EMERGENCY MEDICINE

BOOT CAMP

TOXICOLOGY

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EPIDEMIOLOGY

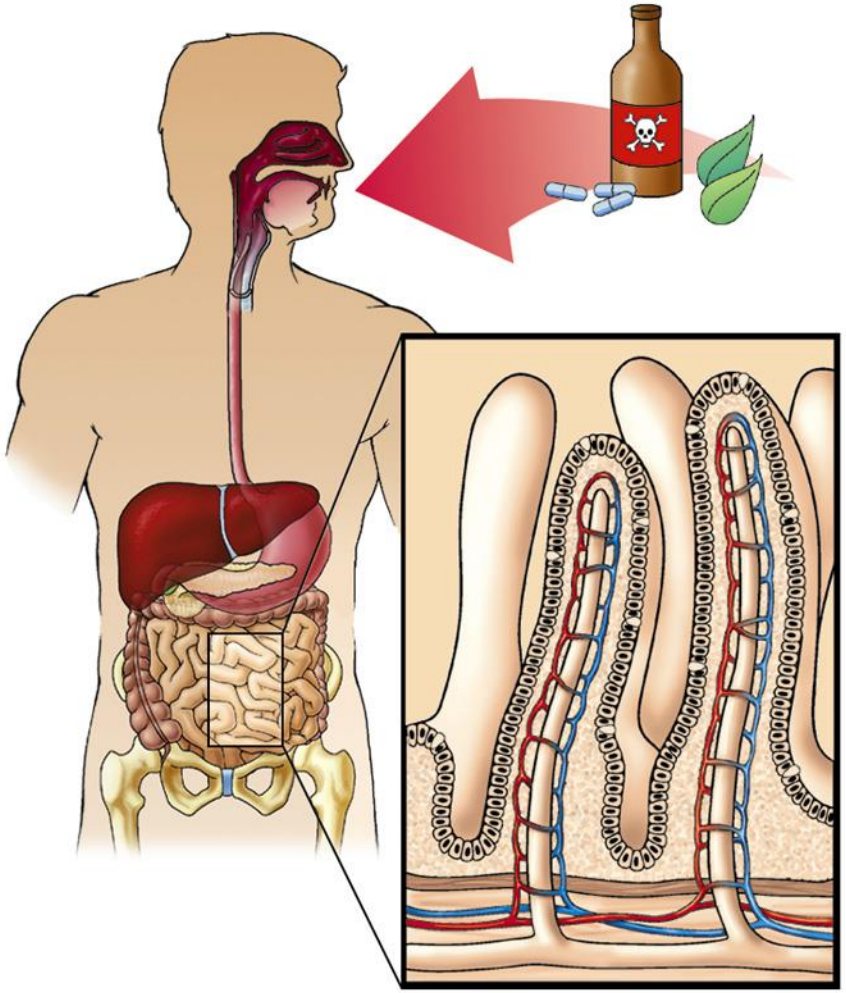
- Over 4 million poisonings occur annually.
- 10% of ED visits and EMS responses involve toxic exposures.
- 70% of accidental poisonings occur in children under 6 years old.
- 80% of attempted suicides involve a drug overdose.

POISON CONTROL CENTERS

- Poison Control
  - National network of specially trained providers.
  - Typically regional or statewide.
  - Accessed by telephone.
- Contact Poison Control Early
  - Assist in determining potential toxicity.
  - Advise on prehospital treatment.
  - Advise the receiving facility and Medical Control.

ROUTES OF TOXIC EXPOSURE

- Ingestion
  - Common agents:
    - Household products
    - Petroleum-based agents
    - Cleaning agents
    - Cosmetics
    - Drugs, plants, or foods
  - Absorption occurs in the stomach and small intestine.



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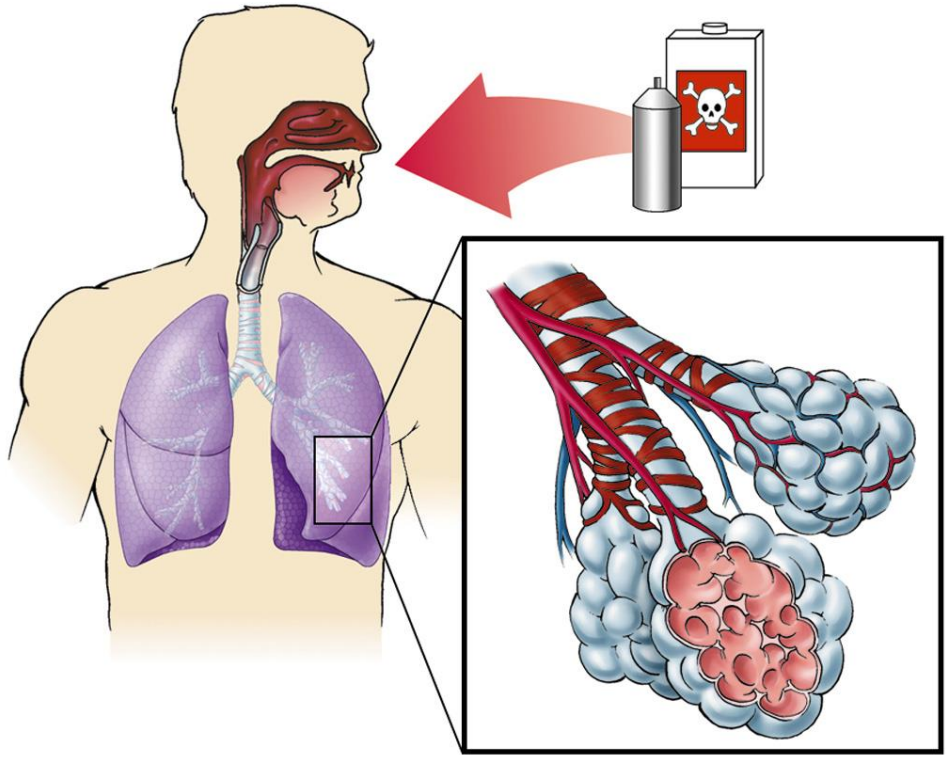
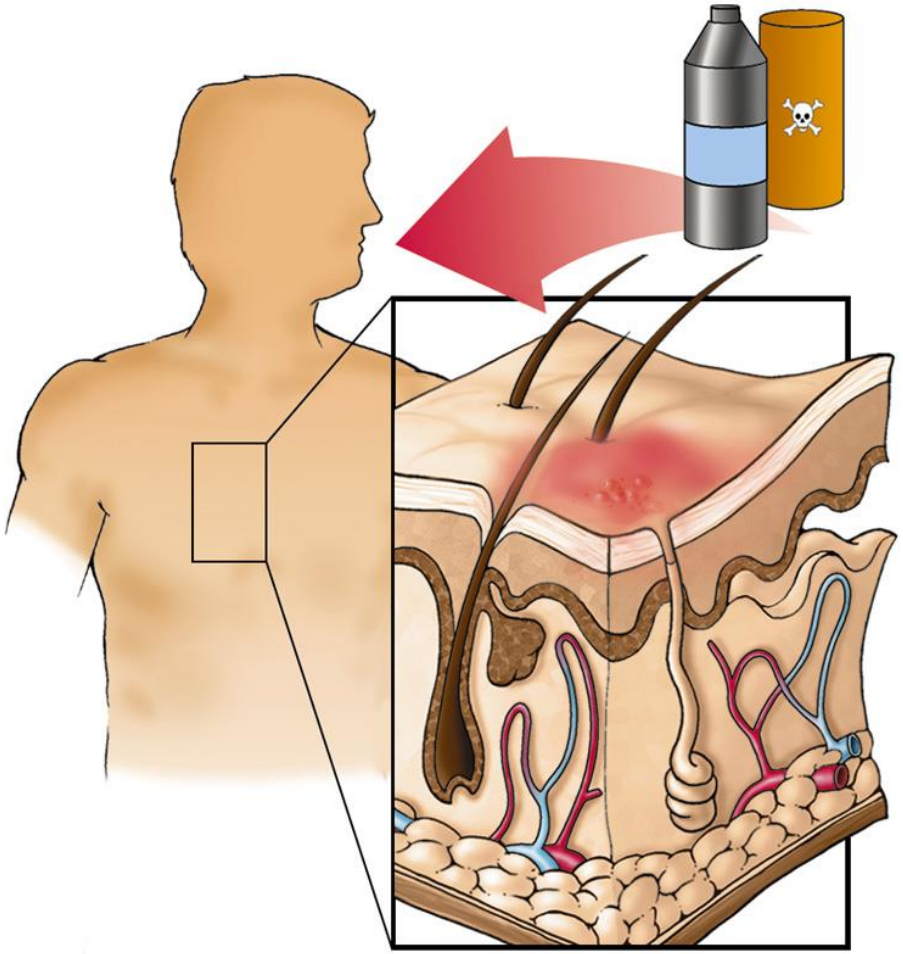
ROUTES OF TOXIC EXPOSURE

- Inhalation
  - Common agents
    - Toxic gases, vapors, fumes, aerosols
    - Carbon monoxide, ammonia, chlorine
    - Tear gas, freon, nitrous oxide, methyl chloride
    - Carbon tetrachloride
  - Absorption occurs via the capillary—alveolar membrane in the lungs.



ROUTES OF TOXIC EXPOSURE

- Surface Absorption
  - Common agents:
    - Poison ivy, oak, or sumac
    - Organophosphates
  - Absorption occurs through capillaries in the skin.



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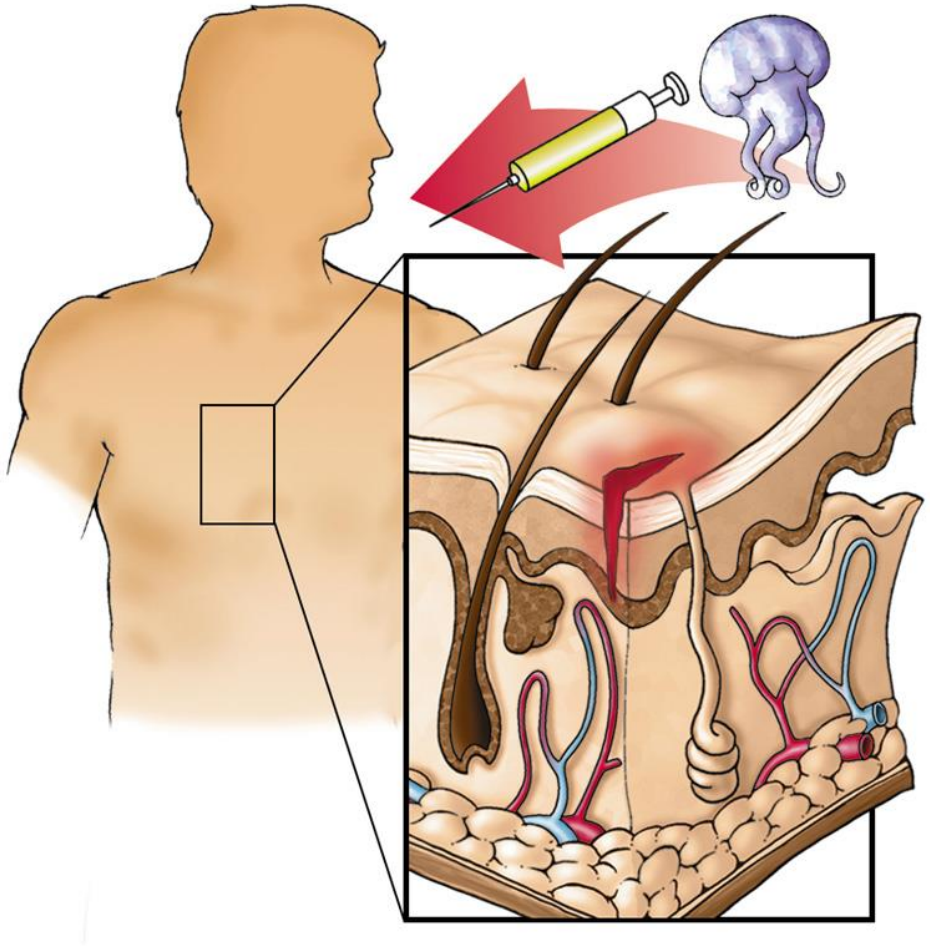
ROUTES OF TOXIC EXPOSURE

- Injection
  - Common agents:
    - Animal bites or stings
    - Intentional injection of illicit drugs
  - Substance enters directly into the body through a break in the skin.



General Principles of Toxicologic Assessment and Management

- Standard Toxicologic Emergency Procedures
  - Recognize a poisoning promptly.
  - Assess the patient thoroughly to identify the toxin and 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.

GENERAL ASSESSMENT

- Scene Size-up
  - 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.
- Initial Assessment
  - Airway and respiratory compromise are common in toxicologic emergencies.
  - Manage life-threatening conditions.

GENERAL ASSESSMENT

- History, Physical Exam, and Ongoing Assessment
  - Identify the toxin and length of exposure.
  - Contact Poison Control and Medical Control according to local policy.
  - Complete appropriate physical exams.
  - Monitor vital signs closely.

GENERAL TREATMENT

- Initiate supportive treatment.
- Decontamination
  - Reduce intake of the toxin.
    - Remove the individual from the toxic environment.
  - Reduce absorption of toxins in the body.
  - Enhance elimination of the toxin.

GENERAL TREATMENT

- Antidotes
  - Useful only if the substance is known.
  - Rarely 100% effective.
  - Must be used in conjunction with other therapies to ensure effectiveness.

- Which of the following is not the correct antidote for the toxic substance?
- a. Organophosphate – atropine and 2-PAM
- b. Iron – DMSA
- c. Nitrates – methylene blue
- d. Acetaminophen – N-acetylcysteine
- e. Methanol - alcohol

GENERAL TREATMENT

Table 8-1 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	Defroxamine	Initial: 10–15 mg/kg/hr IV
Lead	Edetate calcium disodium	1 amp/250 mL D5W over 1 hr
	or Dimercaptosuccinic acid (DMSA)	250 mg PO
Mercury, Arsenic, Gold	BAL (British anti-Lewisite)	5 mg/kg IM
	DMSA	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

GENERAL TREATMENT

- Suicidal Patients and Protective Custody
  - Involve law enforcement.
  - Involve Medical Control.
  - Know local procedures and laws.
    - Laws for protective custody vary widely.

INGESTED TOXINS

- Assessment
  - History
    - 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?

INGESTED TOXINS

- Physical exam
  - Skin
  - Eyes
  - Mouth
  - Chest
  - Circulation
  - Abdomen
- Exposure to multiple toxins
  - Suicide attempt, experimentation

INGESTED TOXINS

- Management
  - Contact Poison Control/Medical Control.
  - Prevent aspiration.
  - Administer fluids and drugs.
    - IV access
    - Use of $D_{50}W$, naloxone, and thiamine
    - Decontamination
  - Do NOT induce vomiting.

INHALED TOXINS

- Assessment
  - History and physical exam
    - Evaluate the scene.
    - Central nervous system effects include dizziness, headache, confusion, seizure, hallucinations, coma.
    - Respiratory effects include cough, hoarseness, stridor, dyspnea, retractions, wheezing, chest pain or tightness, rales, rhonchi.
    - Cardiac effects include dysrhythmias.

INHALED TOXINS

- 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.
  - Perform the initial assessment, history, and physical exam.
  - Initiate supportive measures.
  - Contact Poison Control and Medical Control according to local protocol.

SURFACE-ABSORBED TOXINS

- Assessment and 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.
  - Perform the initial assessment, history, and physical exam.
  - Initiate supportive measures.
  - Contact Poison Control and Medical Control according to local protocol.

- Typical findings in organophosphate poisoning include all except:
- a. Miosis
- b. Excessive secretions
- c. Polyuria
- d. Dry mouth
- e. Diarrhea

SPECIFIC TOXINS

- Toxidromes
  - Similar toxins typically have similar signs and symptoms.
  - In some cases it may be difficult to identify a specific toxin.

- Overdoses with sympathetic stimulants such as the amphetamines can be differentiated from an anticholinergic overdose by the presence of:
- a. Tachycardia
- b. Hypertension
- c. Diaphoresis
- d. Urinary retention
- e. Hyperthermia

SUBSTANCES AND SYMPTOMS

Bradycardia

- A: Alpha agonists
- B: B-blockers
- C: Ca Channel blockers
- D: Digoxin
- E: Everything else
  - Opiods
  - Sedatives

Toxidromes

- Stimulants
  - Cocaine, meth, etc
- Anticholinergic
  - Blind as bat…
- Cholinergic
  - Dumbless, sludge, seizures
- Sedative/Hypnotics
  - Alcohol, benzo
- Opioid
  - Pinpoint pupil, coma; respiratory depression

ONE PILL (LIQUID) THAT CAN KILL

- Opioids
- Alpha agonists
  - Clonidine
  - Tetrahydozoline (Visine)
- Camphor
- Benzocaine
- TCA
- Hydrocarbons
- Antipsychotics
  - Thioridazine
  - Chlorpromazine
  - Loxapine
- CCB
- Colchicine
- Antiarrhythmics
  - Quinidine
  - Flecainamide
  - Procainamide
  - Quinine
- Sulfonylureas
- Diphenoxylate (lomotil)
- Iron
- Lindane
- Salicylate
  - Oil of wintergreen
- Theophylline
- Buprenorphine

HOW CAN YOU DIFFERENTIATE THESE TOXIDROMES?

Serotonin syndrome

Neuroleptic malignant syndrome

HOW CAN YOU DIFFERENTIATE THESE TOXIDROMES?

Serotonin syndrome

Clonus/hyperreflexia

Neuroleptic malignant syndrome

Muscle rigidity

HOW CAN YOU DIFFERENTIATE THESE TOXIDROMES?

Anticholinergic

Sympathomimetic

HOW CAN YOU DIFFERENTIATE THESE TOXIDROMES?

Anticholinergic	Sympathomimetic
Dry (“as a bone”)	Sweaty

TOXIDROMES

Hot Tox (hyperthermic)	Agitated	Sedated
Sympathomimetic (sweaty)	**PCP/cocaine** (superhuman strength)	**Opioid** (miosis)
Anticholinergic (dry)	**Withdrawal syndromes** (esp. EtOH)	**EtOH/benzos** (no miosis)
NMS (muscle rigidity)		**Cholinergic** (wet, DUMBBELSS)
Serotonin syndrome (clonus)		
Malignant hyperthermia (got succinylcholine)		

TOXIC SYNDROMES

Table 8-2 Toxic Syndromes

Toxidromes	Toxin	Signs and Symptoms
Anticholinergic	Belladonna alkaloids Atropine (hyoscyamine) Belladonna alkaloid mixtures: belladonna leaf, fluid extract, tincture Homatropine Methscopolamine Methylatropine nitrate Plants: *Atropa belladonna, Datura stramonium, Hyoscyamus niger, Amanita muscaria* or *pantherina* Scopolamine (I-hyoscine)	Dry skin and mucous membranes Thirst Dysphagia Vision blurred for near objects Fixed dilated pupils Tachycardia Sometimes hypertension Rash, like scarlet fever Hyperthermia, flushing Urinary urgency and retention Lethargy Confusion to restlessness, excitement Delirium, hallucinations Ataxia Seizures Respiratory failure Cardiovascular collapse
	Synthetic anticholinergics Adiphenine, Anisotropine, Cyclopentolate, Dicyclomine, Diphemanil, Eucatropine, Glycopyrrolate, Hexocyclium, Isopropamide, Mepenzolate, Methantheline, Methixene, Oxyphenonium, Oxyphencyclimine, Pentapiperide, Pipenzolate, Piperiodolate, Poldine, Propantheline, Thiphenamil, Tridihexethyl, Tropicamide	
	Incidential anticholinergics Antihistamines, Benactyzine, Phenothiazines, Tricyclic antidepressants	

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TOXIC SYNDROMES

Acetylcholinesterase inhibition	Organophosphates TEPP OMPA Dipterex Chlorthion Di-Syston Co-ral Phosdrin Parathion Methylparathion Malathion Systox EPN Diazinon Guthion Trithion	Sweating, constricted pupils, lacrimation, excessive salivation, wheezing, cramps, vomiting, diarrhea, tenesmus, bradycardia *or* tachycardia, hypotension *or* hypertension, blurred vision, urinary incontinence Striated muscle: cramps, weakness, twitching, paralysis, respiratory failure, cyanosis, arrest Sympathetic ganglia: tachycardia, elevated blood pressure CNS effects: anxiety, restlessness ataxia, seizures, insomnia, coma, absent reflexes, Cheyne-Stokes respirations, respiratory and circulation depression

TOXIC SYNDROMES

Cholinergic	Acetylcholine *Area catechu* Carbachol *Clitocybe dealbata*	Betel nut Bethanechol Pilocarpine *Pilocarpus species*	Methacholine Muscarine	Sweating, constricted pupils, lacrimation, excessive salivation, wheezing, cramps, vomiting, diarrhea, tenesmus, bradycardia *or* tachycardia, hypotension *or* hypertension, blurred vision, urinary incontinence

Toxidromes	Toxin			Signs and Symptoms
Extrapyramidal	Acetophenazine Butaperazine Carphenazine Chlorpromazine Haloperidol	Mesoridazine Perphenazine Piperacetaxine Promazine	Thioridazine Thiothixene Trifluoperazine Triflupromazine	Parkinsonian Dysphagia, eye muscle spasm, rigidity, tremor, neck spasm, shrieking, jaw spasm, laryngospasm
Hemoglobinopathies	Carbon monoxide Methemoglobin			Headache, nausea, vomiting, dizziness, dyspnea, seizures, coma, death Cutaneous blisters, gastroenteritis Epidemic occurrence with carbon monoxide Cyanosis, chocolate blood with non-functional hemoglobin

TOXIC SYNDROMES

Metal fume fever	Fumes of oxides of: Brass Cadmium Copper Zinc	 Iron Magnesium Mercury	 Nickel Titanium Tungsten	Chills, fever, nausea, vomiting, muscular pain, throat dryness, headache, fatigue, weakness, leukocytosis, respiratory disease
Narcotic	Alphaprodine Anileridine Codeine Cyclazocine Dextromethorphan Dextromoramide Diacetylmorphine Dihydrocodeine Dihydrocodeinone Dipipanone Diphenoxylate (Lomotil)	Ethylmorphine Ethoheptazine (meperidene metabolite) Fentanyl Heroin Hydromorphone Levorphanol Meperidine Methadone Metopon Morphine	Normeperidene Opium Oxycodone Oxymorphone Pentazocine Phenazocine Piminodine Propoxyphene Racemorphan	CNS depression Pinpoint pupils Slowed respirations Hypotension Response to naloxone Pupils may be dilated and excitement may predominate Normeperidine: tremor, CNS excitation, seizures

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TOXIC SYNDROMES

Sympathomimetic	Aminophylline Amphetamines Caffeine *Catha edulus* (Khat) Cocaehylene Cocaine Dopamine	Ephedrine Epinephrine Fenfluramine Levarterenol Metaraminol Methamphetamine Methcathinone	Methylphenidate (Ritalin) Pemoline Phencyclidine Phenmetrazine Phentermine	CNS excitation Seizures Hypertension Hypotension with caffeine Tachycardia
Withdrawal	Alcohol Barbiturates Benzodiazepines Chloral hydrate	Cocaine Ethchlorvynol Glutethimide Meprobamate	Methaqualone Methyprylon Opiods Paraldehyde	Diarrhea, large pupils, piloerection, hypertension, tachycardia, insomnia, lacrimation, muscle cramps, restlessness, yawning, hallucinations Depression with cocaine

Adapted from Done AK. *Poisoning—A Systematic Approach for the Emergency Department Physician.* Presented Aug. 6–9, 1979, at Snowmass Village, CO, Symposium sponsored by Rocky Mountain Poison Center. Used by Permission.

CYANIDE

- Exposure
  - Fast-acting toxin
  - Usually ingested or absorbed
- Signs & Symptoms
  - Burning sensation in the mouth and throat
  - Headache, confusion, and combativeness
  - Breath almond like
  - Hypertension and tachycardia
  - Seizures and coma
  - Pulmonary edema


suncoast
chemicals co.
STABILIZER/
CONDITIONER
INCREASER
ACTIVE INGREDIENTS:
Cyanuric Acid Hydrate 98%
Inert Ingredients.....2%
KEEP OUT OF REACH OF CHILDREN
CAUTION
IRRITANT
SEE FIRST AID AND ADDITIONAL
PRECAUTIONS ON BACK PANEL
net wt. 4 lbs.

CYANIDE

- Management
  - Ensure rescuer safety.
  - Initiate supportive care.
  - Administer antidote:
    - Cyanide antidote kit containing amyl nitrite, sodium nitrite, and sodium thiosulfate

- A family of three presents with headache, nausea, and dizziness. They have chest pain and there is cold weather and snow outside. What agent should be considered?
- a. Ethanol ingestion
- b. PCP ingestion
- c. CO intoxication
- d. Cocaine abuse

CARBON MONOXIDE

- Exposure
  - Inhaled colorless, odorless gas
    - Poorly ventilated heating systems
    - Confined spaces
- Signs & Symptoms
  - Headache
  - Nausea and vomiting
  - Confusion or other altered mental status
  - Tachypnea

CARBON MONOXIDE

- Management
  - Ensure rescuer safety.
  - Remove the patient from the contaminated area.
  - Initiate supportive measures.
    - High-flow oxygen
  - Hyperbaric therapy

- Which of the following is true regarding carbon monoxide poisoning?
- a. Most common cause of death in developing nations
- b. Patients may have a metabolic acidosis
- c. Delayed neurologic sequelae may occur
- d. Patients may present with coma or seizures
- e. All of the above

CARDIAC MEDICATIONS

- Exposure
  - Commonly due to dosage errors
- Signs & Symptoms
  - Nausea, vomiting, headache, dizziness, confusion
  - Profound hypotension, cardiac dysrhythmias
  - Bronchospasm, pulmonary edema
- Management
  - Standard toxicologic emergency procedures
  - Antidotes

DIGOXIN TOXICITY

- Yellow Halos
- Nausea/ vomiting
- Bradycardia
- **Dig bind criteria**
  - K+ > 5.5
  - Cardiovascular collapse
  - Blocks (Mobitz II , 3rdDegree)
  - Ventricular Dysrhythmia
  - Dig level >10
  - May have chronic digoxin toxicity with a near above abnormal level

DIGOXIN TOXICITY

- Dig Toxic + Hyperkalemic
- What medication contraindicated?
- Calcium Gluconate/Chloride!!
- Worsens intracellular Calcium derangement

CA CHANNEL BLOCKERS

- Bradycardia
- Hypotension
- AMS
- Prolonged QTC
- Treat with
  - Ca gluconate/CaCl
  - IVF's
  - Vasopressors
  - Glucagon
  - Insulin (may produce hyperglycemia due to the CCB)

B-BLOCKERS

- Bradycardia
- Hypotension
- AMS
- Treatment
  - IVF's
  - Vasopressors
  - Glucagon
  - Insulin
  - Pacemaker
  - HD

CAUSTIC SUBSTANCES

- Exposure
  - Typically occurs by ingestion or surface absorption.
  - Acids
    - Cause significant damage at sites of exposure.
    - Are rapidly absorbed into the bloodstream.
    - Coagulation Necrosis
  - Alkalis
    - Slower onset of symptoms allows for longer contact and more extensive tissue damage.
    - Liquefaction Necrosis
    - (Worse/Deeper Burn)

CAUSTIC SUBSTANCES

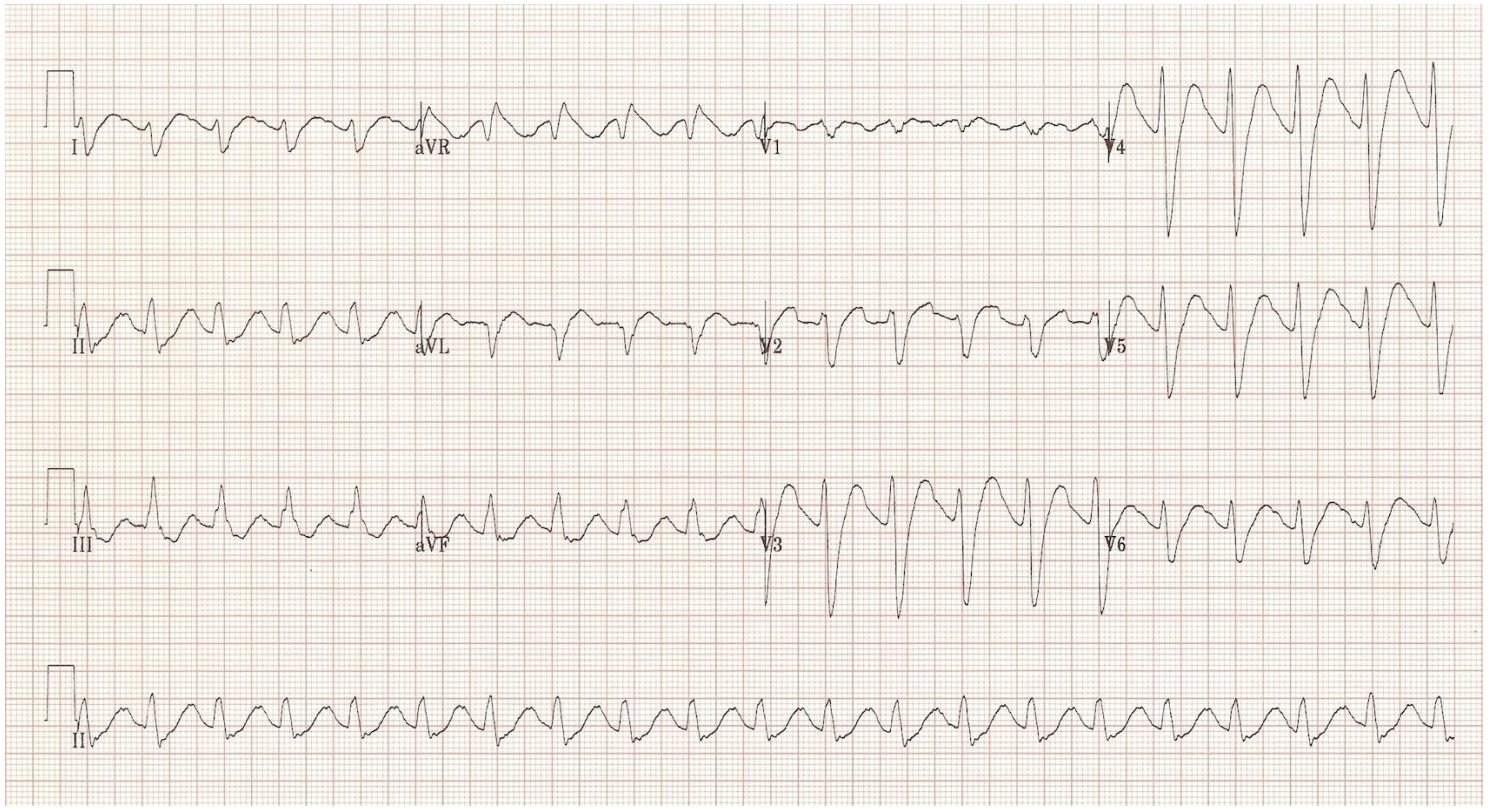
- Signs & Symptoms
  - Facial burns
  - Pain in the lips, tongue, throat, or gums
  - Drooling, trouble swallowing
  - Hoarseness, stridor, or shortness of breath
  - Shock from bleeding, vomiting
- Management
  - Water
  - Perform standard toxicologic emergency procedures.
  - Maintain an adequate airway.

HYDROFLUORIC ACID

- Exposure
  - Highly toxic; used to clean and etch glass.
- Signs & Symptoms
  - Burning at site of contact
  - Confusion, palpitations, muscle cramps
- Management
  - Perform standard toxicologic emergency procedures.
  - Irrigate and immerse the affected area.
  - Transport immediately for definitive care
  - **Calcium**

HYDROCARBONS

- Compounds of Carbon and Hydrogen
  - May be ingested, inhaled, or adsorbed.
- Signs & Symptoms
  - Burns due to local contact
  - Wheezing, dyspnea, hypoxia, pneumonitis
  - Headache, dizziness, slurred speech, ataxia, obtundation, cardiac dysrhythmias
  - Foot and wrist drop with numbness and tingling
- Management
  - Water
  - Nebulizer
  - Standard toxicologic emergency procedures



23 YO M WITH DEPRESSION, BROUGHT IN AFTER SUICIDE ATTEMPT

Dx and Tx?

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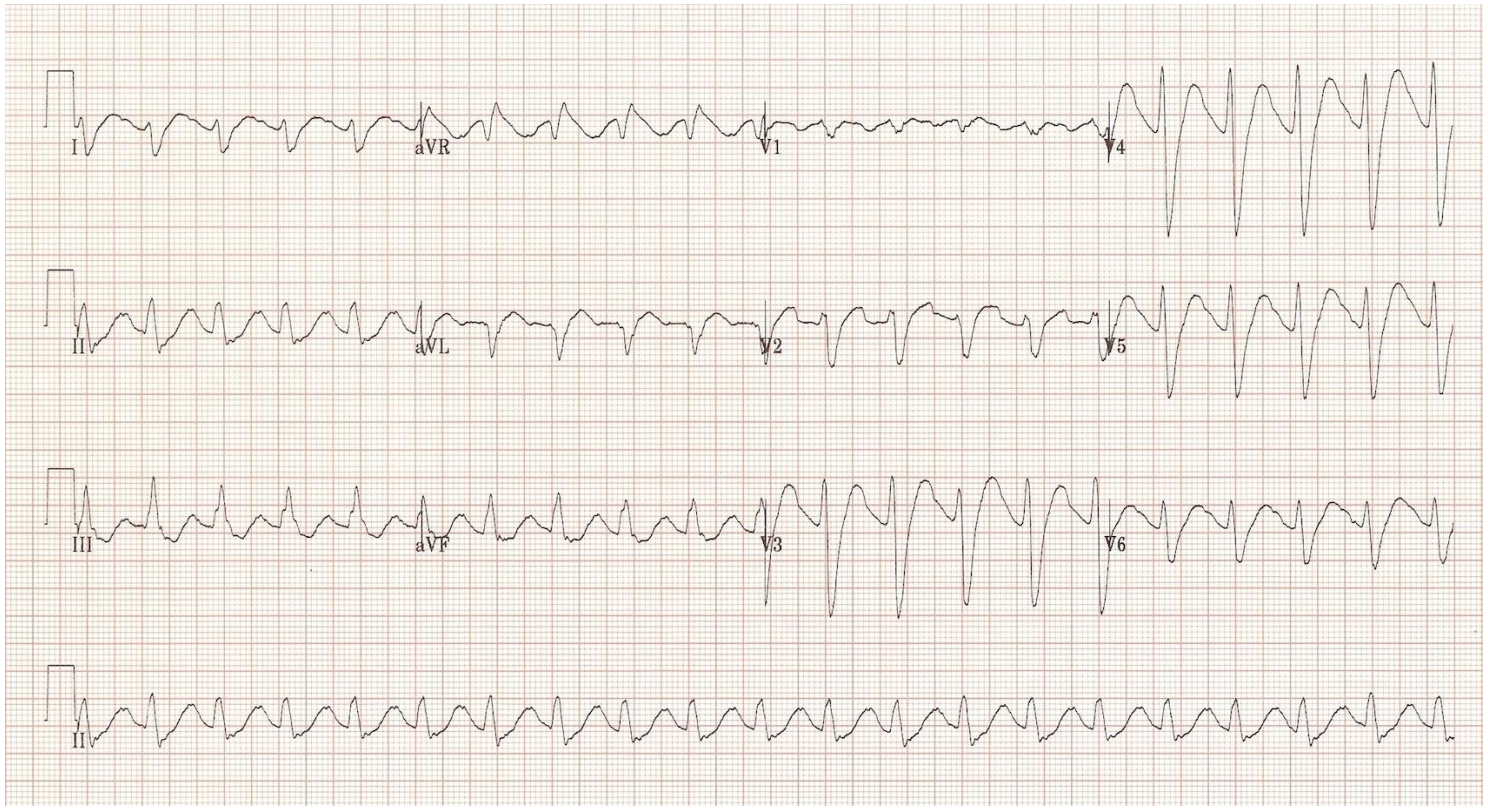

23 YO M WITH DEPRESSION, BROUGHT IN AFTER SUICIDE ATTEMPT

Dx: TCA overdose

Tx: sodium bicarb

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TCA OVERDOSE

TCA overdose	
TCA Medications	Amitriptyline, nortriptyline, doxepin
Affects	Basically all neuroreceptors (ACh -> anticholinergic ssx, NE -> alpha blockade, Na channel -> wide QRS, histamine, GABA -> seizures)
Diagnosis	No levels are available; consider for pt with depression, presenting with AMS, seizures, QRS widening, VT/VF
Treatment	Sodium bicarbonate (competes against Na channel blockade -> narrow QRS, decreased risk of VT/VF), otherwise supportive care only

TRICYCLIC ANTIDEPRESSANTS

- Antidepressants
  - Include amitriptyline, amoxapine, doxepin, nortriptyline, imipramine, clomipramine.
  - TCAs have a narrow therapeutic index.
- Signs & Symptoms of Toxicity
  - Dry mouth, blurred vision, urinary retention, constipation

TRICYCLIC ANTIDEPRESSANTS

- Signs & Symptoms of Severe Toxicity
  - Confusion, hallucinations, hyperthermia
  - Respiratory depression, seizures
  - Tachycardia, hypotension, cardiac dysrhythmias
    - **Prolonged QTc**
- Management
  - Monitor and treat cardiac dysrhythmias.
  - Bicarbonate drip
  - Benzodiazepines for seizures
  - Airway
  - HD
  - Avoid use of flumazenil, which may precipitate seizures.

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MAO INHIBITORS

- Infrequently Prescribed Antidepressant
  - High mortality with overdose because of drug's action
- Signs & Symptoms
  - Headache, agitation, restlessness, tremor
  - Nausea, severe hypertension, hyperthermia
  - Palpitations and tachycardia
    - Progresses to bradycardia, hypotension, coma, and death.
- Management
  - Benzodiazepines for seizures
  - Airway
  - HD
  - IVF's

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NEWER ANTIDEPRESSANTS

- Trazodone, Bupropion, and SSRIs
- Signs & Symptoms
  - Drowsiness, tremor, nausea, vomiting, tachycardia
  - Serotonin syndrome
    - Triggered by increasing the dose or by adding selected drugs.
    - Marked by agitation, anxiety, confusion, insomnia, headache, coma, salivation, diarrhea, abdominal cramps, cutaneous piloerection, flushed skin, hyperthermia, rigidity, shivering, incoordination, and myoclonic jerks.
- Management
  - Benzodiazepines for seizures
  - Airway
  - HD
  - IVF's

LITHIUM

- Prescribed to treat bipolar disorder
  - Narrow therapeutic index
- Signs & Symptoms
  - Thirst, dry mouth, tremors, muscle twitching, and increased reflexes
  - Confusion, stupor, seizures, coma, nausea, vomiting, diarrhea, **bradycardia**, and dysrhythmias
- Treatment
  - Benzodiazepines for seizures
  - Airway
  - HD
  - Standard toxicologic emergency procedures
    - Activated charcoal is not effective with lithium

WHAT IS THE CLASSIC METABOLIC DISORDER WITH SALICYLATE TOXICITY?

WHEN DO YOU DIALYZE FOR SALICYLATE TOXICITY?

WHAT IS THE CLASSIC METABOLIC DISORDER WITH SALICYLATE TOXICITY?

Concurrent metabolic acidosis and respiratory alkalosis

WHEN DO YOU DIALYZE FOR SALICYLATE TOXICITY?

Acute: ASA>100mg/dL Chronic: ASA>60mg/dL

OR

Presence of renal failure, severe acidemia, cerebral/pulmonary edema

- Symptoms of salicylate intoxication include all of the following except:
- a. Tinnitus and impaired hearing
- b. Seizures and coma
- c. Hypothermia
- d. Dehydration
- e. CNS depression

SALICYLATES

- Common Overdose Drug
  - Includes aspirin, oil of wintergreen.
- Signs & Symptoms
  - Tachypnea, hyperthermia, confusion, lethargy, coma, cardiac failure, and dysrhythmias
  - Abdominal pain, vomiting, pulmonary edema, ARDS
  - Respiratory alkalosis then, metabolic acidosis

SALICYLATES

- Treatment
  - Activated charcoal is indicated.
  - Benzodiazepines for seizures
  - Airway
  - Bicarbonate
  - HD
  - IVF's

ACETAMINOPHEN

- Common OTC Antipyretic & Analgesic
- Signs & Symptoms

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**

ACETAMINOPHEN

- Treatment
  - IVF's
  - NAC – Mucomyst PO or Acetadote IV
  - Liver transplant

OTHER NONPRESCRIPTION PAIN MEDICATIONS

- Includes Nonsteroidal Anti-inflammatory Drugs
  - NSAIDs include ibuprofen, keterolac, naproxen sodium.
- Signs & Symptoms
  - Headache, tinnitus, nausea, vomiting, abdominal pain, drowsiness
  - Dyspnea, wheezing, pulmonary edema, swelling of extremities, rash, itching

OTHER NONPRESCRIPTION PAIN MEDICATIONS

- Treatment
  - Activated charcoal is indicated.
  - Benzodiazepines for seizures
  - Airway
  - Bicarbonate
  - HD
  - IVF's

THEOPHYLLINE

- Bronchodilator Prescribed for Chronic Respiratory Problems
- Signs & Symptoms
  - Agitation, tremors, seizures, cardiac dysrhythmias, nausea, and vomiting
  - MAT
- Management
  - Repeated doses of activated charcoal are indicated.
  - Treat cardiac dysrhythmias.
    - Procainamide
  - Activated charcoal is indicated.
  - Benzodiazepines for seizures
  - Airway
  - HD
  - IVF's

METALS

- Iron
  - Overdose of dietary supplement
  - Signs & Symptoms
    - Vomiting (with hematemesis), diarrhea, abdominal pain, shock, liver failure, bowel scarring and obstruction, metabolic acidosis with tachypnea
  - Treatment
    - Activated charcoal is not indicated.
    - Benzodiazepines for seizures
    - Deferoxamine
    - Airway
    - HD
    - IVF's

METALS

- Lead and Mercury
  - Overdose often results from chronic environmental exposure.
  - Signs & Symptoms
    - Headache, irritability, confusion, coma, memory disturbances, tremors, weakness, agitation, abdominal pain
  - Treatment
    - Activated charcoal is not indicated.
    - Benzodiazepines for seizures
    - EDTA, BAL, DMSA
    - Airway
    - HD
    - IVF's

CONTAMINATED FOOD

- Bacteria, Viruses, and Toxic Chemicals
  - Bacterial Toxins
    - Exotoxins and enterotoxins
  - Seafood Poisonings
- Signs & Symptoms
  - Nausea, vomiting, diarrhea, and abdominal pain
  - Facial flushing and respiratory distress

CONTAMINATED FOOD

- Treatment
  - Perform assessment.
  - Collect samples of the suspect food source.
  - Maintain the airway and support breathing.
    - Intubate and assist ventilations if indicated.
    - Administer high-flow oxygen.
  - Establish IV access.
  - Consider medications.
    - Antihistamines, antiemetics

POISONOUS PLANTS AND MUSHROOMS

- Decorative Plants
  - Common source of accidental poisoning in children
- Signs & Symptoms
  - Excessive salivation, lacrimation, diaphoresis, abdominal cramps, nausea, vomiting, diarrhea, and altered mental status
- Treatment
  - Follow treatment guidelines for contaminated food.

Spider bite + necrotic wound + heme problems — Type of spider???

Spider bite + abdominal pain — Type of spider???

Dog or cat bite — Treatment???

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Spider bite + necrotic wound + heme problems	Brown Recluse
Spider bite + abdominal pain	Black widow
Dog or cat bite	Augmentin

INJECTED TOXINS

- General Principles of Management
  - 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 Control.

- A 23-year-old male is reaching into a tackle box when he feels a prick. He thought he poked himself with a fishing lure, but becomes nauseated and presents complaining of severe abdominal pain. On exam, his abdomen is rigid and tender. What is the next best treatment?
- a. Exploratory Laporatomy
- b. Calcium Gluconate
- c. Analgesics and diazepam for muscle spasm and pain
- d. Dapsone

INSECT BITES AND STINGS

- Insect Stings
  - Signs & Symptoms
    - Localized pain, redness, swelling, skin wheal.
      - Idiosyncratic reactions
    - Observe for signs of an allergic reaction.
      - Localized pain, redness, swelling, skin wheal
      - Generalized flushing of the skin or itching
      - Tachycardia, hypotension, bronchospasm, or laryngeal edema, facial edema, uvular swelling

INSECT BITES AND STINGS

- Treatment
  - Wash the area.
  - Remove stingers, if present.
    - Use care not to disturb the venom sac.
  - Apply cool compresses to the injection site.
  - Observe for and treat allergic reactions and/or anaphylaxis.

INSECT BITES AND STINGS

- Brown Recluse Spider Bite
  - Found primarily in the South and Midwest.

INSECT BITES AND STINGS

- Signs & Symptoms
  - Localized, white-ringed macule.
  - Progresses to localized pain, redness, and swelling over next 8 hours.
  - Chills, fever, nausea, vomiting, and joint pain may also develop.

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INSECT BITES AND STINGS

- Signs & Symptoms
  - Tissue necrosis develops over subsequent days and weeks.
- Treatment
  - Follow general treatment guidelines.
  - Provide supportive care.

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INSECT BITES AND STINGS

- Black Widow Spider Bite
  - Signs & Symptoms
    - Immediate pain, redness, and swelling
    - Progressive muscle spasms of all large muscle groups
    - Nausea, vomiting, sweating, seizures, paralysis, and altered level of consciousness

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INSECT BITES AND STINGS

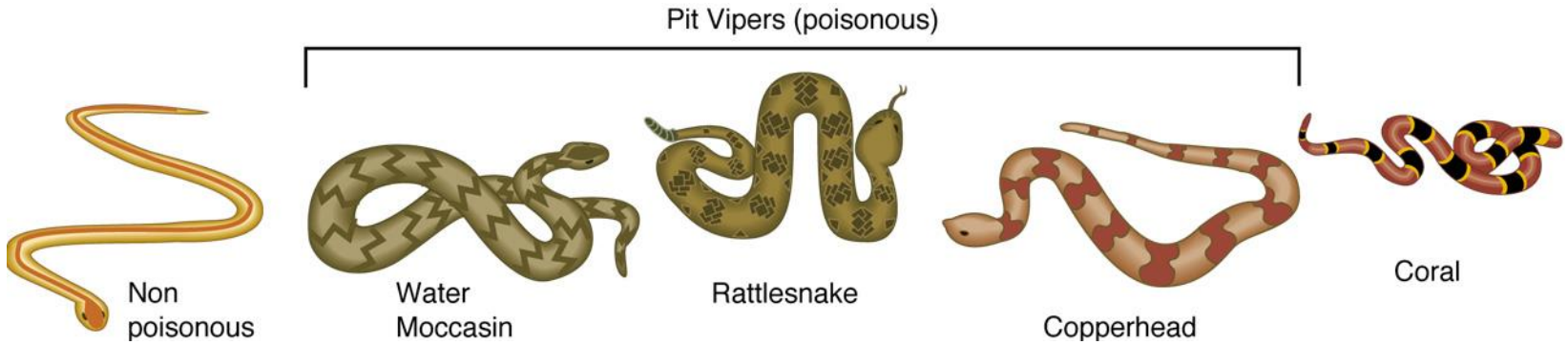
- Treatment
  - Follow general treatment guidelines.
  - Provide supportive care.
  - Consider using muscle relaxants to relieve severe muscle spasms.
    - Diazepam 2.5–10mg IV or 0.1–0.2 mg/kg of a 10% calcium gluconate solution IV

INSECT BITES AND STINGS

- Scorpion Stings
  - Signs & Symptoms
    - Localized burning and tingling sensation
    - Slurred speech, restlessness, muscle twitching, salivation, nausea, vomiting, and seizures
  - Treatment
    - Follow general treatment guidelines.
    - Apply constricting band.

SNAKEBITES

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



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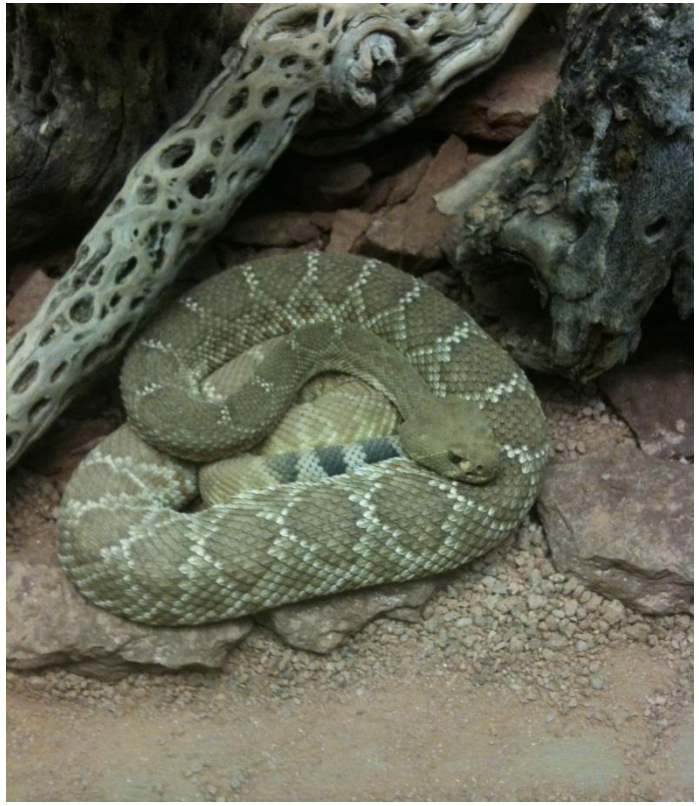

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PIT VIPER BITES

Degree of Envenomation	*Signs and Symptoms*
None	None (either local or systemic)
Minimal	Swelling
	Pain
	No systemic symptoms
Moderate	Progressive swelling
	Mild systemic symptoms
	– paresthesias
	– nausea and vomiting
	– unusual tastes
	– mild hypotension
	– mild tachycardia
	– tachypnea
Severe	Swelling (spreading rapidly)
	Severe pain
	Systemic symptoms
	– altered mental status
	– nausea and vomiting
	– hypotension (systolic <80)
	– severe tachycardia
	– severe respiratory distress
	Blood oozes freely from puncture wounds

PIT VIPER BITES

- Treatment
  - 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.

CORAL SNAKE BITES

- Signs & 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
- Treatment
  - Treat similarly to a pit viper bite.
    - Wash the wound with large amounts of water and maintain the immobilized extremity at the level of the heart.

MARINE ANIMAL INJECTION

Signs & Symptoms

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

Treatment

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

27 YO F NON-RESPONSIVE, BARELY BREATHING

Dx and Tx?

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27 YO F NON-RESPONSIVE, BARELY BREATHING

Dx: Opioid Overdose
Tx: Naloxone

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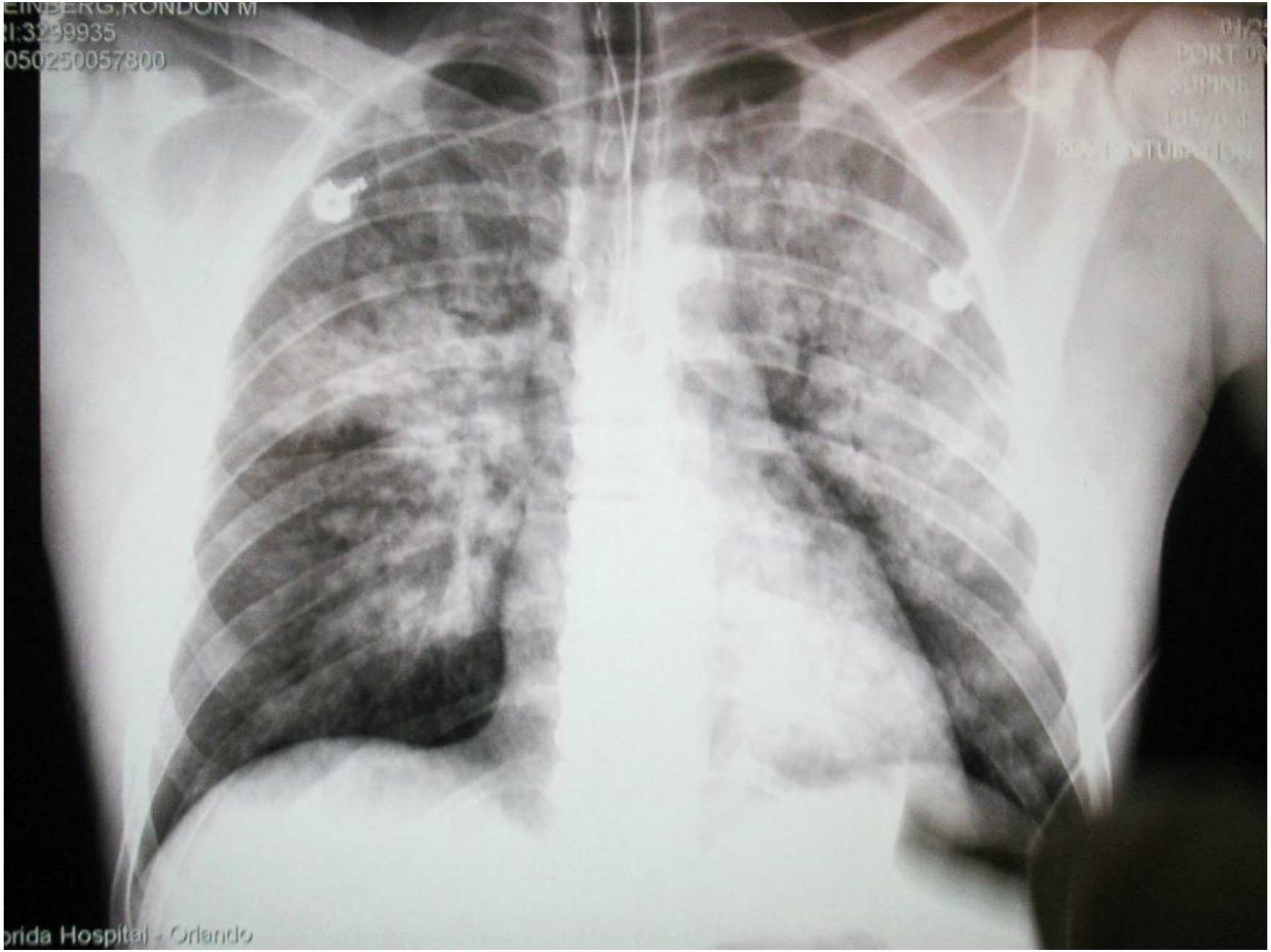
SUBSTANCE ABUSE AND OVERDOSE

- Addiction
  - Habituation
  - Physiological dependence
  - Psychological dependence
  - Tolerance
- Withdrawal
- Drug Overdose

COMMON DRUGS OF ABUSE

- Drugs Used for Sexual Purposes
  - 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 the US.
    - Treat as a benzodiazepine overdose and sexual assault victim.



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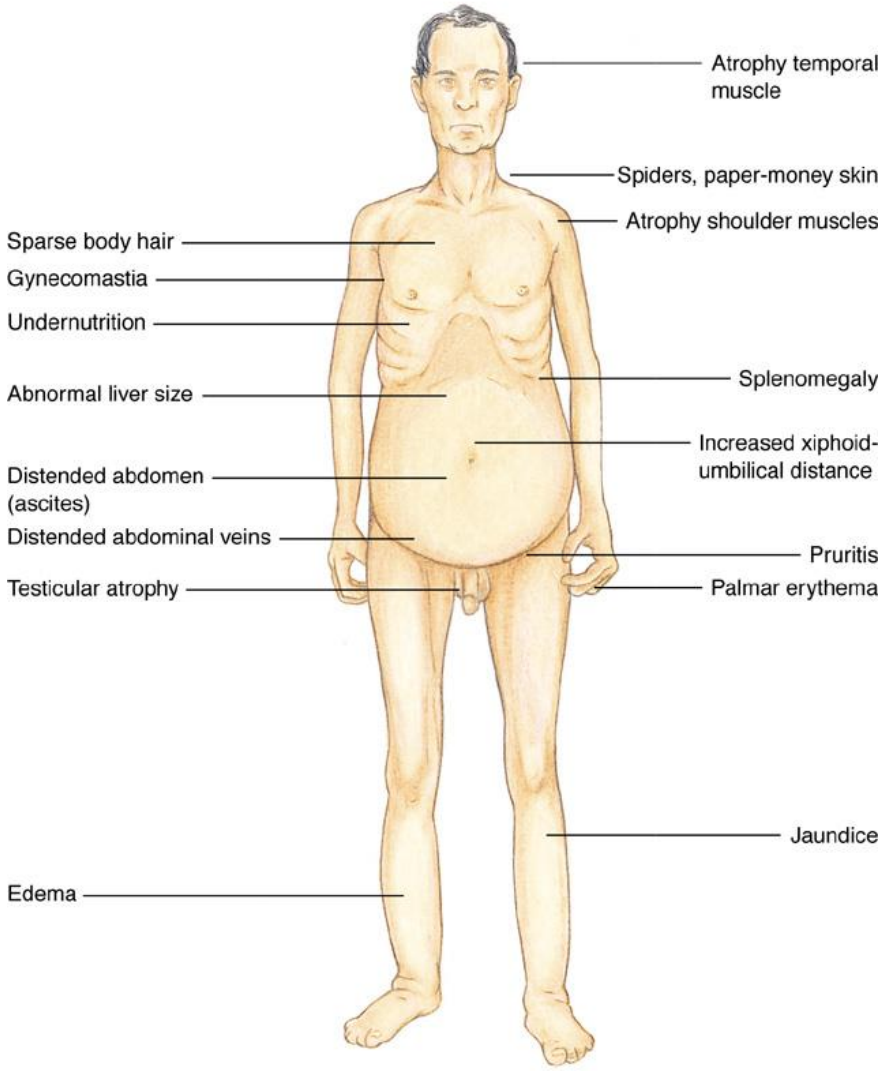
ALCOHOL ABUSE

- Physiologic Effects
  - CNS depressant
  - Alcoholism
    - Susceptible to methanol or ethylene glycol ingestion
  - Peripheral vasodilatation, 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.

ALCOHOL ABUSE

- Consequences of Chronic Alcohol Ingestion
  - 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)



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ALCOHOL ABUSE

- Withdrawal Syndrome
  - Delirium Tremens (DTs)
  - Signs & Symptoms
    - Coarse tremor of hands, tongue, eyelids
    - Nausea, vomiting, general weakness, anxiety
    - Tachycardia, sweating, hypertension, hallucinations, irritability or depressed mood, poor sleep
    - Increased sympathetic tone, orthostatic hypotension

ALCOHOL ABUSE

- Treatment
  - Establish and maintain the airway.
  - Determine if other drugs are involved.
  - Establish IV access.
    - Lactated Ringer's or normal saline
  - Consider medications.
    - 25g $D_{50}W$ if hypoglycemic
    - 100mg thiamine IV or IM
  - Transport, maintaining a sympathetic attitude, and reassure the patient.

- In the treatment of suspected ethylene glycol ingestion:
- a. Gastric lavage is indicated for all ingestions
- b. Correction of the metabolic acidosis will generally require very little exogenous sodium bicarbonate, as the body will correct itself rapidly once metabolites are formed
- c. Fomepizole blocks the metabolism of ethylene glycerol by ADH and prevents the formation of toxic metabolites
- d. Observation and support of respirations is all that is usually necessary
- e. Dialysis is never indicated

METHANOL

- Also known as **methyl alcohol**, **wood alcohol**, **wood naphtha** or **wood spirits**
  - Methanol acquired the name "wood alcohol" because it was once produced chiefly as a byproduct of the destructive distillation of wood. Modern methanol is produced in a catalytic industrial process directly from carbon monoxide, carbon dioxide, and hydrogen
- Methanol ingested in large quantities is metabolized to formic acid or formate salts
  - Poisonous to the central nervous system, and may cause blindness, coma, and death
- The initial symptoms of methanol intoxication include
  - Central nervous system depression, headache, dizziness, nausea, lack of coordination, and confusion
  - Blindness
- High anion gap metabolic acidosis with high osmolar gap

METHANOL

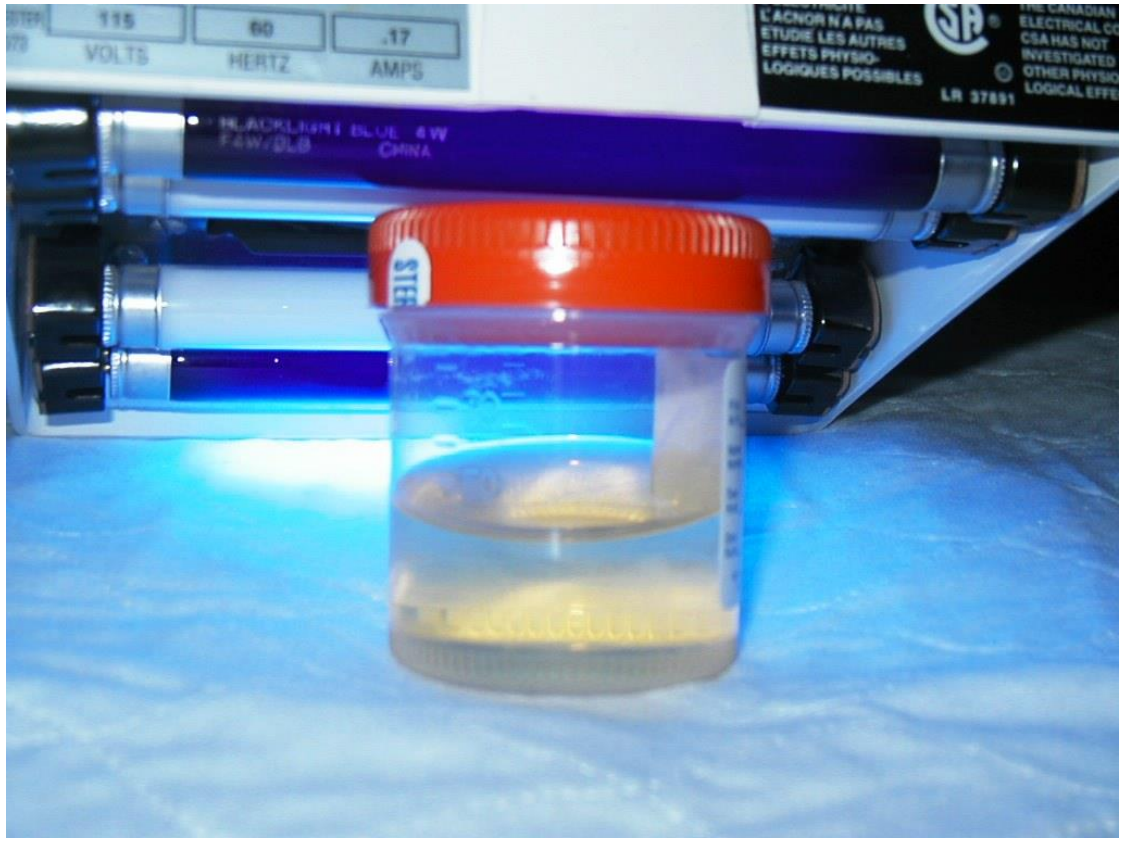
- Methanol poisoning can be treated with:
  - Antidotes ethanol or fomepizole
    - Both drugs act to reduce the action of alcohol dehydrogenase on methanol by means of competitive inhibition, so it is excreted by the kidneys rather than being transformed into toxic metabolites
  - Further treatment may include giving sodium bicarbonate for metabolic acidosis, and hemodialysis or hemodiafiltration can be used to remove methanol and formate from the blood

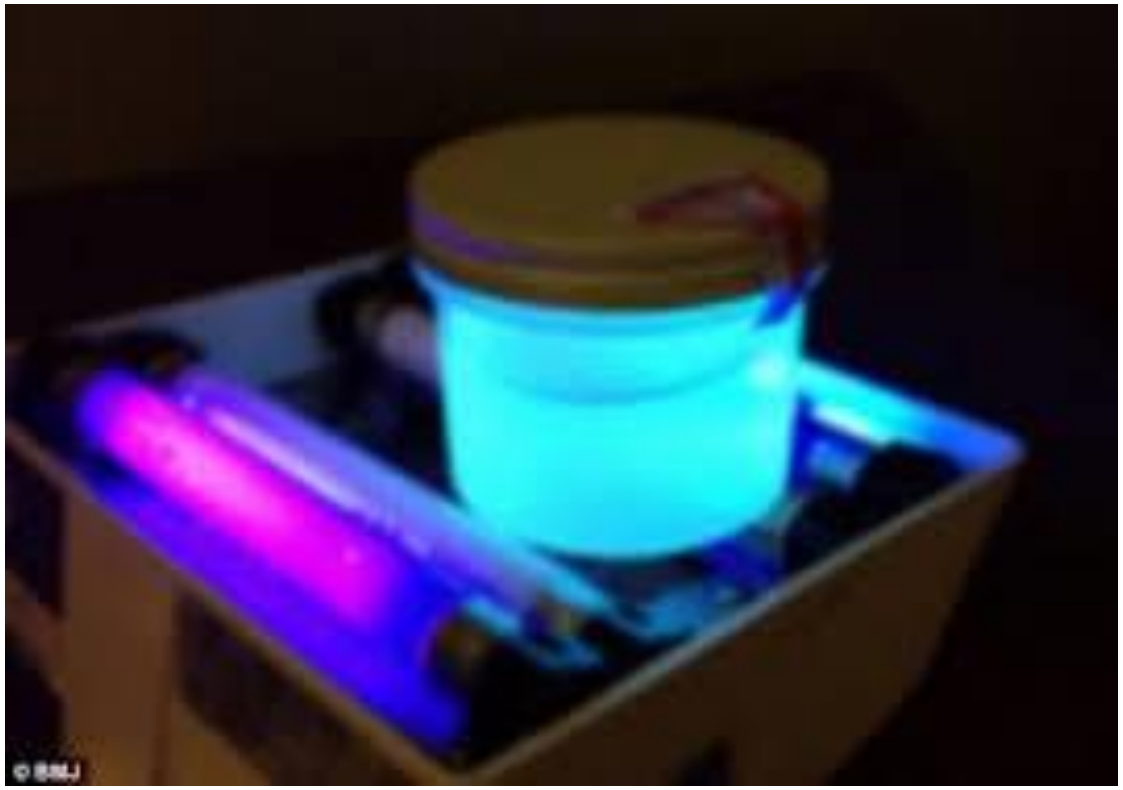
ETHYLENE GLYCOL

- An organic compound widely used as an automotive antifreeze, coolant, and a precursor to polymers.
- In its pure form, it is an odorless, colorless, syrupy, sweet-tasting liquid. Ethylene glycol is toxic, and ingestion can result in death.
- Upon ingestion, ethylene glycol is oxidized to glycolic acid which is, in turn, oxidized to oxalic acid, which is toxic.
- It and its toxic byproducts first affect the central nervous system, then the heart, and finally the kidneys. Ingestion of sufficient amounts can be fatal if untreated.
- Diagnosis can also be aided by examining the urine for the presence of calcium oxalate crystals.
- High anion gap metabolic acidosis with high osmolar gap

ETHYLENE GLYCOL

- Treatment consists of initially stabilizing the patient, followed by the use of antidotes. The antidotes used are either ethanol or fomepizole (Antizol). The antidotes work by blocking the enzyme responsible for metabolizing ethylene glycol and therefore halt the progression of poisoning. Hemodialysis is also used to help remove ethylene glycol and its metabolites from the blood





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ISOPROPYL ALCOHOL

- Isopropyl alcohol and its metabolite, acetone, act as central nervous system (CNS) depressants.
- Symptoms of isopropyl alcohol poisoning include flushing, headache, dizziness, CNS depression, nausea, vomiting, anesthesia, and coma.
- Poisoning can occur from ingestion, inhalation, or absorption; therefore, well-ventilated areas and protective gloves are recommended.
- Isopropyl alcohol does not cause an anion gap acidosis (in which a lowered blood serum pH causes depletion of bicarbonate anion) unlike ethanol and methanol.
- Isopropyl alcohol does however, produce an osmolal gap between the calculated and measured osmolalities of serum, as do the other alcohols.
- Overdoses may cause a fruity odor on the breath as a result of its metabolism to acetone, which is further metabolized to produce the nutrients acetate and glucose.[
- Isopropyl alcohol is oxidized to form acetone by alcohol dehydrogenase in the liver

ISOPROPYL ALCOHOL

- Treatment
  - Supportive
  - IVF's
  - HD?
  - Not as bad as methanol or ethylene glycol

NAME 2 INGESTIONS THAT ARE RADIOPAQUE?

NAME 2 INGESTIONS THAT ARE RADIOPAQUE?

Chloral hydrate

Heavy metals

Iron

Enteric coated

Iodine

Phenothiazine

Solvents

DRUGS THAT ARE RADIOOPAQUE CHIPES

- C = Chloro Hydrate
- H = Heavy Metals
- I = Iron
- P = Phenothiazines
- E = Enteric Coated
- S = Solvents

DRUGS THAT ARE DIALYZABLE BLIST MED

- Barbituates
- Lithium
- Isoniazide/Iron
- Salicylates
- Theophyline
- Methanol
- Ethylene Glycol
- Depakote

USELESS USED OF CHARCOAL

- Lithium
- Alkali/Acids
- Heavy Metals
- Iron
- Hydrocarbons

HIV+ PT ON DAPSONE WITH FATIGUE, 02 SAT 85%

Dx and Tx?

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HIV+ PT ON DAPSONE WITH FATIGUE, 02 SAT 85%

Dx: Methemoglobinemia

Tx: Methylene blue

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METHEMOGLOBINEMIA

Methemoglobinemia	
What is it?	**Iron in Hgb gets oxidized to Fe^{3+}** from normal Fe^{2+}, causing impaired O_2 binding and tissue hypoxia with methemoglobin levels >10%
Causes	Medications (dapsone, topical anesthetics, nitrites/nitrates, antimalarials, Pyridium), environmental (aniline dyes, well water)
Diagnosis	**SaO_2 ~85%** (consistent with MetHgb >10%), **"chocolate"-colored arterial blood**, central cyanosis
Treatment	**Methylene blue** (reduces Fe^{3+} to Fe^{2+}; N.B. avoid in G6PD deficiency, because this will cause hemolysis)

WHEN IS ACTIVATED CHARCOAL CONTRAINDICATED?

Name 1

WHEN IS ACTIVATED CHARCOAL INEFFECTIVE?

Name 1

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WHEN IS ACTIVATED CHARCOAL CONTRAINDICATED?

AMS/obtunded, Ileus,
Vomiting, Risk of Seizure

WHEN IS ACTIVATED CHARCOAL INEFFECTIVE?

Metals, Alcohols, Hydrocarbons,
Caustics

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ASSOCIATIONS

Garlic smell, multi-organ failure	???
Rotten eggs smell, unconscious pt	???
On meds for TB, p/w seizure	???

ASSOCIATIONS

Garlic smell, multi-organ failure	Arsenic
Rotten eggs smell, unconscious pt	Hydrogen sulfide
On meds for TB, p/w seizure	Isoniazid

ANTIDOTE TIME!

Cyanide	???
Methemoglobinemia	???
Carbon Monoxide	???

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ANTIDOTE TIME!

Cyanide	Hydroxycobalamin OR Na thiosulfate+Amyl nitrate+Na nitrate
Methemoglobinemia	Methylene blue
Carbon Monoxide	Oxygen

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ANTIDOTE TIME!

Acetaminophen	???
Benzodiazepines	???
Methanol/Ethylene Glycol	???

ANTIDOTE TIME!

Acetaminophen	N-acetylcysteine (NAC)
Benzodiazepines	Flumazenil (NB: may cause seizure)
Methanol/Ethylene Glycol	EtOH or fomepizole

ANTIDOTE TIME!

Aspirin	???
Digoxin	???

ANTIDOTE TIME!

Aspirin	Bicarb and hemodialysis
Digoxin	Digibind

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ANTIDOTE TIME!

Beta-blocker	???
Calcium channel blocker	???

ANTIDOTE TIME!

Beta-blocker	Glucagon, insulin
Calcium channel blocker	Calcium, glucagon, insulin

ANTIDOTE TIME: TOXIDROMES

Sympathomimetic	???
Anticholinergic	???
Serotonin syndrome	???
Neuroleptic malignant syndrome	???
Malignant hyperthermia	???

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ANTIDOTE TIME: TOXIDROMES

Sympathomimetic	Benzos
Anticholinergic	Benzos, consider physostigmine
Serotonin syndrome	Benzos, consider cyproheptadine
Neuroleptic malignant syndrome	Benzos, consider bromocriptine
Malignant hyperthermia	Dantrolene

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ANTIDOTE TIME: METALS

Iron	???
Lead	???
Mercury	???
Arsenic	???
Lithium	???

ANTIDOTE TIME: METALS

Iron	Deferoxamine
Lead	Dimercaprol or EDTA
Mercury	Dimercaprol
Arsenic	Dimercaprol
Lithium	Hemodialysis

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Alcohol + AMS + Ataxia + Nystagmus

Diagnosis???

Stingray Wound

How do you deactivate toxin???

Beta-blocker OD

Hyperglycemia OR Hypoglycemia

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Alcohol + AMS + Ataxia + Nystagmus	Wernicke Encephalopathy
Stingray Wound	Hot Water Immersion
Beta-blocker OD	Hypoglycemia

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