

Project: Ghana Emergency Medicine Collaborative

Document Title: Toxicology Basics

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Objectives

- Describe the role of GI decontamination
- Recognize common toxidromes
- Recognize substances for which specific antidotes exist
- Initiate ED management of a patient with an overdose

The undifferentiated patient

- A patient is dropped off at the ED door. He is minimally responsive. His friends say they think he took something and drive off...
- Where do we start?

Approach to (possible) Toxicology patient

- Simultaneous treatment & diagnosis
- Immediate action:
 - ABC(D) , IV / O2 / monitor
- Thinking:
 - Is this a tox problem?
 - If yes, are there complicating factors?
 - Got drunk and fell down, now with head injury?
 - Resources to get a history?

Approach to (likely) Toxicology patient

- You've considered a differential and you think it is a toxicologic issue
- Immediate action:
 - Supportive therapy (airway etc)
 - Decontamination
- Thinking:
 - Toxidrome present?
 - What more information do I need?
- Definitive Management
 - Is there an antidote or specific treatment?

Overdose History

- Time of ingestion
- Talk to witnesses
- Get pill bottles & count!
- Assume common co-ingestants
 - Alcohol
 - Acetaminophen
 - Aspirin



Ondřej Karlík, [Wikimedia Commons](#)



Decontamination

- GI exposure
 - Most common route (75% of toxic exposures)
 - Prevent absorption
- Topical exposures
 - Remove clothing
 - Wash skin
- Enhance elimination
 - Whole bowel irrigation
 - Sorbitol
 - Diuresis / ion trapping
 - Hemodialysis

GI Decontamination

■ ***Activated Charcoal***

- Absorbs up to 60% of ingestant
- 1 gm/kg +/- Sorbitol
- Maximal effect if given early (<1 hr)
- Will not bind – metals, electrolytes, acids
- Contraindications
 - Depressed MS – Intubate to avoid aspiration
 - Bowel obstruction / perforation
 - Acid/ alkali ingestion

GI Decontamination

■ Rare interventions

■ Gastric lavage

- Early presentation of potentially lethal OD

- e.g. tricyclics, iron, CCBs, B-blockers

- High Risk – aspiration / perforation / airway compromise

■ Syrup of Ipecac – Rarely used now

- Induces vomiting & eliminates less than charcoal

- Cardiomyopathy risk

■ Whole bowel irrigation

- Sustained release preparations

- Body packers

Treatment Goals with Overdose

- ABC's
- Identify (if possible) substances
- Reduce absorption
- Enhance elimination
- Specific antidotes (if possible)
 - Relatively few but important to know
- Supportive care

Classic Toxidromes

Hint for exam:
Know these

- Narcotic
- Sympathomimetic
- Anticholinergic
- Cholinergic

Narcotics

- Natural & synthetic compounds which mimic endogenous endorphins
- Heroin, Morphine, Dilaudid, Demerol, Vicodin, Methadone, Fentanyl (China White), Oxycontin
- Different pharmacologic parameters
- Common drugs of abuse
- Street drugs – adulterated (mixed OD)

Narcotics

	Temp	HR	RR	Pupils	BS's	Skin
Narcotic	---	↓	↓↓	↓↓	↓↓	---
Sympathomimetic						
Anti-cholinergic						
Cholinergic						

Narcotics - Treatment

- Support ABCs
- Narcan 2mg IV q2min until effect
 - Comes in 0.4mg vials!
- Can require massive doses
- IV / IM / SQ / ET routes
- Short acting & may require repeat doses or IV drip

Sympathomimetics

- Fight or flight system
- Drug activate adrenergic nervous system
- Cross-activation of dopaminergic → euphoria & hallucinations

Sympathomimetics

	Temp	HR	RR	Pupils	BS's	Skin
Narcotic	---	↓	↓↓ ↓↓	↓↓ ↓↓	↓↓ ↓↓	---
Sympathomimetic	↑	↑↑	---	↑	---	sweaty
Anti-cholinergic						
Cholinergic						

Common Sympathomimetics

- Cocaine
- Caffeine
- Ephedrine
- MDMA (ecstasy)
- LSD (prominent hallucinations)
- Pseudoephedrine (Sudafed)

Sympathomimetics Treatment

- ABCs
- Supportive care / time
- Cocaine – avoid B-blockers

Anticholinergic Toxidrome

- Antagonism of the cholinergic nervous system (parasympathetic)
- Sympathetic disinhibition & loss of parasympathetic functions
- Common medication side-effect
- Less commonly abused class of drugs

Anti-cholinergics

	Temp	HR	RR	Pupils	BS's	Skin
Narcotic	---	↓	↓↓ ↓↓	↓↓ ↓↓	↓↓ ↓↓	---
Sympathomimetic	↑	↑↑ ↑↑	---	↑	---	sweaty
Anti-cholinergic	↑	↑	---	↑	↓↓ ↓↓	dry
Cholinergic						

Anti-cholinergics

- Blind as a bat (mydriasis)
- Hot as hare (flushed & warm)
- Mad as a hatter (delirium)
- Dry as a bone (membranes & axillae)
- “Can’t see, can’t pee, can’t s—t, can’t spit”

Common Anti-cholinergics

- Atropine
- Antihistamines
(Benadryl)
- Phenothiazines
(antiemetics)
- Tricyclic
antidepressants
- Jimsonweed (Datura)



Aldipower, [Wikimedia Commons](#)



Anti-cholinergics Treatment

- ABCs
- Decontamination
- Supportive / time
- Urinary drainage

Cholinergic Toxidrome

- Increased acetylcholine activity
- Nicotinic NS: increased nerve transmission and muscle activation
- Muscarinic NS: liquid management
- Rarely abused
- Occupational exposures - insecticides

Cholinergics – Clinical Picture

■ Nicotinic effects

- Tachycardia, muscle fasciculation, weakness (nerve transmissions can't get through), respiratory depression, paralysis, miosis

■ Muscarinic effects - SLUDGE

- Salivation
- Lacrimation
- Urination
- Defecation
- GI upset
- Emesis

Cholinergics

	Temp	HR	RR	Pupils	BS's	Skin
Narcotic	---	↓	↓↓ ↓↓	↓↓ ↓↓	↓↓ ↓↓	---
Sympathomimetic	↑	↑↑	---	↑	---	sweaty
Anti-cholinergic	↑	↑	---	↑	↓	dry
Cholinergic	---	↓	---	↓	↑↑	sweaty

Common Cholinergics

- Organophosphate insecticides
- Nerve gas (i.e. Sarin, VX)
- Myasthenia gravis meds
- “Green tobacco sickness”
 - Nicotine poisoning during harvest



Mr.checker, [Wikimedia Commons](#)



Cholinergics - Treatment

- ABCs
- Decontamination
- Atropine 2 mg q 5 minutes until secretions dry (massive doses)
- Pralidoxime (2PAM) if organophosphates
- Supportive care / time

Case 1

- 2 yo M got into older sister's medication. Mother brings to ED stating he's had an allergic reaction
- P145 R25 T100.1 Skin flushed but no urticaria or rash. Seems to be picking at the air. Pupils dilated. Dry diaper.
- Nurses requesting Benadryl for his allergic reaction.
- Is this a good idea? What's going on?

Case 1 (Continued)

- Anticholinergic toxidrome
- Sister's medication → Detrol
 - Anticholinergic
- Benadryl also anticholinergic!
- Treatment?

Case 2

- 15 people from a local government building with vomiting and weakness.
- 2 patients with respiratory distress require intubation. Copious oral secretions are noted.
- What's going on?

Case 2 (Continued)

- Cholinergic toxidrome
 - SLUDGE
- Nerve gas / deliberate exposure
 - 1995 – Sarin in Tokyo subway
- Treatment?

Classic Ingestions

Acetaminophen

Acetaminophen

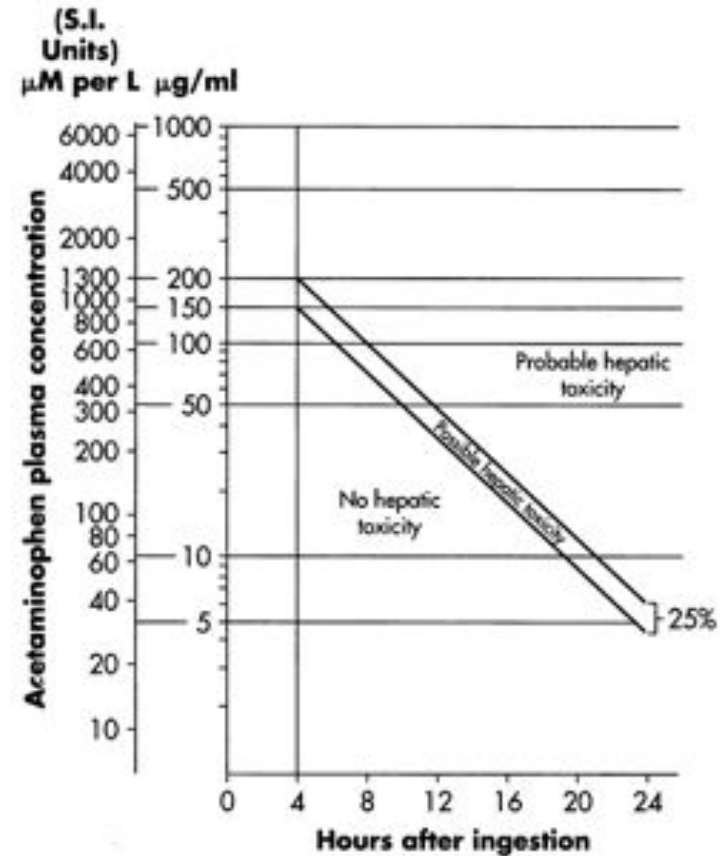
- Common “cry for help”
- Ubiquitous
 - Accidental OD’s – “multi-symptom cold meds”
 - Common co-ingestant
- Initially asymptomatic or mild GI upset
- Quiescent period of a few days after intoxication (LFTs may be elevated)
- Delayed & sometimes fatal liver toxicity

Acetaminophen

- Metabolite toxic to hepatocytes causing hepatic necrosis
- At therapeutic doses, glutathione neutralizes metabolite and prevents toxicity
- At high doses glutathione depleted and toxicity results

Acetaminophen

- Rumack-Matthews Nomogram
- Predicts hepatic toxicity based on level and time of overdose
- Toxic threshold = 140 mcg/ml



www.vh.org/adult/provider/familymedicine/fphandbook/chapter02/figure2-1.html

Specific intoxications: Tylenol

The rule of 140

- Toxic dose is 140 mg/kg
- Toxic level at 4 hours is 140 mcg/ml
- First dose of NAC is 140 mg/kg po (subsequent 17 doses are 70mg/kg)
- If 15 kg child, how many ES Tylenol pills (500 mg each) for toxic level?

Acetaminophen

- Treatment: N-acetylcysteine
- Replenishes glutathione in the liver
- Tastes AWFUL
 - May require NGT administration
 - Newer IV form (Acetadote – 2004)

Salicylates

Salicylates

- ASA, Peptobismol,
- Oil of wintergreen
 - 1 tsp = 7gm salicylate (peds lethal dose)
- Symptoms onset within 1 hour
- Enteric-coated delays absorption
- Gastric bezoars also delay absorption
- Renal clearance

Salicylates

■ Symptoms

- Vomiting, tinnitus, hyperpnea, fever (mild)
 - Acidosis, AMS, seizures and shock (severe)
 - **Metabolic acidosis w/ respiratory alkalosis
- ## ■ Toxicity begins at 50mg/kg (acute)

Specific Intoxications: Salicylates

- General guidelines for severity
 - Mild <300 mg /kg ingested
 - Moderate 300-500 mg/kg
 - Severe / potentially lethal > 500 mg/kg
- Serum level > 30 mg/dl at 6 hrs - toxic
- Done nomogram
 - Historical interest only
 - Serum level not predictive of degree of toxicity

Salicylates - Treatment

- Increased elimination in urine
 - Urine alkalinization
 - 3 amps of bicarb in 1 L of D5W
- Hemodialysis indicated if
 - Coma, seizure
 - Renal, hepatic, or pulmonary failure
 - Pulmonary edema
 - Severe acid-base imbalance
 - Deterioration in condition

Tricyclic Antidepressants

Tricyclic Antidepressants

- Depression, sleep, & pain disorders
- Less common due to SSRI prevalence
- High toxicity in overdose

Tricyclic Antidepressants

- Anticholinergic toxidrome plus
- Cardiac Dysrhythmias
 - Quinidine-like (Ia) effects on Na channels
 - Sinus tach, Vfib, Vtach
- Seizures

Tricyclic Antidepressants

Screening EKG

- Widened QRS

 - $> 100\text{ms}$ – sz & dysrhythmia risk

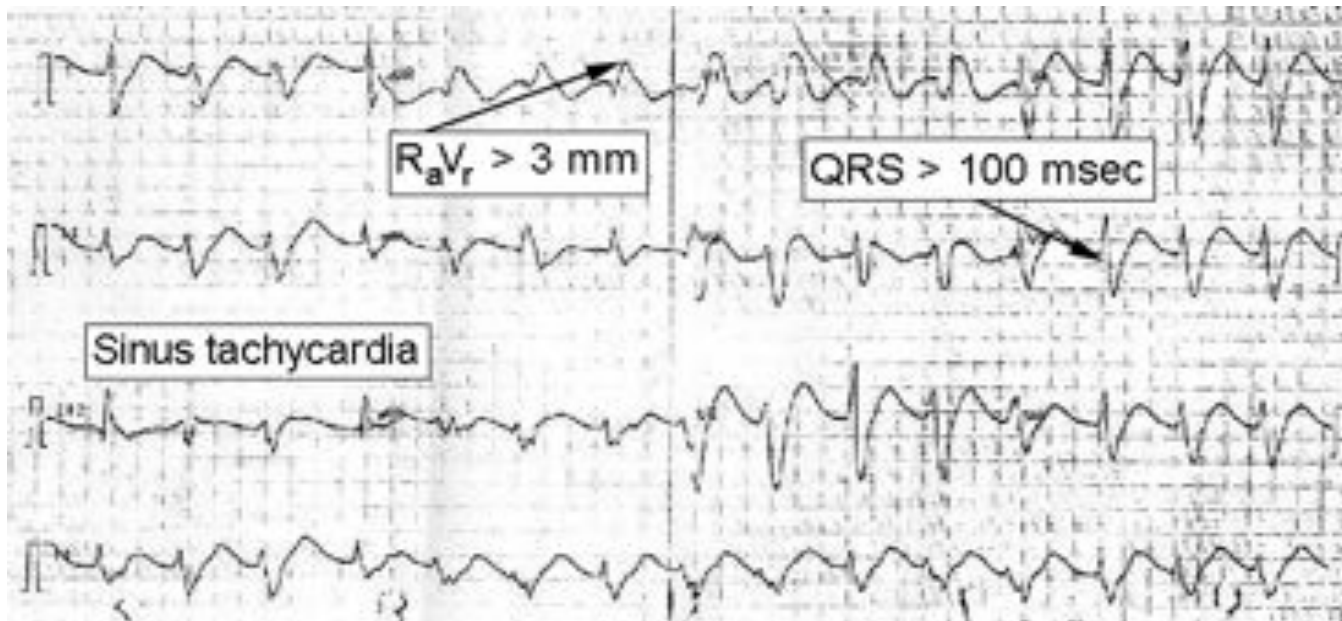
- R wave in aVR and S waves in I, aVL

- Prolonged QTc

TCA Overdose

- EKG ---- CLASSIC

- Sinus Tachycardia
- PR, QRS, QT Prolongation
- Classic Findings - QRS Prolongation, Rightward Axis, “Brugada pattern” in AVR (Terminal R Wave)



EKG and Arrhythmia

- **QRS < 100 ms** -
 - unlikely to develop seizure or arrhythmia
- **> 100 ms** -
 - 34% chance of developing seizure,
 - 14% chance of life-threatening arrhythmia
- **> 160 ms**
 - 50% chance of life-threatening arrhythmia

Tricyclic Antidepressants - Treatment

- ABCs
- Bicarbonate drip
 - Reduces cardiac effects
- Control seizures
 - Benzodiazepines
 - Phenobarbital
 - Avoid phenytoin – risk of dysrhythmias

Case 3:

- 27 yo F brought in by family. Confused and vomiting. “She took some Tylenol this morning” (about 4 hours ago)
- P125 BP135/65 T99.4 Warm, dry skin. Oriented x 2. Sometimes nonsensical answers. +gag reflex. Dilated pupils.
- What do you need to know?
- Does this fit with a Tylenol OD?

Case 3



Ragesoss, [Wikimedia Commons](#)



Case 3

- What are your initial orders?
 - Hint: ABC, IV, O2, monitor
 - What labs / tests do you want?
 - Medications?

Case 3

- Acetaminophen level – 375 mg/dl
- What next?

Case 4

- 32 yo M brought in because of violent behavior
- Agitated and combative
- P125 BP 160/95 T99.4
- Warm & sweaty. Dilated pupils. Exam otherwise non-focal
- Differential?

Case 4

- UDS – cocaine positive
- Treatment?

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Questions?



Dkscully, [Flickr](#)

