Chapter 139 – General Approach to the Poisoned Patient

Key Concepts:

- ❑ Toxidromes are constellations of signs and symptoms based primarily on vital signs and neuropsychiatric functions that are characteristic manifestations of certain toxic exposures.
- ❑ Recognition of the presence of a toxidrome can suggest a potential intoxicant and guide early interventions and management strategies. Examples of toxidromes include sympathomimetic, antimuscarinic, cholinergic, sedative-hypnotic, and opioid categories.
- ❑ Qualitative urine drug levels are inferior to quantitative serum levels in terms of guiding specific therapy.
- ❑ Syrup of ipecac is not indicated in the ED care of a poisoned patient. Gastric lavage is not part of routine care. When given in a timely fashion (1 hour post ingestion), activated charcoal may be indicated for potentially lethal agents in alert, cooperative patients.
- ❑ Whole-bowel irrigation is rarely useful for management of poisoned patients but is potentially helpful for specific poisonings, such as metals, illicit drug packets, or sustained-release medications.
- ❑ Serum alkalinization enhances urinary drug elimination for certain drugs and is indicated for significant poisoning caused by salicylates, phenobarbital, and methotrexate.
- ❑ Hemodialysis is best suited to remove poisons of low molecular weight, low protein binding, and high water solubility; examples include methanol, ethylene glycol, lithium, and salicylates.
- ❑ If the motivation behind the toxic exposure was self-harm, a psychiatric consultation is warranted.
- ❑ Regional Poison Control Centers or a medical toxicologist can assist with antidotal therapy and may help facilitate patient disposition.

Episode Overview:

1. Define Toxidrome and list 5 toxidromes describing features of each
    a. List 8 common causes of each toxidrome
2. List common odors on physical exam in overdose
3. List 4 ‘universal antidotes’
4. List 10 toxins that cause delirium
5. List 6 toxins that are radiopaque (What are the toxins which can be seen on x-ray?)
6. List 5 reasons why urine toxicology screens are not typically useful
7. For activated charcoal, describe
    a. Dosing strategies
    b. Indications for activated charcoal
    c. Overdoses where activated charcoal is not recommended
    d. Contraindications
8. For Whole Bowel Irrigation
    a. List indications
    b. Describe method
9. For Gastric Lavage
    a. List indication
    b. Describe method
10. List 5 dialyzable drug properties

11. List 8 dialyzable drugs
12. List 10 seizure-causing toxins
13. List medications amenable to multidose charcoal
14. Which toxins typically present late (> 6 hrs)

Wisecracks:

1. Mnemonic Madness - Toxicologic differential diagnosis for:
    a) Seizures
    b) Wide complex QRS
    c) Hypoglycemia
    d) Tachycardia
    e) Hyperthermia / Diaphoresis
    f) Mydriasis
    g) Miosis
    h) Bradycardia + hypotension
    i) Substances causing wide-AGMA
    j) Substances causing non-AGMA
2. What are commonly available serum drug levels
3. List the “one pill can kill” drugs

Rosen’s in Perspective

We are entering the land of facts, factoids and for many….fear….unless you’re one of those brainiacs with a memory for obscure details. Yes, toxicology….

The big idea with all this toxicology stuff is:

1. Make diagnosis / or suspect the ingestion/exposure/overdose/toxicity
2. Ask those five W’s and H’s
    a. Who took it?
    b. What did they take, and any other co-ingestions?
    c. When did they take it?
    d. Where did they take it (packer, stuffer, IV, PO, Intranasal, transdermal, rectal)?
    e. Why did they take it (i.e. suicide vs occupational vs accidental) ?
    f. How MUCH did they take?
3. Initiate decontamination
4. Prevent absorption
5. Enhance drug elimination
6. Give any antidotes

When it comes to history, get as much collateral information as possible!

Aspects of the physical exam not to overlook (clues toward a specific toxin or toxidrome):

- Airway! Breathing! Circulation...
- Full vitals, rectal core temperature, glucose
- LOC, pupillary size,
- Seizure activity, clonus, reflexes, muscle tone
- Skin moisture
- Odour

Finally, just because we're talking Tox, don't forget about a comprehensive approach to altered mental status!

- DIMES

Lifeinthefastlane has a great mnemonic:

- R – Resuscitation
- R – Risk Assessment
- S – Supportive Care
- I – Investigations
- D – Decontamination
- E – Enhanced Elimination
- A – Antidotes
- D – Disposition

Note: Most toxicologic interventions have little data or evidence, as it is hard to design RCT's in this area of medicine. So, as such, most recommendations are based on a mix of clinical experience, scientific theory and case studies / series.

[1] Define Toxidrome and List 5 Toxidromes and their Causative Agents

Toxidrome: "constellation of signs and symptoms that can suggest a class of toxin exposure"

Toxidrome	Bottom line	Details	Causes	Treatment
Sympathomimetic	"Fight or flight" "Pedal to the metal" "Crazy, amped"	Excess catecholamines: hypertension, tachycardia, tachypnea, hyperthermia, mydriasis, diaphoresis. ***Risk for arrhythmias and shock***	MDMA, Cocaine, amphetamines, cathinones, ephedrine, pseudoephedrine, phenylpropanolamine, theophylline, caffeine	Benzo's Fluids Supportive
Anticholinergic	"Red as a beet Dry as a bone Blind as a bat Mad as a hatter Hot as hell The bladder keeps its tone and the heart runs alone"	Antimuscarinic and antinicotinic properties - leading to a relative sympathomimetic (sympathetic overdrive because cholinergic tone is blocked) Hyperthermia, cutaneous flushing, delirium, hallucinations, mydriasis, urinary retention, and dry skin and mucous membranes	Antihistamines, tricyclic antidepressants, cyclobenzaprine, orphenadrine, antiparkinson agents, antispasmodics, phenothiazines, atropine, scopolamine, belladonna alkaloids (eg, Jimson Weed)	Supportive, based on the specific agent
Cholinergic	"Fluids coming out of every orifice" "DUBMBBELLS"	Overstimulation of the parasympathetic system. Muscarinic effects: • Diarrhea, diaphoresis	Organophosphate and carbamate insecticides, nerve agents, nicotine, pilocarpine, physostigmine, edrophonium,	Antidotes: • Atropine • 2-pam aka Pralidoxime (2-

	And Nicotinic - DAYS OF THE WEEK.	• Urination • Miosis • Bradycardia • Bronchorrhea • Emesis • Lacrimation • Lethargic • Salivation Nicotinic effects: • Mydriasis • Tachycardia • Weakness • Tremors • Fasciculations • Seizures • Somnolent	bethanechol, urecholine, Liquids from e-cigarettes (muscarinic effects are less prominent)	pyridine aldoxime methyl chloride) • Benzos • Supportive
Sedative/hypnotic	Sedation Vs. Hallucinogenic	Depression of brain activity and muscular metabolism Altered mental status Pupils not changed clinically	Benzodiazepines, barbiturates, carisoprodol, meprobamate, glutethimide, alcohols, zolpidem (USA)	• Supportive • Rule out traumatic injuries
Opiate	Sedation, diminished respiratory drive - responsive to naloxone	Miosis, hypothermia, respiratory depression, apnea, Bradycardia, hyporeflexia, pulmonary edema	Opioids (eg, heroin, morphine, methadone, oxycodone, hydromorphone), diphenoxylate	• Narcan • Supportive care
Hallucinogenic (Sometimes described as the 6th toxidrome)	"Stoned and crazy about coco-puffs"	Hallucinations, perceptual distortions, depersonalization, synesthesia, agitation, mydriasis, Hyperthermia, tachycardia, hypertension, tachypnea, nystagmus	Phencyclidine, LSD, mescaline, psilocybin, designer amphetamines (eg, MDMA ["Ecstasy"], MDEA)	• Supportive

[2] List Common Odors on Physical Exam in Overdose

Refer to Table 139.1 in Rosen's 9th Edition for a more comprehensive table summarizing the characteristic odors in an overdose

Odor on Physical Examination	Potential Source
Bitter Almonds	Cyanide
Carrots	Water Hemlock (Cicutoxin)
Fruity	DKA, Isopropanol
Garlic	Organophosphates, Arsenic, Dimethyl Sulfoxide, Selenium
Gasoline	Petroleum distillates

Mothballs	Napthalene, Camphor
Pears	Chloral Hydrate
Pungent Aromatic	Ethchlorvynol
Oil of Wintergreen	Methylsalicylate
Rotten Eggs	Sulfur Dioxide, Hydrogen Sulfide
Freshly Mowed Hay	Phosgene

[3] List 4 'Universal Antidotes'

These could be those classically available antidotes:

- ❑ Hypoxia - carbon monoxide
- ❑ Dextrose - insulin, oral hypoglycemic agents
- ❑ Narcan - narcotics
- ❑ Thiamine - Wernicke's / chronic ETOH abuse

Here's a bigger list from Rosen's:

Refer to Table 139.4 in Rosen's 9th Edition for a more comprehensive table summarizing select antidotes for numerous common poisons

Antidote	**Poison**
N-acetylcysteine	Acetaminophen
Fomepizole/Ethanol	Methanol/Ethylene Glycol
Oxygen/Hyperbarics	Carbon Monoxide
Naloxone	Opioids
Physostigmine	Anticholinergics
Atropine/Pralidoxime	Organophosphates
Methylene Blue	Methemoglobinemia
Nitrites/Hydroxycobalamin	Cyanide
Deferoxamine	Iron
Dimercaprol (BAL)	Arsenic, Lead
Succimer	Lead, Mercury
CaEDTA	Lead
Fab Fragments	Digoxin, Crotalids
Glucagon	Beta Blockers
Sodium Bicarbonate	Salicylates, TCA's
Calcium, Insulin/Glucose	CCB's
Dextrose, Glucagon, Octreotide	Oral Hypoglycemic Agents
Pyridoxine	Isoniazid
Intravenous Fat Emulsion	Local Anesthetics, Systemic Toxicity, Fat Soluble Medications

[4] List 10 Toxins That Cause Delirium

Ten toxins that cause delirium (As per UptoDate) are as follows:

1. Prescription medications (e.g., opioids, sedative-hypnotics, antipsychotics, etc…)
2. Non-prescription medications (e.g., OTC antihistamines)
3. Drugs of abuse (e.g., ethanol, heroin, hallucinogens, etc…)
4. Withdrawal states (e.g., ethanol, benzodiazepines)
5. Medication side effects (e.g., hyperammonemia from valproic acid, serotonin syndrome, etc…)
6. Poisons
    a. Toxic alcohols
    b. Inhaled toxins (e.g., carbon monoxide)
    c. Plant-derived toxins (e.g., Salvia)

[5] List 6 Toxins That are Radiopaque

Agents possibly radiopaque on plain x-ray:

- ❑ Substances with an atomic number >15 are more likely to be radiopaque (e.g., metals and halogenated hydrocarbons)
- ❑ Substances that are resistant to dissolution are more likely to be radiopaque (e.g., enteric coating or sustained-release formulations)

As per UptoDate, use the mnemonic CHIPES:

- ❑ C – chlorinated hydrocarbons (e.g., chloral hydrate, carbon tetrachloride), calcium salts (e.g., calcium carbonate), crack vials
- ❑ H – heavy metals (e.g., iron, arsenic, mercury, thallium, lead)
- ❑ I – iodinated compounds (e.g., thyroxine)
- ❑ P – psychotropics (e.g., phenothiazines, lithium, TCA's), packets of drugs (e.g., cocaine and heroin body packers), Play-Doh, potassium salts
- ❑ E – enteric-coated tablets (e.g., ASA)
- ❑ S – salicylates, sodium salts, sustained-release preparations

[6] List 5 Reasons Why Urine Toxicology Screens are not Typically Useful

There are a number of reasons why urine toxicology screens are not typically useful:

- ❑ Many false negatives
- ❑ Many false positives
- ❑ Are qualitative (not predictive of acute intoxication)
- ❑ Costly, without changing patient care
- ❑ Have a time lag (exposure may be days or weeks ago)

For a comprehensive list of the limitations of urine drug screens, see table 139.2 in Rosen's 9th Edition

[7] For Activated Charcoal, Describe:

Dosing strategies:

- ❑ Activated charcoal is a carbonaceous substance that has been exposed to high heat and steam, resulting in a large surface area to volume ratio, to provide ample surface space for ingested substances to adsorb, and thus decrease absorption into the body
- ❑ Activated charcoal historically has most often been given in a dose of 25 to 100 grams (10 to 25 grams or 0.5 to 1.0 gram/kilogram in young children)
- ❑ Customize the dose to the dose of the ingested agent by administering activated charcoal in a weight ratio of 10:1 (ratio of activated charcoal to drug).
- ❑ Note: Ratio is important because many people don't tolerate the full dose mg/kg dose... but many don't require the full dose
- ❑ Note: Rule of thumb: 1 gram/kg = typically 50grams / patient
- ❑ SDAC (single-dose activated charcoal) and MDAC (multi-dose activated charcoal) are NOT recommended to be given by NG tube.

Indications for activated charcoal:

- ❑ "Although few studies have shown a reduction of morbidity or mortality attributable to activated charcoal administration, and there have been reports of pulmonary aspiration of activated charcoal with serious patient harm, these aspiration events have occurred in a minority of patients receiving activated charcoal; and activated charcoal, accordingly, is considered a is a low risk Intervention." - Rosen's.
- ❑ The Killer C's (i.e., the indications for activated charcoal administration) are as follows:
    - ❑ Cyanide
    - ❑ Colchicine
    - ❑ CCB's
    - ❑ TCA's
    - ❑ Cardioglycosides
    - ❑ Cyclopeptide mushrooms
    - ❑ Cocaine
    - ❑ Cicutoxin (water hemlock)
    - ❑ Salicylates

Refer to Table 139.9 in Rosen's 9th Edition for a more comprehensive table summarizing the indications for the administration of activated charcoal

Overdoses where activated charcoal is not recommended:

Charcoal, please don't PHAILS us! The following are the ingestions that would no warrant the administration of activated charcoal. Use the mnemonic PHAILS to remember!

- ❑ Pesticides
    - ❑ Organophosphates
    - ❑ Carbamates

- ❑ Hydrocarbons/Heavy Metals
- ❑ Acids/Alkalis/Alcohols
- ❑ Iron
- ❑ Lithium
- ❑ Solvents

Contraindications to the administration of activated charcoal:

So that's FIVE checkpoints or questions! No to any of these indications = contraindication:

- ❑ Time (< 1-2 hrs)
- ❑ Toxin (lethal ingestion)
- ❑ Ton (large ingestion)
- ❑ Tacky (adsorption)
- ❑ Tasty (patient willing to take it)
- ❑ PHAILS drugs

"Don't PHAILS with Chef Charcoal because A TON of TACKY TOXINS in TIME is TASTY"

Note: If the patient is sedated, has an unprotected airway, or is unwilling to drink the charcoal suspension, administration is contraindicated. (e.g. commonly children, altered adults!)

Note: To make things slightly confusing: Rosen's states: "due to the lack of convincing evidence demonstrating benefit in clinical outcome in human overdose, we do not recommend the *routine* use of activated charcoal following ingestion. We do, however, recommend its use in <u>certain</u> overdose scenarios." - Rosen's page 1819 - 9th Ed.

For a comprehensive algorithm to guide your decisions surrounding administration of activated charcoal, see Figure 139.1 in Rosen's 9th Edition

[8] For Whole Bowel Irrigation, List the Indications and Describe the Method of Administration

Indications for Whole Bowel Irrigation:

- ❑ Ingestion of certain drugs:
  - ❑ Extended release preparations
  - ❑ Illicit drug packets
  - ❑ Metals (iron / lead)

Method for Whole Bowel Irrigation:

- ❑ Start @500ml/hr, increase as tolerated
- ❑ 2 L / hr in adults of polyethylene glycol solution (via NG)
- ❑ Not recommended in patients who are critically ill, gut hypoperfusion

[9] For Gastric Lavage, List the Indications and Describe the Method of Administration

Indications for Gastric Lavage:

Note: Gastric lavage has little data or evidence showing its efficacy and should not be performed routinely for the treatment of poisoned patients.

Given the risks of aspiration and the risk of esophageal trauma, the American Association of Poison Centers suggests gastric lavage only be used "within an hour of ingestion of a potentially life-threatening poison which does not adsorb to activated charcoal or for which no antidote exists" and, even then, in a center with "sufficient expertise" to perform the procedure safely. Only a rare overdose will meet all these criteria; and hence, despite its once widespread use, lavage is mostly of historical interest only.

Indications for gastric lavage:

- ❑ Lethal ingestion
- ❑ Early ingestion (drugs not in GI transit)
- ❑ No known antidote
- ❑ Not amenable to other decontamination strategies
- ❑ TCA is the most common

Method for Gastric Lavage:

Gastric lavage, the process of directly removing an ingested substance from the stomach is performed in the following way:

- ❑ Intubation
- ❑ Heavy sedation +/- paralysis
- ❑ Place patient in L lateral decubitus
- ❑ Place a 30 Fr or larger orogastric tube
  - ❑ Use specialized fenestrated tubes with rounded ends for this purpose
  - ❑ Confirm w/ xray
- ❑ Apply suction:
  - ❑ If it is a liquid ingestion simply applying suction through an NG is sufficient
  - ❑ Otherwise, you should give ~100 -200 cc alloquotes of water down the OG and then aspirate it back until you are no longer getting gastric contents/pill fragments.

[10] List 5 Dialyzable Drug Properties

- ❑ Low molecular weight
- ❑ Low protein binding or easily saturable protein binding in a toxicological context
- ❑ Low volume of distribution
- ❑ Low plasma clearance

- ❑ Low dialysate drug concentrations
- ❑ High water solubility

For more information, check out the following link: https://wikem.org/wiki/Dialyzable_drugs

[11] List 8 Dialyzable Drugs

Here's the list: STUMBLED

- ❑ Salicylates
- ❑ Theophylline
- ❑ Uremia
- ❑ Metformin / methanol
- ❑ Barbituates
- ❑ Lithium
- ❑ Ethylene glycol
- ❑ Depakote - valproic acid

Or IV STUMBLE (add Isoniazid and Valproic Acid)

We recommend checking out the following link for more information regarding dialyzable drugs: http://www.extrip-workgroup.org/

Note: Can add the following to the list:

- ❑ **Chloral hydrate**
- ❑ **Theoretically some Beta blockers (SANTA)**
- ❑ **Acetaminophen (massive)**

[12] List 10 Seizure-causing Toxins

To answer this question, use the mnemonic OTIS CAMPBELL:

- ❑ Organophosphates, oral hypoglycemics
- ❑ TCA's
- ❑ Insulin, isoniazid
- ❑ Sympathomimetics, salicylates
- ❑ Camphor, cocaine, CO, CyN, chlorinated hydrocarbones
- ❑ Amphetamines, anticholinergics
- ❑ Methylxanthines, methanol
- ❑ PCP, propranolol
- ❑ Benzo withdrawal, botanicals, bupropion
- ❑ ETOH withdrawal, ethylene glycol
- ❑ Lithium, lidocaine
- ❑ Lead

Note: This list above is not comprehensive. Pretty much ANY drug can cause seizure in a patient. Always be cognizant of that when managing these patients in the ED.

For more information on this topic, check out the link below:
https://www.epilepsy.com/learn/professionals/resource-library/tables/toxins-and-drugs-reported-induce-seizures

[13] List Medications Amenable to Multi-dose Charcoal

Note: MDAC is used to help remove a drug that has already been absorbed. Additionally, MDAC is useful for large ingestions where dissolution can be delayed.

Charcoal has some additional mechanisms to aid in elimination:

- ❑ MDAC helps create a form of "gut hemodialysis" by decreasing the amount of unbound drug in the gut lumen and drawing the drug from the circulation.
- ❑ Charcoal may also be helpful in enhancing elimination for drugs that have entero-hepatic recirculation.

To remember the list of medications amenable to MDAC, use the mnemonic ABCDQ:

- ❑ Aminophylline/theophylline
- ❑ Barbiturates
- ❑ Concretion forming drugs (salicylates) or carbamazepine
- ❑ Dapsone
- ❑ Quinine

Note: MDAC is dosed similar to single dose activated charcoal for the initial dose (05.-1 g/kg) and then ~50% of the initial dose every 4 hrs.

[14] Which Toxins Typically Present Late (> 6 hrs)?

Below is a non-comprehensive list of "toxic time bombs". For a more in-depth list, please see UptoDate's table of drugs with delayed clinical toxicity:

- ❑ Acetaminophen
- ❑ Pennyroyal Oil
- ❑ Mushrooms (multiple types)
- ❑ Toxic alcohols
- ❑ Sustained-release preparations (e.g., CCB's, BB's, Li)
- ❑ Enteric-coated preparations (e.g., ASA)
- ❑ MAOI's
- ❑ Drug packet ingestion
- ❑ Oral Hypoglycemic Agents
- ❑ Cyanogenic Glycosides
- ❑ Warfarin

Wise Cracks:

[1] List / Mnemonic Madness: Toxicologic differential diagnosis for:

- ❑ **Wide complex QRS (drugs that block sodium channels) :**
  - ❑ TCA's
  - ❑ Type 1a and 1c antidysrhythmics
  - ❑ Cocaine
  - ❑ Diphenhydramine
- ❑ **Hypoglycemia:**
  - ❑ Oral hypoglycemic agents
  - ❑ Beta blockers (especially in peds)
  - ❑ Isoniazid (INH)
  - ❑ Salicylates
  - ❑ Sulfonylureas
  - ❑ Insulin
  - ❑ Ethanol
- ❑ **Tachycardia + hypertension – FAST:**
  - ❑ Free base (cocaine), freon
  - ❑ Anti's (anticholinergics, antihistamines, antipsychotics), alcohol withdrawal, amphetamines
  - ❑ Sympathomimetics (cocaine, caffeine, amphetamines, PCP, solvents), nicotine
  - ❑ TCAs, thyroid hormones, theophylline
- ❑ **Hyperthermia / Diaphoresis – NASA:**
  - ❑ NMS, nicotine
  - ❑ Antihistamines, alcohol withdrawal
  - ❑ Salicylates, sympathomimetics, Serotonin syndrome
  - ❑ Anticholinergics, antidepressants, antipsychotics
- ❑ **Hypothermia – COOLS:**
  - ❑ Carbon monoxide
  - ❑ Opioids
  - ❑ Oral hypoglycemics, insulin
  - ❑ Liquor (alcohols)
  - ❑ Sedative hypnotics

- ❑ **Mydriasis – SAW:**
    - ❑ Sympathomimetics
    - ❑ Anticholinergics
    - ❑ Withdrawal syndromes
- ❑ **Miosis – COPS:**
    - ❑ Cholinergics, clonidine, carbamates
    - ❑ Opioids, organophosphates
    - ❑ Phenothiazines (antipsychotics), pilocarpine, pontine hemorrhage
    - ❑ Sedative-hypnotics
- ❑ **Bradycardia + hypotension:**
    - ❑ **PACED:**
        - ❑ Propranolol (and other BB's), poppies, physostigmine
        - ❑ Anticholinesterase drugs, antiarrhythmics
        - ❑ Clonidine, CCBs
        - ❑ ETOH and other alcohols
        - ❑ Digoxin, digitalis
    - ❑ **CRASH:**
        - ❑ Clonidine, CCB's
        - ❑ Rodenticides (cyanide, arsenic)
        - ❑ Antidepressants, antihypertensives
        - ❑ Sedative-hypnotics
        - ❑ Heroin / other opioids
- ❑ **Substances causing wide AGMA - A CAT PILES MUD:**
    - ❑ Alcoholic ketoacidosis
    - ❑ Cyanide - CO – colchicine
    - ❑ Acetaminophen
    - ❑ Toluene
    - ❑ Paraldehyde
    - ❑ Iron, isoniazid, ibuprofen
    - ❑ Lactic acidosis
    - ❑ Ethylene glycol
    - ❑ Salicylates
    - ❑ Methanol, metformin
    - ❑ Uremia
    - ❑ DKA

- ❑ **Substances causing non-AGMA:**
    - ❑ Loss of bicarbonate (diarrhea, RTA), gain of chloride (ammonia, CaCl)
    - ❑ **HARDUP:**
        - ❑ Hyperalimentation
        - ❑ Acetazolamide
        - ❑ RTA
        - ❑ Diarrhea
        - ❑ Ureteroenterostomy
        - ❑ Pancreatoenterosomites

[2] What are Commonly- available Serum Drug Levels?

In general, a solid toxic workup includes these labs:

- ❑ CBC, serum chemistry
- ❑ Renal function
- ❑ Liver function tests (INR/Bili/Alb) w/ Liver Enzymes (AST/ALT/ALP/GGT)
- ❑ Urinalysis (with HCG)
- ❑ Serum ETOH
- ❑ Serum lactate
- ❑ Bedside glucose
- ❑ Serum osmolality
- ❑ EKG

With the information about, you can then calculate that AG (Na - (HCO3 + Cl)) and osmolar gap.

When considering specific drug level testing, you often times take a more refined approach. Below is a list of medications that can be directly measured in the blood in the toxicology patient.

- ❑ Acetaminophen
- ❑ Acetylsalicylic acid (salicylate)
- ❑ Carbamazepine
- ❑ Carbon monoxide
- ❑ Digoxin
- ❑ Ethanol
- ❑ Ethylene glycol
- ❑ Iron
- ❑ Isopropyl alcohol
- ❑ Lead
- ❑ Lithium
- ❑ Methanol
- ❑ Methotrexate
- ❑ Phenobarbital
- ❑ Phenytoin

- ❑ Valproic acid

Refer to table 139.3 in Rosen's 9th Edition for a comprehensive description of the toxicological electrocardiogram manifestations of differed drug overdoses.

[3] List the "One Pill Can Kill" Drugs

The following is a list of one-pill-can-kill drugs or substances that can cause death if ingested in small quantities. Children are particularly vulnerable to these substances.

Here's a list of a few:

Remember: "Chiasms are Toxic" or another variation "MISCAST pills are Toxic"

CHIASMS ARE TOXIC:

- ❑ Clonidine / CCBs
- ❑ Hypoglycemics
- ❑ Iron
- ❑ ASA / methyl salicylates
- ❑ Sulfonylureas
- ❑ Methadone (and opiates)
- ❑ Suboxone
- ❑ TCA's

MISCAST:

- ❑ Methadone (and opiates)
- ❑ Iron / Insulin like drugs
- ❑ Sulfonylureas
- ❑ CCBs clonidine
- ❑ ASA (salicylates)
- ❑ Suboxone
- ❑ TCA's

If you want to learn more about these substances, check out the link to LITFL:
https://lifeinthefastlane.com/tox-library/basics/risk-assessment/