Pediatric and adolescent ingestions are common reasons for 911 dispatches and emergency department visits. With greater availability of medications and drugs, healthcare professionals need to stay sharp on current trends in medical toxicology. This lecture examines mind altering substances, initial prehospital approach to toxicology and stabilization for transport, poison control center resources, and ultimate emergency department and intensive care management.
Pediatric Toxicology

Dr. James Burhop FAAP, FACOP
Pediatric Emergency Medicine
Children’s Hospital of the Kings Daughters
Objectives

• Epidemiology

• History of Poisoning

• Review initial assessment of the child with a possible ingestion

• General management principles for toxic exposures
  • Acetaminophen, beta-blockers, Ca-channel blockers, Clonidine, TCA, Sulfonylureas, Opioids

• Emerging drugs of abuse
  • Cathinones, Synthetics, Salvia, MCAT, 25I, Kratom, DXM, Moonshine
1 Pill Can Kill
1 Pill Can Kill

- Child
- Respiratory rate 4 per minute
- Grandmother thinks she took a pill
- Unknown ingestion
- Rapid Deterioration
- Manage the Airway
- Notify Pediatric receiving facility
Poisoning

History

Poisoning is as ancient as history.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>4500 BC</td>
<td>Known to Sumerians</td>
</tr>
<tr>
<td>1500 BC</td>
<td>Ebers Papyrus – Medical Text</td>
</tr>
<tr>
<td>399 BC</td>
<td>Poisoning execution of Socrates</td>
</tr>
</tbody>
</table>

The Death of Socrates by Jacques Louis David (1787)
Environmental Poisoning

History

On aqueducts in the Roman Empire (pre-476 AD)

“Water conducted through earthen pipes is more wholesome than that through lead; [lead] destroys the vigor of the blood; water should therefore on no account be conducted in leaden pipes if we are desirous that it should be wholesome.”
Occupational Poisoning

History

Charles Dickens, 1863

The “Uncommercial Traveler”
Dickens describes a hunched mill worker...

“And tis the lead, sir.”

“The what?”

“The lead, sir. Sure, tis the lead mills, where the woman gets took on at eighteen pence a day, sir…and her constitooshun is lead-poisoned, bad as can be, sir; and her brain is coming out her ear and it hurts dreadful…”
Development of Toxicology

Colonial Philadelphia

Dr. Philip Physick (1768-1837)

Developed the “Physick Tube”

A stomach pump to remove poisons
Development of Toxicology

Governmental Regulation

1927  Federal Caustic Poison Act
1938  Federal Food, Drug, Cosmetic Act
       Elixir of Sulfanilamide tragedy

1970  Poison Prevention Packaging Act
1970  EPA established
Development of Toxicology
Rise of Environmental Toxicology

1960s  Dawn of environmental activism

1962  Publication of “Silent Spring”
Rachel Carson
DDT

“Nature is vulnerable to human intervention”
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWII</td>
<td>Increase production of household chemicals</td>
</tr>
<tr>
<td>1953</td>
<td>First PCC, Chicago, IL</td>
</tr>
<tr>
<td>1978</td>
<td>National standards for PCCs</td>
</tr>
<tr>
<td>1991</td>
<td>Dr. A. Sasha Shulgin – A Chemical Love Story</td>
</tr>
<tr>
<td></td>
<td>Phenethylamines I have loved</td>
</tr>
</tbody>
</table>
## Development of Toxicology

### Poison Control Centers & Synthetics

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
</table>
| 2008 | 57 certified PCCs  
 National toll-free number |
| 2012 | Synthetic Drug Abuse Prevention Act – 26 synthetic cathinones and synthetic cannabinoids into schedule I |
What is a “poison”?
What is “poisoning”?
Poisoning
Definition

What is a “poison”?  
What is “poisoning”?  

Is water a poison?
Poisoning:
Definition

Woman dies after water-drinking contest
Water intoxication eyed in ‘Hold Your Wee for a Wii’ contest death

SACRAMENTO, Calif. - A woman who competed in a radio station’s contest to see how much water she could drink without going to the bathroom died of water intoxication, the coroner’s office said Saturday.

Jennifer Strange, 28, was found dead Friday in her suburban Rancho Cordova home hours after taking part in the “Hold Your Wee for a Wii” contest in which KDND 107.9 promised a Nintendo Wii video game system for the winner.

“She said to one of our supervisors that she...
Poisoning
Definition

- **What is there that is not poison?**

- **All substances are poisons; the right dose differentiates a poisons from a remedy.**

- **Dose determines toxicity.**

  - Paracelsus (1493-1541)
  
  *Physician & Philosopher*
Poisoning
Definition

Per the CDC:

“Damaging physiological effects of ingestion, inhalation, or other exposure to a range of pharmaceuticals, illicit drugs, and chemicals, including pesticides, heavy metals, gases/vapors, and common household substances, such as bleach and ammonia.”
Poisoning
Which of these are “poisoning deaths”?

- 4yo dies from drinking pesticide in garage?
Poisoning

Which of these are “poisoning deaths”?

■ 4yo dies from drinking pesticide in garage?
■ 28yo actor dies in his sleep while taking prescription pain medicines?
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- 19yo drunken driver dies in a car crash?
- 6yo dies from known complication of chemotherapy?
Poisoning Statistics

AAPCC Data (www.aapcc.org)

• ~ 3 million poison exposures / yr
• 2/3 aged < 19 yrs
• 1/2 aged < 6 yrs
Poisoning Statistics

• Unintentional (1-2 years)
  – Exploratory
  – Boys > girls
  – Unable to discriminate safe from unsafe liquid

• Intentional (adolescent)
  – Purposeful
  – Girls > boys
Poison Exposures by Age, National Capital Poison Center, 2013

Number of Poison Exposures

Age (years)
Poisoning Statistics

AAPCC Data: Most Common Exposures

- Pain relievers
- Cosmetics / Personal products
- Cleaning substances
- Sedatives / psychiatry meds
- Cold and cough medicines
Poisoning Statistics

AAPCC Data: Most Common Fatal Poisons

- Sedatives / psychiatry medicines
- Opioid drugs
- Heart / blood pressure drugs
- Acetaminophen
- Depression medicines
- Other street drugs
Evaluation

- History of poisoning
- Physical Examination
- Laboratory studies
- Gastrointestinal decontamination
Initial Assessment: Overview

• Treat the patient, not the poison
• Assessment triangle
  – General appearance
  – Work of breathing
  – Circulation
• ABCDs
• IV access and monitors
• High Suspicion
Evaluation of Suspected Poisoning

• ABC’s and routine ICU management
• Establishing the diagnosis
  – Must consider poisoning, especially in “at risk” age groups
    • Less than 6 year old with acute decompensation (AMS, arrhythmias, hypotension, metabolic acidosis, etc.)
Initial Assessment: Physical Examination

• Directed exam (after ABCs)
  – mental status
  – vital signs
  – pupillary size
  – skin signs
Initial Assessment: Diagnostics

- Cardiac monitoring or 12-lead EKG
- Chest and abdominal radiographs
- Electrolytes (anion and osmolar gaps)
- Toxin screening rarely helpful
- Specific drug levels
Secondary Assessment

• AMPLE
• A- Allergies
• M- Medications
• P- Past Medical History
• L- Last PO Intake
• E- Events Prior To Presentation
Secondary Assessment

• Obtain detailed history of the amount and time of ingestion

• Use family or friends as historians

• May need to search the home
History

• What?
• When?
• How much?
• Reliability...
What?

• Medication
• Illicit drug
• Hazardous chemical
What forms?

- Pill
- Solid
- Liquid
- Gaseous
What route?

- Ingestion
- Inhalation
- Topical
- Intravenous
When?

- Elapsed time
How much?

- Estimate amount
- Concentration
Clinical Pearl

EMS can be the critical clinical link based on observation & history of ingestion.
Prevention or Minimization of Absorption

• Ipecac
  – No longer recommended

• Gastric lavage (also almost never used)
  – massive ingestions
  – arrival within one hour of ingestion
Activated Charcoal

- Ineffective in some ingestions (garage)
  - pesticides
  - hydrocarbons
  - acids, alkalis, and alcohols
  - iron
  - lithium
Activated Charcoal

• Recommended dose

  – child under 6 years: 1 - 2 grams/kg
  – 6 years and older: 50 - 100 grams

  – Sorbitol?
    • Hypernatremia
    • Dehydration
Cathartics

• Studies of the effectiveness of cathartics are inconclusive

• Complications related to systemic absorption
  – electrolyte disturbance and severe dehydration
  – neuromuscular impairment and coma
Whole Bowel Irrigation

- Golytely® (PEG-ELS)
  - combination of electrolytes and polyethylene glycol (PEG)
  - 0.5 L/hr for small children and 2 L/hr for adolescents and adults
  - administer for 4 - 6 hours or until effluent is clear
  - useful for ingestions of iron, lithium, and sustained release preparations
Enhancement of Excretion

• Multiple dose charcoal
  – May cause bowel obstruction
  – phenobarbital, theophylline

• Hemodialysis
  – Alcohols
  – Salicylates
  – Lithium
Common Pediatric Ingestions – Cases
Case #1

- You are called to transport a 16 year old girl after she tells her boyfriend “I took as much Tylenol® as I could”

- Denies other ingestions or medication use

- Ingestion occurred three hours prior
Case Progression

- Patient is anxious, diaphoretic nauseated
- PE reveals a mildly tender abdomen
- HR- 120 RR-20 BP 100/70
Do You Transport?

YES
Case Discussion: Acetaminophen

- Most widely used pediatric analgesic on the market
- Most common ingestion in toddlers, preschoolers and adolescents
- Normal cytochrome P-450 metabolism yields small amounts of free oxidants that are hepatotoxic
  - Glutathione depletion
Case Discussion: Stages

- **stage 1 (4 - 12 hours)**
  - malaise, nausea, vomiting

- **stage 2 (24 - 72 hours)**
  - asymptomatic, increasing LFTs

- **stage 3 (48 - 96 hours)**
  - liver failure, elevated prothrombin time

- **stage 4 (7 - 8 days)**
  - resolution of liver injury
Case Discussion: Diagnosis

- Kinetics dictate that a serum level be checked 4 hours after ingestion
- Toxic dose: 150 mg/kg
- 4 hour toxic blood level 150mg/dl
- Apply the level to the management nomogram
Rumack-Matthew nomogram for predicting prognosis of hepatotoxicity in acetaminophen overdoses.
Our Patient

- Charcoal 50mg
- 4 hour level is 215 µg/ml
- Now What?
Case Discussion:  
*N*-acetylcysteine (NAC) Therapy  

- Proven to be 100% effective when given within 8 - 16 hours of ingestion  
- Load with 140 mg/kg orally  
- Complete regimen with 17 subsequent doses of 70 mg/kg every four hours
Case Discussion:

*N*-acetylcysteine (NAC) Therapy

- IV NAC (Acetadote)

- Load with 50 mg/kg over 4 hours

- Maintenance 100mg/kg over 16 hours
Case #2
Case #2

• 12 year old boy was dared by his friends to drink from a bottle filled with antifreeze

• Swallowed a few gulps, and then yelled and dropped the bottle

• His father, utters a few choice words and calls an ambulance
Case Progression

• Upon arrival, the child has clumsy movements with a decreased level of consciousness

• Vital signs: HR 120, RR 20, BP 80/50, T 37.4º C, weight 12 kg

• What class of toxin has this child ingested?
Alcohol

• Why can’t we let him ‘sleep it off’?
Case Discussion: Alcohols

- **Ethanol**
  - hypoglycemia, osmolar gap, ketoacidosis

- **Methanol**
  - blindness, large osmolar gap, metabolic acidosis

- **Ethylene glycol**
  - renal failure (calcium oxalate crystals), osmolar gap, metabolic acidosis
Alcohol metabolism

• Ethylene glycol
  – Broken down by ADH to oxalic acid
  – Results in renal failure

• Methanol
  – Broken down by ADH to formic acid
  – Results in blindness
Alcohol metabolism

• Ethanol
  – Broken down by ADH to CO2 and H2O
  – Results in DRUNK

• Isopropanol
  – Broken down by ADH to CO2 and H2O
  – Results in REALLY DRUNK
Osmolar Gap

- osmolar gap = measured – calculated

- calculated = (2 x Na) + (glucose/18) +(BUN/2.8)

- normal = 10 – 15 mOsm/kg H₂O

- all alcohols cause an elevated osmolar gap
Anion Gap

- $[\text{Na} + \text{K}] - [\text{HCO}_3^- + \text{Cl}^-] > 12$
  - M- Methanol
  - U- uremia
  - D- DKA
  - P- Paraldehyde
  - I- Iron
  - L- Lactic Acidosis
  - E- Ethylene Glycol
  - S- Salicylates
Case Progression

• Patient has an osmolar gap and metabolic acidosis consistent with ingestion of ethylene glycol

• Now what?
Therapeutic Intervention

• IV ethanol (old)
  – competes for alcohol dehydrogenase (ADH) to prevent build up of toxic metabolites

• Fomepizole (4-methyl pyrazole)
  – Blocks alcohol dehydrogenase (ADH)

• Requires ICU admission
Moonshine
https://www.youtube.com/watch?v=qEttJyXNEr8
What temperature?
Methanol
C₆H₁₂O₆ → 2 C₂H₅OH + 2 CO₂
<table>
<thead>
<tr>
<th>Name</th>
<th>Formula</th>
<th>Boiling point (°C) at 1 atm. (~101.33 kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>CH₃OH</td>
<td>~64.7</td>
</tr>
<tr>
<td>Ethanol</td>
<td>CH₃CH₂OH</td>
<td>~78.3</td>
</tr>
<tr>
<td>Propanol</td>
<td>CH₃CH₂CH₂OH</td>
<td>~97.2</td>
</tr>
<tr>
<td>Isopropanol</td>
<td>CH₃CH(OH)CH₃</td>
<td>~82.3</td>
</tr>
<tr>
<td>Butanol</td>
<td>CH₃CH₂CH₂CH₂OH</td>
<td>~117.7</td>
</tr>
<tr>
<td>Isobutyl alcohol</td>
<td>CH₃CH(CH₃)CH₂OH</td>
<td>~108</td>
</tr>
<tr>
<td>sec-Butanol</td>
<td>CH₃CH₂CH(OH)CH₃</td>
<td>~99.5</td>
</tr>
<tr>
<td>tert-Butanol</td>
<td>(CH₃)₃COH</td>
<td>~82.5</td>
</tr>
</tbody>
</table>
• Boiling point of methanol
  148.5 degrees F (64.7 degrees C)
• Boiling point of ethanol
  173.1 degrees F (78.37 degrees C)
• How to avoid methanol discard all alcohol that boils <172 degrees
• Blindness
  – Optic nerve destruction
• Coma
• Death
Methanol? Ethanol? Moonshine?
Case #3

• You arrive at a home where a parent has called 911. You find a 5 year old who is crying and rubbing at his arms yelling “get the bugs off me.”

• T-102, HR- 150, RR-23, BP- 100/60
• Skin is flushed, pupils are dilated and extremities are warm and dry.
• His neuro exam is nonfocal
• What toxidrome?
ANTI-CHOLINERGIC
Toxidrome: Anticholinergics/antihistamines

- Mad as a hatter
- Red as a beet
- Dry as a bone
- Hot as a hare
- Blind as a bat
Anticholinergic Toxidrome

“HOT as a Desert”
hyperthermia

“I can’t see!”

“Blind as a Bat”
dilated pupils
(mydriasis)

“Mad as a Hatter”
confused

“Dry as a Bone”
dry mouth
urinary retention

shaking

grabbing
invisible
objects

“Red as a Beet”
flushed skin
tachycardia
absent bowel
sounds

Kloss and Bruce.com
Anticholinergic Toxidrome

- CNS
  - agitation, hallucinations, coma
- Respiratory
- Circulation
  - tachycardia, arrhythmias, hypertension
- Skin
  - warm, flushed, dry
- Eyes
  - mydriasis
Case Progression

- gastric decontamination
  - charcoal, 50 grams

- supportive care

- antidote: physostigmine
  - indications: coma, unstable vital signs
  - 0.5 mg IV (child) or 1 - 2 mg IV (teen)
  - Contraindicated if wide QRS
Case #4

You are called to a man down in the park.

On arrival you find an adolescent, well dressed in collared shirt saying random words. Non-combative

Heart rate 170s

You find a packet next to him that says “not for human consumption” on the label.
Synthetic Cathinones
Synthetic cathinones

- 2009 – Western Europe
- 2010 – First appeared in U.S.
  - December Poison Center Calls
- 2011 – Drastic increase due to media
- 2015 – Peak incidence likely passed
Synthetic cathinones

• Sold over Internet
• Gas stations
• Convenience stores
• Head shops
• Smoke shops

• Labeled “not for human consumption”
  – Circumvent drug abuse legislation
Synthetic cathinones aka

Bath salts, bloom, blue silk, chare+, hurricane Charlie, ivory snow, ivory wave, lunar wave, ocean burst, ocean snow, pure ivory, purple wave, red dove, scarface, sextacy, snow leopard, stardust, vanilla sky, white dove, white knight, white lightning, white rush, zoom.
Cathinones

- Leaves and stems of khat plant
- Slow growing shrub native to Ethiopia, East Africa, SW Arabian Peninsula
- Practice of chewing the leaves
- Psychostimulant and euphoric effect
- Used since 11th century
- 10 million daily khat users worldwide
Cathinone

- Stimulant
  - Central nervous system
- Increased heart rate
- Increased blood pressure
- Euphoria
- Alertness
- Psychomotor hyperactivity
Cathinone

- Hypertension
- Myocardial infarction
- Acute coronary vasospasm
- Esophagitis
- Gastritis
- Liver toxicity

- Insomnia
- Depression
- Anorexia
- Psychosis
- Impaired memory
- Withdrawal
- Cerebral edema
- Brainstem herniation
Synthesis of Cathinone Derivatives

• 1920s
  – Methcathinone
  – Mephedrone

• Bupropion
  • Only cathinone derivative that carries medical indication

• First mention internet forms 2007

• # of different cathinone derivatives is immense and ever growing
Schedule I Controlled Substance

• 3 most popular cathinones
  – MDPV
    • U.S.
  – Methylone
  – Mephedrone
    • Europe

• Synthetic Drug Abuse Prevention Act 2012
  – “any material, compound, mixture, or preparation which contains specified cannabimimetic agents (salts, isomer, or salts of isomers)”
  – “specified additional hallucinogenic substances”
  – Verbiage broadens spectrums of substances classified under Schedule I
Patterns & Method of Abuse -- Cathinones

- 2010 – 310 calls
- 2011 6138 calls
- 2012 2363 call
- Exposures reported in children to 6 years-old
- United Kingdom 20% of high school and college students report using mephedrone at least once
- Commonly nasally insufflated or ingested
  - Keying – snort off key
  - Bombing – wrapped in cigarette paper and orally ingested
  - Less common – gingival, rectal, IM, IV
Synthetic Cathinone Treatment

- Supportive care
- Symptom control
- IVF
- Benzodiazepines
- Oxygen
- Sedatives
- Correct hyponatremia slowly with hypertonic saline to avoid central pontine myelinolysis
- Surgical debridement if necrotizing fasciitis at IM site
Case #5

- You are dispatched to a home after a call by a parent whose 2 year old was found with a container of dishwasher detergent pods in his hands and some residue around the mouth
- Broken pod found on floor
- Patient is asymptomatic
- Physical exam is normal, including oropharynx
Case #5

• What are you going to do?

• Reassure parents and leave them to follow-up with the pediatrician as needed?

• Offer transport to the local ED?
Case Discussion: Caustics

- drain cleaners, oven cleaners, automatic dishwasher detergents

- If pH <3 or >12 = BAD

- **DO NOT LAVAGE, GIVE ACTIVATED CHARCOAL, GIVE CATHARTICS OR GIVE IPECAC**
Caustics

• Acids
  – Coagulation necrosis
  – Stomach injury

• Alkali
  – Liquefaction necrosis
  – Oropharyngeal and esophageal injury
Caustics

• Dilution
  – Water
  – Milk
  – Saline
  – Give within 30 minutes
Caustics

• Can your physical exam predict injury?

NO!!!!!
Case #6

- Grandma says her 18 month old grandson “isn’t acting right”

- Grandmother is concerned that child may have ingested some of her medication
  - Digoxin
  - Furosemide
  - “some kind of” antihypertensive medication
Case Progression

- Examination reveals lethargic child with 1 - 2 mm pupils

- vital signs: HR 70, RR 12, BP 80/45, T 37°C, weight 13 kg
Case Progression

• 1 - 2 mm pupils- miosis

• HR- 70- bradycardia

• RR- 12- bradypnea
Which medication?

• Digoxin?

• Furosemide?

• Other Antihypertensive?

• Opiate?
Clonidine

![Images of pills with dosages: 0.1 mg, 0.2 mg, 0.3 mg]
Case Discussion: Clonidine

- Central acting alpha-2 agonist; antihypertensive; also used to treat narcotic withdrawal
- Comes in small tablets and in patch form
- Low blood pressure (after transient hypertension), miosis, coma
- Naloxone may work to reverse respiratory depression
EMS

- Always be ready to support breathing

- Rapid decline

- Vigorous stimulation can *transiently* improve bradycardia and hypotension
Opiate/Clonidine Toxidrome

- **CNS**
  - lethargy, seizures, coma
- **respiratory**
  - slow respirations, pulmonary edema
- **circulation**
  - hypotension, bradycardia
- **skin**
- **eyes**
  - miosis
Case #7

• Midweek holiday
• Called to adolescents home by parents
• Acting strange
• Seems very tired
• Parents are concerned he is lethargic
On Exam

- 17 yo M
- Slumped on couch
- Tachycardic
- Apnea that responds to stimulation
- Generalized increased muscle tone in extremities
Synthetic Cannabinoids
Synthetic Cannabinoids

- Herbal marijuana alternative
- Labeled Spice or K2
- U.S. 2008
- Marketed as incense or potpourri
- Labeled “not for human consumption” to bypass legislation
- No ingredients listed on packaging
- Bay bean, blue lotus, dwarf scullcap, honey, Indian warrior, lion’s-tail, lousewart, maconha brava, marshmallow, pink lotus, red clover, rose, Siberian motherwort, and vanilla
Synthetic Cannabinoid Consumption

- Smoked
  - Similar to marijuana
    - Euphoria
    - Relaxation

- Sprayed no plant
Synthetic Cannabinoid Street Names

Spice, K2, albino rhino buds, aroma, barely legal, black mamba, bliss, Damiana, drolle, exclusive cherry, exclusive mint, galaxy, genie, gorilla, halo, k2 summit, krypto buds, red magic, sence, skunk, solar flare, space, spice diamond, spice gold, spice silver, star fire, tai fun, Yucatan fire, zohai, and many more

$40 per 3-g packet
Adverse effects of synthetic cannabinoids

- Tachycardia
- Agitation
- Irritability
- Anxiety
- Hallucinations
- Nausea
- Vomiting
- Hypertension
- Confusion
- Conjunctival injection
- xerostomia

- Seizure
- Psychosis
- Supraventricular tachycardia
  - cardioversion
Poison center calls synthetic cannabinoids

- 2010 – 2906 calls
- 2011 – 6959 calls
- 2012 – 4460 calls

- Texas: 40% of users <20 years-old
- 35% of samples from juvenile probation centers in 2010 tested positive for synthetic cannabinoids
- 2010 classified as Schedule I substance
  - JWH-018, JWH-073, JWH-200, CP-47,497, cannabicyclohexanol
Synthetic Cannabinoid Tx

• Supportive care
• Monitor Vitals
• Benzodiazepines
  – Seizure
  – Agitation
  – Anxiety
• Antipsychotic medications
  – Psychosis
  – Behavioral symptoms
Case #8
Case #8

• 2 year old who was found unconscious with empty bottle of grandma’s calcium channel blockers at his side

• multiple episodes of vomiting on transport to the hospital, producing pill fragments
Case Progression

• Patient responsive to deep pain only, extremities cool with decreased pulses

• VS: T 37.5°C, HR 45 with third degree heart block, RR10, BP 70/25
Case Discussion: Calcium Channel Blockers

- Morbidity and mortality after toxic exposures result from cardiovascular collapse
- Therapy
  - gastric decontamination (charcoal, WBI)
  - blood pressure support
  - calcium
  - glucagon
EMS Treatment

- Supportive
- IV Fluids
- Atropine, Epinephrine, and/or pacing
  - May not work depending on severity of overdose
- For inter-hospital transport may encounter
  - Hyperinsulinemia & Euglycemia Therapy
  - D50W + Insulin 1U/kg
Case #9

Robitussin®
DM
Cough Suppressant / Expectorant

- Controls Coughs
- Loosens & Relieves Chest Congestion

Alcohol-Free
Children & Adults
Cough Formula

12 FL OZ (355 mL)
Case #9

- 15 yo F
- Hallucinating
- On Exam Rotatory Nystagmus
DXM – Lemon Drop

- Active ingredient in cough syrup
- Dextromethorphan
- Guaifenesin
- Acid-Base reaction
- Extracted with ammonia, lighter fluid and citric acid
DXM

• Ingested
• Freebase
• Vapor pipe

• Hallucinations
• Rotatory nystagmus
• Tachycardia
Case

- 19 yo M
- Hallucinations
- Abnormal behavior
Salvia divinorum
Salvia divinorum

- Herb native to Mexico
- Used for centuries
- Mind-altering
- Potent visionary effects
- Active component is salvinorin A
  - Hallucinogenic properties
Salvia divinorum street names

Sally D, diviner’s sage, Maria Pastora, SkaPastora, magic mint, mystic sage, purple sticky, and sage of the seers

• Sold at head shops, gas stations, Internet
SÁLVIA

ORIGEM
É oriunda de uma pequena região em Oaxaca, no México, onde cresce na área montanhosa dos índios Mazatecas.

"ERVA DIVINA"
Além desse nome, a planta também é conhecida por termos mais populares, tais como: Ska (Maria) Pastora, folha da pastora, menta mágica e sava.

FORMA VENDIDA
A Sálvia divinorum é vendida normalmente em folhas secas ou em forma de extrato.

EFEITOS
Dependendo de peso do corpo, sensibilidade, dose tomada, método de ingestão e potência da sálvia usada, os efeitos variam desde sutis a extremamente fortes.

USO
A maioria das pessoas fuma a sálvia num bongo ou cachimbo, mas os índios mexicanos Mazatecas usavam dois métodos tradicionais: infusão ou mastigar e engolir.

INTERAÇÃO
A sálvia não pode ser considerada uma droga para festas, pois as pessoas geralmente não se interagem quando se encontram sob o efeito da sálvia, mas têm uma experiência alucinógena mais pessoal.
Salvia divinorum

• Increase in recreational use by adolescents and young adults
  – U.S. Canada, Europe, Japan
• “unique and intense” high, hallucinations, perceptions of bright lights and vivid colors and shapes, “out-of-body experience”
Emerging Drugs of Abuse

Monitoring the Future is an annual survey of 8th, 10th, and 12th-graders conducted by researchers at the University of Michigan, Ann Arbor, under a grant from the National Institute on Drug Abuse, part of the National Institutes of Health. Since 1975, the survey has measured drug, alcohol, and cigarette use and related attitudes in 12th-graders nationwide. Eighth and 10th graders were added to the survey in 1991.

Overall, 41,675 students from 389 public and private schools participated in the 2013 survey.
What’s getting up your nose?
Legal doesn’t mean safe

**KET**

‘Bombing’ or ‘snorting’ powders - even so called ‘legal highs’ - could cause you serious harm.
*They can even kill.*

Mixing MCAT or ketamine with other drugs, including alcohol, increases the risk.

Some people are having serious problems with MCAT or ketamine.

If you are worried about your drug or alcohol use, please talk to someone confidentially.

[Contact information]

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**MCAT – Maxy -- Ket**
Kratom

stimulant
Cinnamon Challenge

- Swallowing a tablespoon of ground cinnamon
- 60 seconds
- Without drinking fluids

- Pneumonitis
- Aspiration
- Ventilation support
YouTube

- 51,100 clips depicting Cinnamon Challenge
- One video viewed >19 million times
- Viewed by 13- to 24- year-olds
  - People taking challenge
  - Associated with greatest need for conformity
Thank You
Case

• 3 year old boy who drank from a soda bottle containing gasoline

• Cried immediately, gagged and coughed, and then vomited

• Alert and crying. HR- 122, RR-24, BP-90/60

• You arrive on the scene...do you transport?
Case Discussion: Hydrocarbons

• Degreasers, solvents, fuels, pesticides, and additives in household cleaners and polishes

• Low surface tension allows for rapid movement through pulmonary system

• Toxic effects
  – pulmonary, cardiovascular, or systemic
Case Discussion: Management Issues

- Admit all symptomatic patients and obtain ABG, EKG, and CXR
- Absence of symptoms for 4-6 hours after ingestion makes chemical pneumonia unlikely
- Ipecac?  **NO!!**
- Steroids?  **NO!!**
- Prophylactic antibiotics?  **NO!!**
Case

• A 5 year old girl was at school, when she developed
  – Nausea
  – Vomiting
  – bloody diarrhea
Case

- Patient reports that she ate some of her mother’s prenatal vitamins at breakfast

- The bottle had contained 30 pills of ferrous sulfate, and is now empty
Case Discussion: Iron

- Toxic exposure is based on elemental iron load

- Most children’s preparations contain less iron than adult preparations
  - children’s: 3 - 25 mg per pill
  - adult: 37 - 65 mg per pill
Case Discussion: Iron

• Toxic dose: 40-69 mg/kg elemental iron

• Lethal Dose: 180 mg/kg elemental iron
Case Discussion: Clinical Presentation

- Gastrointestinal stage (30min-6h)
  - nausea, vomiting, and bloody diarrhea
- Relative stability (6-24h)
  - apparent clinical improvement
- Shock stage (12-48h)
  - coma, shock, seizures, coagulopathy
- Hepatotoxicity stage (within 48 hours)
- GI scarring (4-6 weeks)
Case Discussion: Management

- AXR - iron tablets are radio-opaque
Case Discussion: Management

- Whole bowel irrigation
  - 500cc/hour (children) 1-2L/hr (adults)
  - Effluent=Influent
- Deferoxamine
  - Serum fe >500mcg/dl
  - Significant clinical toxicity
  - Persistent XR findings despite GI decontamination
Case

- 6 year old boy who was playing outside and returned to his house with respiratory distress

- You arrive on the seen and you note him to be lethargic, diaphoretic, and in moderate respiratory distress
Case Progression

• Physical exam reveals rales and wheezing in all lung fields with copious oral secretions

• Lethargic with 1 mm pupils

• Vital signs: HR 50, RR 70, BP 90/palp, T 37.8°C, weight 25 kg
Cholinergic (Organophosphate) Toxidrome

- D diarrhea
- U urination
- M miosis
- B bradycardia
- B bronchosecrections
- E emesis
- L lacrimation
- S salivation
Cholinergic toxidrome- organophosphate poisoning

- **ATIONS**
  - Salivation
  - Lacrimation
  - Urination
  - Fasciculation

- **HEAS**
  - Diarrhea
  - Bronchorrhea
  - Rhinorrhea
  - Bradycardia
Cholinergic agents

• Inhibit

ACETYLCHOLINESTERASE
Case Discussion: Management

• REMOVE CLOTHING- Skin decontamination

• Atropine (vagal block)
  – Dries secretions, decreases bronchoconstriction and increases heart rate
  – large doses (0.5 - 10 mg IV) may be needed

• Pralidoxime (Protopam, 2-PAM)
  – Regenerates acetylcholinesterase
  – 20 - 50 mg/kg/dose (IM or IV)
Case

• 3 year old has fever, progressive sleepiness, and respiratory distress 2 hours after drinking some oil of wintergreen from the kitchen cabinet

• Patient noted to be lethargic and tachypneic, with adequate circulation
Case Progression

• Patient responds to mother’s voice, and there are no focal findings on neurologic exam

• Vital signs: HR 140, RR 60 and deep, BP 90/70, T 40º C, weight 12 kg

• I stat shows 7.25/25 HCO3-10
What did this patient ingest????

• Hint: Remember your blood gas

• PH: 7.25
• CO2: 25
• HCO3: 10
Salicylates

• Metabolic acidosis with respiratory alkalosis=

• SALICYLATE toxicity until proven otherwise
Case Discussion: Salicylates

- Respiratory alkalosis
- Increased Temp, HR, RR
- Alters platelet function and bleeding time
- May develop cerebral edema secondary to vasoactive effects
- Tinnitus
Case Discussion: Clinical Manifestations

• Vomiting, hyperpnea, tinnitus, and lethargy

• Severe intoxication: coma, seizures, hypoglycemia, hyperthermia, and pulmonary edema

• Death from cardiovascular collapse
Case Discussion: Toxic Dose

- Therapeutic dose is 10 - 15 mg/kg
- Toxic dose is over 150 mg/kg
- Done nomogram ONLY useful in acute toxicity
Salicylate toxicity management

• Urinary alkalinization with sodium bicarbonate to maintain urine pH > 7
  
  – Keeps ASA in renal tubules
Salicylate toxicity management

• Hemodialysis is very effective for drug removal and to control acid-base imbalance
  – Acute ingestions > 100mg/dl
  – Chronic ingestions > 60 mg/dl
  – Persistent rise in ASA
  – Renal insufficiency
  – Refractory metabolic acidosis
  – Altered mental status
Case

• Called to transport a 13 year old after her parents arrived home from work to find the patient unresponsive

• Long history of psychiatric problems in the family, including the patient
Case Progression

• VS: T 38°C, HR 120s with widened QRS on the monitor, RR 24, BP 90/50

• Pupils are dilated and reactive, skin is dry and flushed, and patient is responding to deep pain only
Case Discussion: Tricyclic Antidepressants

- Clinical picture is anticholinergic intoxication, CNS depression, and cardiovascular instability

- Mainstay of therapy is sodium bicarbonate in addition to supportive measures
Case Progression: Management

- Charcoal, 50 grams after airway secured
- Fluid bolus
- Alkalinization
  - 100 meq/L of NaHCO$_3$
- EKG
  - QRS duration, PR interval, QTc
    - R wave height of $> 3$ mm in aVR
    - QRS duration of $> 120$ ms
QRS duration

- QRS > 100ms associated with seizures
- QRS > 160ms associated with cardiac arrhythmia
Potential Carbon Monoxide Sources in the Home

- Blocked chimney opening
- Clogged chimney
- Portable heater
- Improperly installed kitchen range or cooktop vent
- Propane powered refrigerator
- Gas or woodburning fireplace
- Leaking chimney pipe or flue
- Corroded or disconnected water heater vent pipe
- Cracked heat exchanger
- Clothes dryer
- Operating barbecue grill in enclosed area such as the garage
- Auto exhaust fumes from attached garage
Case

• 15 yo twins are brought to the ED by mom.
• She found them both unconscious in the hallway at home and dragged them out of the house where they both woke up.
• She is now in the ED and they both are alert and appropriate.
• You are bothered by the fact that both boys had LOC. And, you cannot chalk it up to teenage pregnancy.

• Carboxy hemoglobin level
Case Discussion: Carbon Monoxide Poisoning

- CO-hgb affinity is 250 times O$_2$-hgb affinity; results in decreased oxygen delivery to the tissues
- Non-irritating, tasteless, odorless, and colorless gas
- Sources: smoke inhalation, auto exhaust, poorly ventilated charcoal, kerosene or gas heaters, and cigarette smoke
Case Discussion: Carbon Monoxide

• Toxic effects are the result of cellular hypoxia
• Concentrations of 20% produce neurologic symptoms, and death can occur with concentrations over 60%
• Pulse oximetry may be normal
• Peak level may occur in the field prior to $O_2$ delivery
Case Discussion: Therapy

- Administering oxygen at high concentrations reduces half life of CO from 6 hours to 1 hour
- Hyperbaric therapy
  - neurologic dysfunction
  - pregnant women
  - Unstable
  - children with levels over 25%
Summary

• Most pediatric ingestions are non-life threatening

• Recognition of toxidromes and knowledge of available antidotes MAY assist in the initial management of the poisoned patient, but supportive measures are more likely to be life saving