

# 4th year Emergency Medicine Didactic Series: Common Toxicologic Emergencies

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# OBJECTIVES

- DISCUSS TOXIDROMES
- DISCUSS DECONTAMINATION METHODS
- DISCUSS THE WORKUP OF AN OVERDOSED PATIENT
- DISCUSS THE COMMONLY USED ANTIDOTES
- REVIEW SOME OF THE COMMONLY SEEN DRUG OVERDOSES IN A COMMUNITY HOSPITAL

# OVERDOSES

- Approximately 5 million annually.
- Less than 1% mortality.
- Mean time to presentation is 3-4 hours.
- SUPPORTIVE CARE
- Educational opportunities for patients

# TOXIDROMES

- constellation of signs and symptoms that suggest a specific class of poisoning

# OPIOIDS

- Morphine
- Meperidine
- Propoxyphene
- Mixed agonist/antagonist
- Synthetic opiates (fentanyl)
- Drug combinations: Lortab, Percocet, Vicodin
- Heroin

# OPIOIDS

- CNS Depression
- Respiratory Depression
- Miosis
- Seizures
- Nausea & Vomiting
- Hypotension and Bradycardia

# Sympathomimetic Agents

- Drugs of abuse
- Adrenergic agonists
- Amphetamines
- Cocaine
- PCP
- TCA
- Early MAOI
- Sedative/hypnotic withdrawal

# SYMPATHOMIMETIC

- Hypertension
- Tachycardia
- Mydriasis
- CNS Excitement
- Hyperthermia
- Diaphoresis



# CHOLINERGIC AGENTS

- Organophosphates
- Carbamates
- Insecticides
- Nerve agents

# CHOLINERGIC

## DUMB BELLS/SLUDGE/SLUG BAM

- Salivation/Sweating
- Lacrimation
- Urination
- GI complaints (N/V/D)
- Bradycardia/Bronchoconstriction
- Abdominal cramping
- Miosis/Muscle fasciculations

# Anticholinergic Agents

- TCA
- Scopolamine
- Neuroleptics
- Parkinson meds
- Benztropine mesylate (Cogentin)/Trihexyphenidyl (Artane, Apo-Trihex),
- Antihistamines: Benadryl
- Gyromitra
- Jimson weed

# ANTICHOLINERGIC

- Hot as Haiti (hyperthermia)
- Red as a beet (flushed skin)
- Dry as a bone (dry skin, urinary retention)
- Blind as a bat (mydriasis)
- Mad as a hatter (delirium, hallucinations, myoclonic jerking)

# SALICYLATES

## ASPIRIN

- Altered mental status
- Sweating
- Pulmonary edema
- Irritable
- Ringing in ears (tinnitus)
- Increased temp., breathing, and heart rate
- Nausea and vomiting

# PATIENT WORK UPS

# Do the DONT

- Dextrose
- Oxygen
- Naloxone
- Thiamine

What type of work up  
needs to be done?



# ESSENTIAL WORK UP

- ELECTROLYTES
- EKG
- ACETAMINOPHEN LEVEL
- CARDIAC MONITORING

# ADDITIONAL WORK UP

- ALCOHOL LEVEL
- SALICYLATE LEVEL
- PREGNANCY TEST
- TOXIC ALCOHOL LEVELS
- URINE DRUG SCREEN

# URINE TOX SCREEN

- TCA FALSE POSITIVES
  - Cyclobenzaprine (Flexeril)
  - Benadryl
  - Quetiapine fumarate (Seroquel)
  - Carbamazepine (Tegretol)
  - Cyprohepatidine
  - Hydroxyzine (Vistaril)

# ANION GAP METABOLIC ACIDOSIS

## A MUD PILE CAT

- ◆ Aspirin
  - ◆ Methanol
  - ◆ Uremia
  - ◆ Diabetic Ketoacidosis
  - ◆ Paraldehyde, Phenformin
  - ◆ INH, Iron, Ibuprofen
  - ◆ Lactic acidosis
  - ◆ Ethylene glycol
- ◆ CO, CN, Caffeine
  - ◆ Alcoholic ketoacidosis
  - ◆ Theophylline, Toluene

# DECONTAMINATION TECHNIQUES

# IPECAC

- Only for very LIMITED home use.
- Not for use in the emergency department.
- Do not use on caustic substances
- Less effective than activated charcoal and equivalent to gastric lavage.

# Gastric Lavage

- Frequently used in the past, now very infrequently used.
- Only to be used within 30-60 minutes of ingestion
- Only to be used on LIFE-THREATENING ingestions.

# Gastric Lavage

- Decreases absorption of toxin ~26% @ 30 minutes vs. 12 % @ 60 minutes
- ? Airway protection
- Time consuming
- ? Promotes absorption of toxins



# ACTIVATED CHARCOAL

- Dose is 1 gram/kg
- Aqueous charcoal vs. charcoal with sorbitol
- Recommendation to use within 1 hour of ingestion
- May use later if the patient has ingested a substance that slows gut motility.
- Mean drug bioavailability is reduced by 69% at 30 minutes vs. 34% at 60 minutes

# ACTIVATED CHARCOAL

DOES NOT WORK FOR THESE INGESTIONS:

## Heavy Metals

Arsenic

Lead

Mercury

Iron

Zinc

Cadmium

## Inorganic Ions

Lithium

Na/K/Mg

Fluoride

Iodide

## Corrosives

Acids/alkali

## Hydrocarbons

Alkanes

Alkenes

Alkyl halides

Aromatic hydrocarbons

## Essential Oils

## Alcohols

# ACTIVATED CHARCOAL

- Be aware of the contraindications.
  - Doesn't work for some meds
  - Needs to be given early
  - Do NOT give to someone who is at risk for aspiration

# MULTI-DOSE CHARCOAL

- INDICATIONS:
  - Theophylline
  - Phenobarbital
  - Carbamazepine (Tegretol)
  - Digitalis
  - TCA

# WHOLE BOWEL IRRIGATION

- Polyethylene glycol (GoLytely , MiraLax) 2 L/hr until clear rectal effluent
- Nasogastric tube
- Drugs (Packers vs. Stuffers)
- Sustained released or enteric coated drugs
- Toxins not well adsorbed by AC (e.g., lithium or other heavy metals)

# Acetaminophen

**150**

# ACETAMINOPHEN

- Most commonly used drug
- Combined in over 100 different drugs
- Majority absorbed within 2 hours
- Peak plasma levels around 4 hours



# ACETAMINOPHEN

## Knowledge of APAP Containing Products

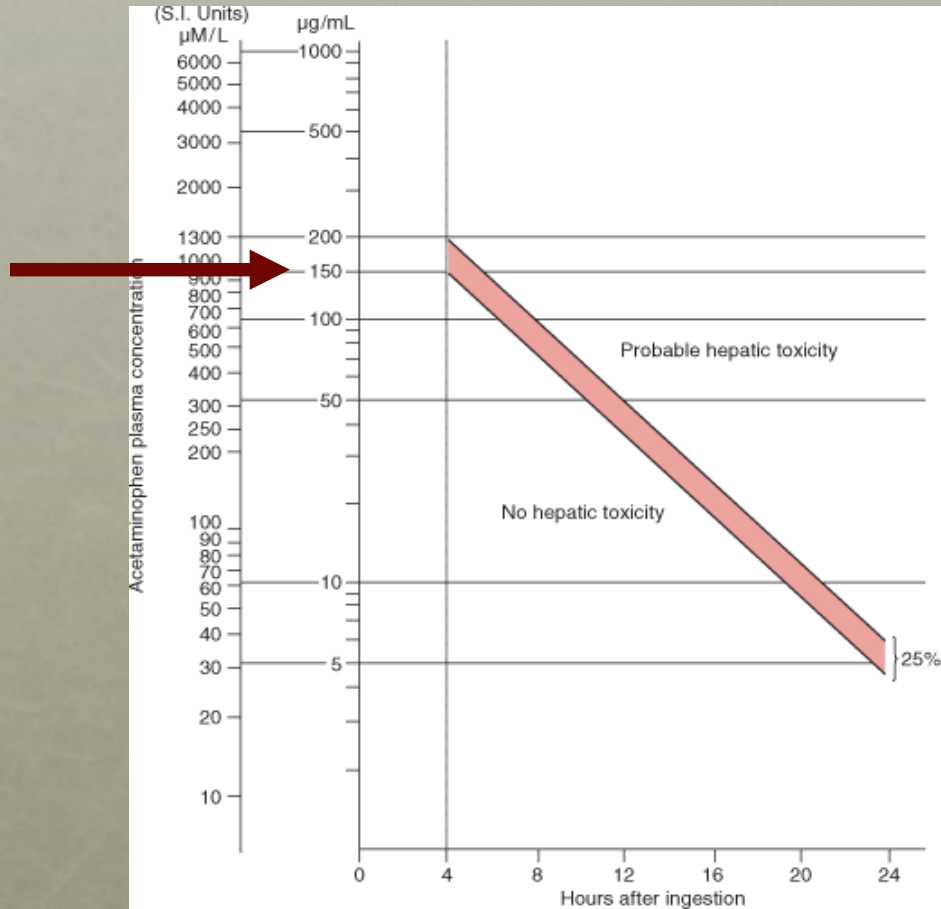
- 71.2% recognized brand Tylenol as having acetaminophen
- 50% recognized Tylenol PM
- Fewer than 15% recognized Vicodin, Darvocet, Tylox, Percocet, and Lorcet as containing APAP
- 6.7 to 19.2% indicated that Motrin, ibuprofen, Sudafed, Aleve, and Benadryl contained APAP

# ACETAMINOPHEN

## Estimates of Acetaminophen Associated Overdoses in the United States

- 56,000 emergency room visits
- 26,000 hospitalizations
- 127,000 exposures reported
- 458 deaths of which 100 were unintentional
- Doubling of fatalities from 1997 to 2001
- Depending on the data source, 8 to 26% of overdoses were unintentional

# RUMACK-MATTHEW NOMOGRAM



# ACETAMINOPHEN

- Therapeutic dose: 10-15 mg/kg
- Toxic dose: 150 mg/kg

# STAGES OF TOXICITY

## STAGE ONE

- 0.5-24 HOURS
- Malaise
- N/V
- Pallor
- Lethargy
- Diaphoresis
- **Lab tests are normal**

## STAGE TWO

- 24 to 72 hours
- RUQ pain
- ↑ LFT's
- ↑ PT, Tbili
- Oliguria and renal dysfunction
- \*\* AST is the first sign of hepatotoxicity \*\*

# STAGES OF TOXICITY

## STAGE THREE

- 72-96 hours
- LFT's peak
- Stage one symptoms reappear.
- Severe hepatotoxicity =  
ALT/AST > 10,000, elevated  
PT/INR, low glucose, lactic  
acidosis, Tbili > 4.0
- DEATH is most common in  
this stage.

## STAGE FOUR

- 4 days to 2 weeks
- If survival, liver function  
usually returns to normal

# Acetaminophen Toxicity

- TREATMENT:

- N-Acetylcysteine (NAC)

- Oral or IV preparations

- Activated Charcoal

\*\* Treatment is 100% effective if given in <8 hours \*\*

# Acetaminophen Toxicity

- TREATMENT:
  - Oral Regimen – **140** mg/kg load, then 70 mg/kg every 4 hours times 17 doses
  - IV Regimen – **150** mg/kg in 250 ml of D5W over 30-45 minutes, then 50 mg/kg in 500 ml of D5W over 4 hours, then 100 mg/kg in 1000 ml of D5W over 16 hours

\* Be cautious of fluid volume in pediatrics.



# Chronic Ingestions

- Start N-Acetylcysteine (NAC)
- Check Acetaminophen level, LFTs, Coags
- Repeat levels in 4 hours to determine half life.
- Plot two or three levels on the nomogram to determine toxicity
- Check acetaminophen level and LFTs
  - If not detectable and no abnormalities = OK

# ASPIRIN

# SALICYLATES

## ASPIRIN

- Altered mental status
- Sweating
- Pulmonary edema
- Irritable
- Ringing in ears (tinnitus)
- Increased temp., breathing, and heart rate
- Nausea and vomiting

# SALICYLATES/ASPIRIN

- Alka-Seltzer
- Anacin
- Excedrin
- Pepto-Bismol
- Oil of Wintergreen

# SALICYLATES

- Therapeutic levels 10-30 mg/dL
- Mild toxicity 40-50
- Severe toxicity > 100
  
- Peak blood levels occur within one hour of therapeutic doses. Greater than 6 hours in overdoses.
- May result in pylorospasm, bezoars. Caution with enteric coated and extended release meds.

# SALICYLATES

- Tachypnea – stimulates medullary resp. centers
- Hyperthermia – uncouples oxidative phosphorylation
- Tachycardia – hypovolemia, agitation, distress
- Tinnitus – seen at levels around 20mg/dL
- Acid-base abnormalities – respiratory alkalosis or mixed respiratory alkalosis/metabolic acidosis

# SALICYLATES

- AMS –
  1. Direct toxicity of salicylate in CNS
  2. Cerebral edema
  3. Low CNS glucose levels

# TREATMENT

- DONE Nomogram = Don't Use!!
- ABCs – Do not intubate!
- Activated Charcoal
- Alkalinize the urine (NaHCO<sub>3</sub> gtt)
- Hemodialysis – Call Nephrology early!
- Check labs (K<sup>+</sup> and ABG) and levels every 2 hours until declining.



# Indications for Dialysis

- Altered Mental Status
- Pulmonary or Cerebral Edema
- Renal insufficiency
- Fluid overload that prevent  $\text{NaHCO}_3^-$  administration
- Level > 100 mg/dL
- Clinical deterioration despite treatment.

# Opioids

# OPIOIDS

- CNS Depression
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- Hypotension and Bradycardia

# OPIOIDS

- Morphine
- Meperidine
- Propoxyphene
- Mixed agonist/antagonist
- Synthetic opiates (fentanyl)
- Drug combinations
- Heroin

# OPIOIDS

- Naloxone (Narcan)
  - Repeat doses every 20-60 minutes prn
  - May need drip. Start at 2/3 initial successful bolus
  - Need high doses for propoxyphene, methadone and fentanyl ~ 10-20 mg
  - If no re-dosing after 4 hours, then may disposition patient

# Benzodiazepines

# Benzodiazepines

- Intubation and supportive care
- Flumazenil
  - Use with extreme caution
  - May precipitate life threatening withdrawal and seizures

# Calcium Channel Blockers



# Calcium Channel Blockers

- Dihydropyridines
  - Nifedipine, amlodipine, felodipine, nicardipine
  - Potent vasodilators and minor effect on contractility and conduction
- Non-dihydropyridines
  - Verapamil and diltiazem
  - Depressive effect on contractility and conduction, but minor effects of vasodilation

# Calcium Channel Blockers

- Hypotension is seen with both types
- Bradycardia is usually only seen with verapamil and diltiazem

# Treatment

- Gastric Lavage
- Activated Charcoal
- Whole Bowel Irrigation
- IV Calcium
- Glucagon
- Vasopressor = Levophed
- \*\* INSULIN \*\*

# BETA BLOCKERS

# BETA BLOCKERS

- Most are symptomatic within 2 hours, all by 6 hours
- Use caution with sustained release products and sotalol
- EKG Changes
  - Decreased AV node conduction = PR prolongation
  - Slowed automaticity in SA node = bradycardia
  - QRS prolongation
  - QTc prolongation with sotalol toxicity

# BETA BLOCKERS

- HYPOTENSION and BRADYCARDIA
- Hypoglycemia
- Seizures
- Arrhythmias

# TREATMENT

- Activated charcoal
- Whole bowel irrigation
- Gastric lavage

# TREATMENT

- Fluids for hypotension
- $\text{NaHCO}_3^-$  and Magnesium for arrhythmias
- Glucagon is considered first line treatment
  - 5 mg bolus, if no effect repeat in 10 minutes, then start drip at 2-5 mg/hour
- ◆ Calcium
- ◆ Epinephrine drip – poor outcomes, last resort
- ◆ HIGH DOSE INSULIN THERAPY



# HIGH DOSE INSULIN THERAPY

- One amp of D50
- Regular insulin bolus of 1-2 units/kg over 5 minutes
- Regular insulin infusion of 0.5 U/kg/hr, with a goal rate of 2 units/kg/hr
- Frequent monitoring of glucose and potassium

# Alcohol

- There are different kinds of alcohol so find out exactly what was taken
  - don't be fooled: Joose, mouthwash, colognes and perfumes, and OTC meds
- Do a good history and a great physical exam
- Be cautious in assuming altered mental status is secondary to alcohol
  - consider the possibility of a head injury and other causes

# Alcohol

- Pathophysiology
  - metabolized at about 20 mg/dL per hour
  - decreases gluconeogenesis so be wary of hypoglycemia (do the DON'T)
  - patient's may be malnourished and have a low thiamine level (do the DON'T)
- Blood alcohol levels are rarely useful and correlate poorly with the clinical examination

# Alcohol

- Disposition
  - Offer counseling or referral resources for alcohol abuse.
  - If alert, oriented x 3, appropriately conversant and able to walk with a steady gait and if considered clinically sober => may be d/c'd from the ED under the care of a responsible adult
  - If intoxicated with an abnormal mental status or neurologic exam, the patient should not be allowed to leave the ED, even if they want to.
    - place them on a hold as they are danger to themselves

# Alcohol withdrawal

- Clinically
  - can occur at any level of blood alcohol
  - the hallmark is CNS excitation
  - usually begins 24 hours after reduction in EtOH intake
  - lasts 2-7 days

# Alcohol Withdrawal

- Mild
  - occurs 6-24 hours after decrease in consumption
  - peaks at 24-36 hours
  - mild autonomic hyperactivity: nausea, anorexia, tremor, tachycardia, HTN, anxiety, sleep disturbance
- Major
  - occurs more than 24 hours after decrease
  - peaks at 50 hours
  - same symptoms as above, but more severe. Also decreased seizure threshold, auditory and visual hallucinations, and delirium

# Delirium Tremens

- the extreme end of the EtOH withdrawal spectrum
- tremor, hallucinations, profound confusion, agitation, and hyperadrenergic syndrome (fever, tachycardia, and HTN)

# Treatment of EtOH withdrawal

- Supportive care: IVF, MVI, thiamine, folate, Mg
- Medications:
  - First line: benzos (lorazepam, diazepam)
    - Ativan 1-5 mg IV q 5-15 minutes prn agitation/tremor
  - Second line: butyrophenones (haloperidol)
    - Haldol 5-10 mg IV for agitation
  - **BE AGGRESSIVE WITH MEDS**
    - don't be afraid of large doses (there are reported cases of patients needing 480 mg of lorazepam and 240 mg of haloperidol in 24 hours)



# SUMMARY

- Toxidromes are clues to the mystery.
- Ipecac = NO
- Flumazenil = No
- Gastric Lavage = Probably no
- Whole Bowel Irrigation = Maybe
- Activated Charcoal = Probably
- NAC = YES
- Naloxone = Yes

# Summary

- Acetaminophen = NAC (150)
- Aspirin = Bicarb + Nephrologist
- Opioids = Narcan
- Benzo's = Intubation
- Ca<sup>++</sup> Channel and Beta Blockers = High Dose Insulin

# Poison Control Center

- CALL THEM!!!!

• 1-800-222-1222

# That's it!

Thanks.

Contact me for any questions or concerns.

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