Childhood Poisoning

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### Presenter Disclosures

<table>
<thead>
<tr>
<th>Category</th>
<th>Disclosure</th>
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<tr>
<td>Consultant/ Speakers bureaus</td>
<td>None</td>
</tr>
<tr>
<td>Research funding</td>
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<td>Stock ownership/Corporate boards-employment</td>
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<td>Off-label uses</td>
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Topics of Discussion

- The problem of poisoning
- General principles of assessment and management
- Specific poisons
- Poison Prevention
## 10 Leading Causes of Injury Deaths by Age Group Highlighting Unintentional Injury Deaths, United States – 2015

### Table

<table>
<thead>
<tr>
<th>Rank</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
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<th>Total</th>
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<tr>
<td>1</td>
<td>Unintentional Suffocation 1,125</td>
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<td>Unintentional MV Traffic 351</td>
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**Data Source:** National Center for Health Statistics (NCHS), National Vital Statistics System

**Produced by:** National Center for Injury Prevention and Control, CDC using WISQARS™.
2,168,371 human exposures reported in 2015 to US Poison Centers
- 47% are in children under age 6 years (1,017,369) - virtually all are unintentional
- 7.7% are in adolescents - 60% are intentional (highest proportion of any age group)
- 38% of toxic exposures are in adults - approximately 1/3 are intentional
Deaths in children

- Almost all exposures in children under age 6 are accidental
  - 24 deaths (out of > 1 million exposures)
- More than half of exposures with known reason in adolescents are intentional
  - 58 deaths (out of 166,000 exposures)
US Deaths in children under 6

- Analgesics (15)
- Batteries (5)
- Fumes/gases/vapors (5)
- Stimulants and street drugs (4)
El Paso County statistics 2016

- total # of exposure calls: 5,037
- total # pediatric calls: 2,578
- total # adolescent calls: 632
- 733 children see in hospital
  - 95 admitted to ICU
- No pediatric death
El Paso County statistics 2016

- 78% of children under 6 were managed safely on site without a hospital referral
- 78% of adolescent exposures required referral by the poison center to a health care facility
How are patients exposed?

- Ingestion – most common
- Injection
  - Wrong route or dose, drug abuse, bites/stings
- Inhalation
  - CO, industrial accidents, mixing of products, solvent abuse
- Dermal
  - Direct damage, cutaneous exposure with absorption leading to systemic toxicity
- Ocular
  - Installation, irritation from fumes, systemic absorption
And why?

- Unintentional
  - Unsupervised child exposed to substance
  - Therapeutic error
  - Environmental or occupational exposure
  - Contaminants

- Intentional
  - Suicidal
  - Malicious
    - e.g. MBP
Poisoning in children

What are the most commonly encountered exposures in children?
Poisoning in children

- Substances most frequently involved in young children
  - Cosmetics and personal hygiene products
  - Cleaners
  - Analgesics
  - Foreign bodies
  - Topical preparations
Risk factors in children

- Young children
  - inadequate supervision
  - exploratory behavior
  - attractive packaging
  - pleasant taste
  - look-alikes
  - mimicking behavior

- Adolescents
  - Risk-taking behavior
  - Mental illness
Lookalikes

- Risk factor for all age groups
So how do poisonings present?
Common presentations of poisoning

- coma
- seizures
- sedation
- agitation/psychosis
- burns
- cardiopulmonary arrest
Initial Assessment

- A - Airway
- B - Breathing
- C - Circulation
- D - Decontamination
- E - Prevent secondary Exposure
History

- Who
- What
- Where
- When
- Why
- How
Most ingestions are known, or at least highly suspected, at the time of presentation.
Physical examination

- Odor on breath or skin
- Discoloration of skin or mucous membranes
- Physical evidence of poison
- "Toxidromes"
Toxidromes

- Anti-cholinergic
  - Tachycardia
  - Mydriasis/cycloplegia
  - Dry mucous membranes
  - Flushing
  - Dry, warm skin
  - Urinary retention/ileus
  - Mental status changes
Anticholinergic drugs

- Belladonna alkaloids
  - Atropine, scopolamine, hyoscymamine
- Tricyclic antidepressants
- Phenothiazines
- Carbamazepine
- Cyclobenzaprine
Toxidromes

- Cholinergic
  - Salivation
  - Lacrimation
  - Sweating
  - Bronchorrhea, bronchospasm
  - Vomiting/diarrhea
  - Urinary incontinence
  - (bradycardia)
  - (miosis)
Cholinergic agents

- Cholinesterase inhibitors
  - Organophosphates, carbamate insecticides, myasthenia gravis drugs
- Pilocarpine
- Bethanecol
- Nicotine
Toxidromes

- Sympathomimetic ("fight or flight")
  - Tachycardia
  - Hypertension
  - Mydriasis
  - Pallor
  - Tremor
  - Anxiety
Sympathomimetics

- Pseudoephedrine, phenylpropanolamine, phenylephrine
- Caffeine, theophylline
- Amphetamines
- Cocaine
Toxidromes

- Opioid
  - Depressed level of consciousness
  - Respiratory depression
  - Miosis
Opioids

- Morphine, codeine and derivatives
- Meperidine
- Propoxyphene
- Pentazocine
- Methadone
- Buprenorphine
- Fentanyl and its congeners
Laboratory investigations

- Ordering of “routine” blood work not indicated
- Anion gap critical if there is acidosis
- Osmol gap elevation may suggest toxic alcohols
- Electrocardiogram
Toxicologic screening

- Limited value
- Usually adds nothing to the management
- Targeted testing more appropriate
  - Result directs therapy
  - Result establishes prognosis
- “Baseline” lab tests have no use
Surface Decontamination

- Copious flushing with tepid water
- Don’t waste time looking for esoteric decontamination solutions
- DO NOT ATTEMPT TO NEUTRALIZE ALKALI OR ACIDS
  - Thermal injury may occur
Decontamination
Decontamination

- Worry about the victim first
  - Containment is 2nd priority
GI Decontamination

- Gastric emptying
  - Induction of emesis
  - Oro-gastric lavage
- Activated charcoal
- Whole bowel irrigation
Induction of emesis

- Syrup of Ipecac
- Dish soap is an alternative
- Must be instituted almost immediately
- Risk of pulmonary aspiration
- Limited efficacy
- No longer routinely recommended
Induction of emesis

- Contra-indications
  - Non-toxic ingestion
  - Caustic ingestion
  - Hydrocarbon ingestion
  - Vomiting patient
Oro-gastric lavage

- Need to use large bore “hose”
- Technically impossible in small children
- Limited efficacy
- May need to protect airway
- Benefit doubtful beyond one hour
- Punitive lavage is not indicated or effective
Activated charcoal

- Decontamination method of choice
- Very effective at binding most drugs
- Ineffective at binding metals and alcohols
- Makes endoscopic evaluation difficult
- Consider in all ingestions presenting within one hour and, in selected cases, up to four hours
Whole bowel irrigation

- Administration of bowel prep solution (e.g. Golytely™) orally or via NG tube until effluent is clear
- May be useful for sustained release products or products not adsorbed to charcoal
Enhancement of elimination

- Hemodialysis
- Repeated-dose activated charcoal
Rest Stop
Specific toxins
Drugs that cause coma

- Narcotics (opioids)
- Benzodiazepines
- Barbiturates and other sedatives
- Antidepressants
- Antipsychotics
- Diabetes drugs
- GHB
- Synthetic cannabinoids
Drugs that slow the heart

- Beta blockers
- Calcium channel blockers
- Digoxin
- Sedatives
- Clonidine
- Opioids
Drugs that cause arrhythmias

- Antidepressants
- Digoxin
- Cocaine and stimulants
- Local anesthetics
- Antipsychotics
- Antidysrhythmics
Drugs that cause seizures

- Antidepressants
- Propranolol
- Muscle relaxants
- Isoniazid
- Cocaine/ampetamines
- Anti-seizure medications!
Drugs that cause agitation

- Cocaine
- Amphetamines
  - ADD medications
  - Illicit substances
- Bath salts
- “Designer” drugs
Acetaminophen

- Found in a variety of OTC/Rx preparations
- 200 mg/kg is considered potentially toxic
- Primary toxicity is hepatocellular
- Often asymptomatic initially
**Acetaminophen**

- Antidote is N-acetylcysteine (Mucomyst®, Acetadote®)
  - Single level determines need to treat
  - Most effective within 10 hours
  - May be given intravenously or orally
Use of Nomogram in Management of Acute Acetaminophen Overdose

An Approach to Management of Acute Acetaminophen Overdose

1. Draw blood for acetaminophen plasma assay 4 or more hours post-ingestion.
2. PLOT ON NOMOGRAM
3. If the acetaminophen level, determined at least 4 hours following an overdose, falls above the broken line, administer the entire course of acetylcysteine treatment.
4. If the acetaminophen level, determined at least 4 hours following an overdose, falls below the broken line, acetylcysteine treatment is not necessary or if already initiated may be discontinued.
5. Serum levels drawn before 4 hours may not represent peak levels.

*(Adapted from Rumack, B. and Matthew, S. *Pediatrics* 55: 871-875, 1975)*
Salicylates

- ASA (aspirin), oil of wintergreen
- Respiratory alkalosis/metabolic acidosis
- Alkalization of the urine enhances excretion - sodium bicarb infusion
- Serious cases warrant hemodialysis
- 1 teaspoon of oil of wintergreen can kill a toddler
Anti-depressants

- Tri-cyclic anti-depressants
  - Depressed level of consciousness, anti-cholinergic signs, seizures
  - QRS prolongation/ventricular dysrhythmias
  - Hypotension
- Cardiac toxicity develops within 6 hours
- Treatment of dysrhythmias is with intravenous sodium bicarbonate
Anti-depressants

- SSRI’s
  - Fluoxetine, paroxetine, fluvoxamine, sertraline
- Toxicity is usually mild unless massive ingestion
- May cause tachycardia, hypertension, agitation, tremor, occasionally seizures
- Exception is citalopram
  - Cardiotoxicity related to a toxic metabolite
Benzodiazepines

- Major toxicity is sedation
- Respiratory depression is generally not seen in the absence of co-ingestants
- Antidote is flumazenil
  - Several contra-indications - may precipitate acute withdrawal
  - More useful in children than adults
  - Best indication is reversal of iatrogenic overdose
Iron

- Children’s multivitamins are generally non-toxic
- Major risk is with adult iron tablets and pre-natal vitamins
- Corrosive effects on gastric mucosa
- Causes late multisystem failure
- Antidote is the chelator deferoxamine
Acids and alkali

- Toilet and drain cleaners, rust removers, hair straightener
- Most risk with pH less than 2 or greater than 12
- Cause skin, mucosal and ocular burns
- May lead to scarring or stricture and necessitate surgical management
Acids and alkali

- DO NOT INDUCE VOMITING
- DO NOT ATTEMPT TO NEUTRALISE
- Flush skin or eyes with water
- Activated charcoal may obscure visual field
- Consider endoscopy – within 24 hours
- Use of corticosteroids is controversial
Hydrogen peroxide

- Industrial strength can cause severe burns and acute gastric distention
- $\text{H}_2\text{O}_2 \leftrightarrow \text{H}_2\text{O} + \text{O}_2$
Most household plants are non-toxic or cause mild GI symptoms
- Holly
- Mistletoe
- Ivy
Dieffenbachia

- Also called dumbcane
- Contains insoluble needlelike oxalate crystals
- May cause severe local pain and swelling
- Airway compromise is possible
- Local measures are indicated
Philodendron

- Also contains insoluble oxalate crystals
- Toxicity less severe than that of dumbcane
- May also cause contact dermatitis
Poinsettia

- Not considered to be toxic
Ethanol

- Alcoholic beverages, perfume, mouthwash
- Causes inebriation and drowsiness
- Toddlers are more prone to develop hypoglycemia
Carbon monoxide

- Clear, colorless, odorless
- Slightly lighter than air
- Normal air concentrations < 10 ppm
- 8-hr TWA 35 ppm
- 15 min STEL 200 ppm
Carbon monoxide

- Motor vehicle exhaust, faulty heating equipment, misuse of cooking apparatus, fire
- Prevents oxygen from being carried in the blood
- Symptoms may be vague in cases of low level poisoning
## Carbon monoxide

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<th>CO level in air (ppm)</th>
<th>Carboxyhemoglobin (%)</th>
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<tr>
<td>70</td>
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<td>120</td>
<td>20</td>
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<td>220</td>
<td>30</td>
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<tr>
<td>350 - 520</td>
<td>40 - 50</td>
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<td>800 - 1220</td>
<td>60 - 70</td>
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<td>1950</td>
<td>80</td>
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Ref.: Ellenhorn, 1988
Carbon monoxide

Levels do not always correlated with severity of symptoms
Oxygen, oxygen, oxygen!
Don’t wait for confirmation of diagnosis
Hyperbaric oxygen is controversial and not universally accepted
Masimo RAD-57

- Portable co-oximeter
- Works like a pulse oximeter to provide COHb level in the patient
Case 1

- 3 year old boy
- Comes in from garage choking and gagging
- Mother notices smell of petroleum
- Gasoline has been spilled from soft drink container in garage
- Child hypoxic in ER with patchy infiltrates on CXR
Petroleum distillates

- Low viscosity
  - Kerosene
  - Gasoline
  - Mineral seal oil
  - Pine oil
- High viscosity
  - Lubricating oils
  - Mineral oil
  - Petroleum jelly
  - Grease
Petroleum distillates

- Major risk is that of pulmonary aspiration
- Aspiration risk inversely proportional to viscosity
- Poorly absorbed via GI tract
- DO NOT INDUCE VOMITING
- May be discharged if asymptomatic after 6 hours
Case 2

- A 4 year old child ingests an unknown amount of sibling’s ADHD medication
- Develops apnea, leading to endotracheal intubation and ventilation
- Small pupils, hypertension
- Gradually wakes up over several hours
Case 2 - clonididine

- Centrally-acting alpha-2 agonist
- Causes coma, apnea, bradycardia, hypotension
- May see initial hypertension from peripheral alpha-1 effect
- May cause cyclic changes in mental status
- May reverse transiently with high-dose naloxone
Case 3

- Adolescent male
- “Found” unresponsive by friends
- Smells of alcohol
- Intubated in the ED because of diminished level of consciousness
Case 3

- Differential diagnosis of coma
  - Alcohols, benzodiazepines, barbiturates, other sedatives, opiates, phenothiazines, atypical antipsychotics, tricyclic antidepressants, antiepileptics, antimicrobials... *ad nauseum*
Case 3

- Ethanol level 240 mg/dL
- When to intubate a comatose patient?
  - “Less than 8, maybe wait…”
Case 4

- 16 year old boy drinks some concoction he made with his friend with bourbon
- Becomes agitated, tachycardic, flushed, with warm skin, low grade temperature and dilated non-reactive pupils
- Admitted to critical care unit
Case 4

- Jimsonweed
Case 4

- Contains tropane alkaloids
  - Scopolamine, hyoscyamine, atropine
- Causes antimuscarinic syndrome
- Patient soaked the seeds in alcohol overnight
- Following day, strained and drank it
Prevention
Safe storage

- out of reach
- locked cabinets
- use only original container
Prevention

- Child-resistant packaging
- Poison Prevention Packaging Act of 1970
- Authority lies with Consumer Product Safety Commission
  - Specifies products that require it
  - Sets standard for packaging
  - Sets testing standards
Prevention

- Laws governing transport of hazardous substance (DOT)
- Environmental standards (EPA)
- Drug testing (FDA)
- Pesticide use (USDA)
- Local ordinances (CO detectors)
Public Education Committee of American Association of Poison Control Centers

- Each poison center has an educator
- Poison Prevention Week
  - poisonprevention.org
- HRSA
  - poisonhelp.hrsa.gov
Refer...
…or don’t refer?
2 year old 13 kg child drinks 30 ml of Fabuloso® liquid cleaner
Household cleaners

Soaps and detergents
Sometimes weak acids or bases
Toxicity generally limited to GI irritation
3 year old 15 kg child eats 6 of his pregnant mother’s prenatal vitamins
Prenatal vitamins

May contain 60 mg/tablet of elemental iron

Dose = 24 mg/kg

Enough to cause significant vomiting/diarrhea/fluid loss

Needs referral to a health care provider
4 year old 20 kg child eats 15 of her children’s multivitamins with iron
Children’s multivitamins

Typically contain iron 15 mg/tablet or less

Dose = 225 mg/20 kg = 11 mg/kg

Mild GI effects might be anticipated
14 year old depressed male ingests 2 aspirin tablets in a suicide attempt
SSRI’s

Toxicity generally mild
More severe toxicity (e.g. seizures) only seen with very large overdose
Needs referral to ED because
An 18-month 10 kg child ingests a teaspoon of Oil of Wintergreen
Oil of wintergreen

98% methylsalicylate
Each mL equivalent to 1.4 g ASA
Dose ingested = 700 mg/kg
LETHAL DOSE
A 6 year old boy gives his 15 month old (11 kg) baby brother an ounce of Irish Cream Liqueur.
Ethanol

Causes CNS depression, hypoglycemia

Dose = 25 g X 20%

$V_D$ approximately 0.5 L/kg

Predicted serum level 90
POISON Help
1-800-222-1222