Objectives

- Define what toxicology is
- Describe the role of poison control centers
- Describe general toxidromes that can be used to classify the poisoned patient
- Describe the different modalities of decontamination
- Identify some of the more common substances of ingestion/overdose
- Identify some of the new toxic substances on the horizon

Overdose

- Wide range of challenges
  - Scene safety
  - Finding the agent
- Supportive care
  - Airway
  - Breathing
  - Circulation
- Occasionally antidote
The latest report from American Association of Poison Control Centers – 2008
- Almost 2.5 million human exposures
- The top 5 exposures
  - Analgesics
  - Cosmetic/personal care products
  - Household cleaning products
  - Sedative/hypnotics
  - Foreign bodies, toys, etc.
- Top 5 exposures in children less than 5 years of age
  - Cosmetics/personal products
  - Analgesics
  - Household cleaning products
  - Toys/foreign bodies
  - Topical preparations
- Ingestion is the most frequent exposure type, followed by dermal and inhalation
- Unintentional exposure is the most frequent reported except for 13-19 year olds
- In 2008, nearly 1800 reported deaths to AAPCC that were thought to be related directly to toxicity
  - Sedative/hypnotics
  - Opiates
  - Antidepressants
  - Cardiovascular drugs
  - acetaminophen
Study of toxins/poisons
- Look at the properties of the poison as well as the effects on the body
  - Chemistry
  - Biochemistry
  - Epidemiology

Poison control centers
- Regional centers throughout the US that provide assistance for toxic exposures
- Staffed 24/7
- Trained personnel
- 1-800-222-1222

Route of Entry
- Inhalation
  - Breathing
  - Example - carbon monoxide, cyanide
- Ingestion
  - Eating or drinking
  - Example - acetaminophen
- Absorption
  - Skin or eyes
  - Example - nitroglycerin paste, hydrocarbons, fuels
- Injection
  - Penetration of the skin
  - Example - heroin
**Toxidromes**
- Series/group of signs and symptoms
- May help you identify agent

**Anticholinergic Toxidrome**
- Antihistamines, TCA, muscle relaxants, plants, atropine
- “red as a beet, dry as a bone, blind as a bat, mad as a hatter, and hot as a hare.”
- May have seizures and arrhythmias in severe cases

**Cholinergic Toxidrome**
- “wet” patient
- SLUDGE
- May also have pinpoint pupils, confusion, bronchospasm, arrhythmias, seizures, coma
- 2-PAM and atropine for reversal
Can be the most dangerous
- Amphetamines, LSD, PCP, mescaline, marijuana, mushrooms
- Visual hallucinations, delusions, CNS and respiratory depression, paranoia, tachycardia, chest pain, seizures

Narcotic/Opiate Toxidrome
- Codeine, fentanyl, heroin, meperidine, methadone, morphine
- Euphoria, pinpoint pupils (meperidine), nausea and vomiting, hypotension, seizures, CNS and respiratory depression, coma
- Narcan may precipitate acute withdrawl and violent behavior!

Sympathomimetic toxidrome
- Amphetamine, cocaine, ritalin, pseudophedrine
- Paranoia, delusions, diaphoresis, hypertension, CNS excitation, tachycardia, seizures
Scene Safety

Decontamination
- External
- Internal

ABC

Specific care

Removal of the poisonous substance

Surface contamination
- Skin or eye absorption
- Inhalation

Internal
- Ingestion
- Puncture wounds
- Aspiration

Decontamination

Internal decontamination

- Syrup of Ipecac
  - Reduced absorption by 30%
  - Almost universally discouraged
  - Studies show no benefit
  - FDA 2004 voted to remove OTC approval
  - Gastric rupture, aspiration, interferes with activated charcoal

- Activated charcoal
  - Treatment of choice for most poisonings
  - Risks are low and benefits can be high!
  - Administered within 1 hour
  - Charred wood
  - Sorbitol is often added (not it peds)
  - Contraindicated in hydrocarbon, caustic ingestions
  - Doesn’t work on methanol, ethanol, mineral acids, or metals
- Gastric lavage
  - Within 1 hour of ingestion
  - Not routinely recommended
- Whole bowel irrigation
  - More effective than gastric lavage
  - Salicylate and iron poisonings
  - Any substance that wouldn’t bind charcoal
  - Lengthy procedure

**Common ingestions**

- Most common encountered ingestion
  - Over 2.3 million ingestions/year
- Abbreviated APAP
- Analgesic and antipyretic
- Common ingredient in OTC cold preparations and often combined in narcotic combinations
  - Found in over 200 OTC products
- Generally safe medications at therapeutic doses
- Metabolized by the liver –
  - 90% of metabolites are non toxic
  - 10% NAPQI

**Acetaminophen**
Dosing

- Therapeutic doses
  - Adult 4 grams/24 hours
  - Pediatrics 65mg/kg/24 hours
- Toxic doses
  - >7.5 grams/24 hours or >140mg/kg/24 hours

Toxicity

<table>
<thead>
<tr>
<th>Stages</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (0-24 hours)</td>
<td>Weakness, fatigue, nausea, vomiting</td>
</tr>
<tr>
<td>2 (24-48 hours)</td>
<td>Abdominal pain, decreased urine, increased liver enzymes</td>
</tr>
<tr>
<td>3 (72-96 hours)</td>
<td>Jaundice, dysrhythmias, hypoglycemia, lethargy</td>
</tr>
<tr>
<td>4 (4-14 days)</td>
<td>End stage liver - death and coma</td>
</tr>
</tbody>
</table>

Once end stage hepatic failure is reached, mortality is 50-80%
ABC’s
- Detailed history including exact dose and time
- Activated charcoal within 1 hour of ingestion
- Antidote - Mucomyst, N-acetylcysteine (NAC)

Oral or IV form
- NAC - helps replenish the glutathione, reducing the NAPQI
- Given is multiple doses
  - Oral form given - 72 hour protocol
  - IV form - 21 hour protocol
- Most beneficial if given within 8 hours
Salicylates

- Aspirin, acetylsalicylic acid
- Found in many OTC preparations
- Toxic threshold is much greater than tylenol
- Toxic doses cause acid base disorders – metabolic acidosis

Toxicity

- Found when dose is >300mg/kg
- Stimulates the respiratory center
- Fever, tachycardia, hypoglycemia, ketosis, fluid and electrolyte loss, tinnitus
- Toxic level usually does not correlate with symptoms

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting, GI bleeding</td>
<td>Lethargy, confusion, hallucinations</td>
</tr>
<tr>
<td>Mixed acid base disorder</td>
<td>Metabolic acidosis</td>
</tr>
<tr>
<td>Death uncommon</td>
<td>Death common</td>
</tr>
<tr>
<td>Normal clotting factor</td>
<td>Prolonged clotting</td>
</tr>
<tr>
<td>Younger patients</td>
<td>Older patient</td>
</tr>
<tr>
<td>Levels are &gt;50mg/dL</td>
<td>Levels 15-35 mg/dL</td>
</tr>
</tbody>
</table>

Acute toxicity: vomiting, GI bleeding, lethargy, confusion, hallucinations, metabolic acidosis, mixed acid base disorder, death uncommon. Chronic toxicity: prolonged clotting, older patient, levels 15-35 mg/dL.

Death uncommon, death common depending on age and levels.
ABC’s
Detailed patient history
IV fluids
Activated charcoal if within 1 hour
ER – multi-dose charcoal
• Whole bowel irrigation for enteric coated
• Bicarbonate to alkalinize the urine
• CHF, acute renal failure, hypernatremia
• Hemodialysis
• CNS toxicity, inability to alkalinize the urine, deterioration

Antidepressant Tricyclic Antidepressants
• Narrow therapeutic index
• Accidental or suicide gesture
• Use of TCA’s declined
• 2006 – 75 reported deaths associated with TCA’s
• Act by increasing brain neurotransmitters –
  • Norepinephrine and serotonin
• Block the sodium channels in myocardium

Toxicology
• Dry mouth, urinary retention, constipation, blurred vision
• Late signs – respiratory depression, confusion, hallucinations, hyperthermia, cardiac dysrhythmias, wide QRS and seizures
• May have sudden cardiac arrest
Treatment

- ABC’s
- Detailed history
- IV fluids
- Cardiac monitoring!!
- If wide QRS – sodium bicarbonate!
- No direct antidote
- Lavage!

Cardiovascular drugs
2003 Cardiovascular Fatalities

- TCAs 46%
- Calcium channel blockers 31%
- Other 5%
- Beta blockers 9%
- Digoxin 9%

CaCl Channel blockers
- Class IV antidysrhythmic – verapamil, diltiazem, amlodipine, nicardipine
- Used for blood pressure by decreasing contractility
- Reduce heart rate by preventing calcium channels from opening

Toxicology
- Hypotension, bradycardia, CNS and respiratory depression, hyperglycemia, syncope, seizures, cardiac dysrhythmias, coma
**Treatment**
- ABC’s
- Oxygen
- Detailed patient history
- Glucose check
- Activated charcoal (if within 1 hour)
- IV fluids
- Cardiac monitoring
- May need vasopressors - dopamine
- Antidote – calcium chloride or calcium gluconate, atropine, pacing, glucagon

**Beta blockers**
- Class II antidysrhythmic
- Atenolol, esmolol, labetolol, metoprolol, propranolol
- Used for blood pressure and heart rate control
- Rapidly absorbed after ingestion

**Toxicology**
- Vary by drug property
- Hypotension, bradycardia, cardiac dysrhythmias, seizures, hypoglycemia, coma, fatigue, dyspnea
Treatment

- ABC’s
- Oxygen
- Detailed patient history
- Glucose check
- Activated charcoal (if within 1 hour)
- IV fluids
- Cardiac monitoring
- May need vasopressors - dopamine
- Antidote - calcium chloride or calcium gluconate, atropine, pacing, glucagon

Antihistamines

- Benadryl, hydroxyzine, antivert, meclizine
- Used as cold preparations and allergy treatments
- May be used in some sleep aids

Toxicology

Anticholinergic syndrome

- Blind as a bat
- Red as a beet
- Mad as a Hatter
- Dry as a bone
- Hot as Hades
Sedation, respiratory depression, nausea and vomiting, hypotension, seizure and cardiac dysrhythmias

**Treatment**
- ABC’s
- Detailed patient history
- Glucose check
- Reverse the hyperthermia
- IV fluids
- Cardiac monitoring
- Activated charcoal (within 1 hour)
- Whole bowel irrigation (no ileus)
- Lavage ???
- No direct antidote

- If wide QRS – sodium bicarbonate
- If prolonged QT – magnesium
- Seizures – benzodiazepine
- Agitation – treat with benzo’s
Sedative/Hypnotics

- Opiates – pain medications
- Demerol, darvon, darvocet, oxycodone, hydrocodone, morphine, codeine, fentanyl, hydromorphone
- Bind to the mu receptors to alleviate pain, create euphoria, and sedation
- May be used for anxiolysis
- Anti-tussive

Toxicidrome

- CNS depression
- Respiratory depression
- Miosis
- Decreased bowel sounds

Treatment

- ABC’s
- Detailed history
- Glucose check
- Keep on O2 100%
  - Due to resp and cardiac problems
- Antidotal therapy
- Benzodiazepam, Barbituates for seizures
- Serum alkalinization for conduction disturbances (QRS>100msec)
Narcan – naloxone
- Antidote for opiate overdose
- Short acting, ½ life of about 30 min
- Start with low dosage: 0.4 mg
- Goal is to protect airway and assure adequate ventilation – NOT TO WAKE UP PT!!!
- Observe pt for 4-6 hrs before discharge

Side Note

The sleepy anesthesiologist on call gives a quick dose of a high potency opioid IV and later noticed that the patient presented with chest wall rigidity.
- What was the opioid given?
- Fentanyl

Benzodiazepines
- Used for anxiolysis, seizures, sedation
- Common misused as drugs of abuse
- Xanax, clonazepam, diazepam, lorazepam, serax
- Act by binding to the inhibitory GABA receptor
Toxicity
- Respiratory depression, drowsiness, slurred speech, hypotension, hypothermia, coma, bradycardia

Treatment
- Supportive
- ABC
- Respiratory support
- Oxygen
- Glucose check
- IV fluids
- Detailed patient history
- Activated charcoal (within 1 hour)
- Antidote – Flumazenil (Romazicon)
  - Do not give if benzo dependent patient

Carbon Monoxide
- Common sources are fires, cigarette smoke, defective heating systems, automobile exhaust
- CO binds to hemoglobin with high affinity, impairs the normal facilitation of oxygen unloading, and decreases the oxygen carrying capacity of blood.
- Approximately 5600 deaths/year in the United States
- 50% are unintentional
Weakness, fatigue, headache, syncope, confusion, seizures, nausea and vomiting, chest pain and dyspnea

Bradycardia, cardiovascular collapse

Levels of CO do not necessarily correlate with symptoms

Scene safety

ABC’s

Detailed history

Oxygen

Cardiac monitoring

EKG for ischemia

Glucose check

Possible transfer to Hyperbaric center – Bettendorf, Iowa City, IMMC, and Mercy

Hyperbaric oxygen therapy indications

1. Abnormal neuropsychic testing

2. COHb level > 25%

3. Pregnancy with COHb level > 10-15%

4. History of syncope

5. Neurologic findings

6. Ongoing myocardial ischemia

7. Refractory or worsening symptoms despite treatment with normobaric oxygen
“Club Drugs” are in constant evolution

21st Century Club Drugs:
- MDMA
- LSD
- GHB
- Ketamine
- Dextromethorphan
- K2
- Hallucinogenic
- Nitrous Oxide
- “Research Chemicals”
- Four Loko

Club Drug problem is escalating among teens and young adults and is very serious

Users: predominantly white, middle/upper class, age 13-25 yrs; suburban>urban
Ecstasy/MDMA
- Ingestion – take an initial high dose and then stack
- May be smoked or snorted in powder
- Cost $20-40
- May be stacked or rolled with other drugs
  - MDMA + Ketamine: “kitty flipping”
  - MDMA + LSD: “candy flipper”, “rolling & trolling”
  - MDMA + Heroine/Fentanyl: “rolling”
  - MDMA + Viagra: “hammerhead”

Toxicology
- increased HR, BP, RR
- mydriasis
- diaphoresis
- increased energy
- decreased appetite & thirst
- trismus & bruxism
- nystagmus, ataxia, tremor
- Hyperthermia

Treatment
- ABC
- Detailed history
- Oxygen
- Rapid cooling for hyperthermia
- Sedation with benzodiazepine
- IV fluids
- Cardiac monitoring
Dextromethorphan-DXM

- Legal, cough suppressant in 10-30 mg doses
- Recreational drug used by young teens: same drug class as PCP and Ketamine
- “PCP-like high”/“LSD-like high”
- DXM Sources
  - Coricidin HBP Cough & Cold
  - Dexam capsules
  - DXM/guaifenesin tablets
  - DXM syrups
  - Drixoral cough liquid caps
  - Robitussin cough gel
  - DXM bulk powder

Toxicology

- Euphoria, mydriasis, drowsiness, dysphoria, nystagmus, incoordination, hallucinations, tachycardia, tremors, dissociation, diarrhea, catonia,
- Severe overdose: coma, respiratory depression

Treatment

- ABC
- Detailed history
- Oxygen
- Prepare for airway support
- IV fluids
- Cardiac monitoring
K2
- New synthetic marijuana like drug
- Herb and spice sprayed with a compound synthetically similar to THC
- Produced in China and Korea
- Legal in the United States, except few states
- FDA labeled it as a “drug of concern”
- Often marketed as “herbal incense”

Toxicology
- Sleepiness, relaxation, reduced blood pressure, and at high doses, hallucinations and delusions.
- Treatment – symptomatic, ABC’s, detailed history, oxygen, glucose check, IV fluids, prepare for airway support
Hyped up energy drink with alcohol
- Contains alcohol 12%, caffeine, and other energy products
- Described as “legalized cocaine in a can”
- Believed to attract younger crowds and underage drinking
- There are also three other companies marketing such products
- FDA found that it was related to increased hospitalization of college-age students who were drinking

FDA has issued warnings and demanded companies to remove these products from the shelves by December 13, 2010.
Treatment would be supportive, just as any alcoholic ingestion