Antihistamines, tricyclic antidepressants, cyclobenzaprine, orphenadrine, antiparkinson agents, antispasmodics, phenothiazines, atropine, scopolamine, belladonna alkaloids (eg, Jimson Weed)
Hallucinogenic	Hallucinations, perceptual distortions, depersonalization, synesthesia, agitation	Mydriasis (usually)	Hyperthermia, tachycardia, hypertension, tachypnea	Nystagmus	Phencyclidine, LSD, mescaline, psilocybin, designer amphetamines (eg, MDMA, MDEA)
Opioid	CNS depression, coma	Miosis	Hypothermia, bradycardia, hypotension, hypopnea, bradypnea	Hyporeflexia, pulmonary edema, needle marks	Opiates (eg, heroin, morphine, methadone, oxycodone, hydromorphone), diphenoxylate
Sedative-hypnotic	CNS depression, confusion, stupor, coma	Miosis (usually)	Hypothermia, bradycardia, hypotension, hypopnea, bradypnea	Hyporeflexia	Benzodiazepines, barbiturates, carisoprodol, meprobamate, glutethimide, alcohols, zolpidem
Cholinergic	Confusion, coma	Miosis	Bradycardia, hypertension orhypotension, tachypneaor bradypnea	Salivation, urinary and fecal incontinence, diarrhea, emesis, diaphoresis, lacrimation, GI cramps, bronchoconstriction, muscle fasciculations and weakness, seizures	Organophosphate and carbamate insecticides, nerve agents, nicotine, pilocarpine, physostigmine, edrophonium, bethanechol, urecholine
Serotonin syndrome	Confusion, agitation, coma	Mydriasis	Hyperthermia, tachycardia, hypertension, tachypnea	Tremor, myoclonus, hyperreflexia, clonus, diaphoresis, flushing, trismus, rigidity, diarrhea	MAOIs alone or with: SSRIs, meperidine, dextromethorphan, TCAs, L-tryptophan
Tricyclic antidepressant	Confusion, agitation, coma	Mydriasis	Hyperthermia, tachycardia, hypertension then hypotension, hypopnea	Seizures, myoclonus, choreoathetosis, cardiac arrhythmias and conduction disturbances	Amitriptyline, nortriptyline, imipramine, clomipramine, desipramine, doxepin