General Approach to the Poisoned Patient
James Sinex, MD., FACEP

Definition of Terms
Poisoning can be defined as exposure to a chemical or other agent that adversely affects functioning of an organism. The circumstances of exposure can be occupational, environmental, recreational, medicinal, or intentional. The route of exposure can be by ingestion, injection, inhalation, insufflation, or cutaneous exposure.

Incidence and Characteristics
There are between 3 and 4 million poisonings annually in US. Variability in reporting makes exact incidence somewhat unclear. More than half are pediatric. 50% of adult overdoses will be multidrug. Roughly 10,000 poisoning deaths occur each year.

Evaluation: ABCs
Always the first step in evaluation of any potentially ill patient
Airway – check for presence of gag reflex, pooling of secretions
Breathing – evaluate respiratory efforts, pattern, ventilatory sufficiency
Circulation – examine pulses, perfusion
These should always take precedence over everything else, both initially and throughout the patient’s course.

Initial Management
After ABCs, there are two other groupings of three actions which should be followed or considered
IV - acquire reliable access
Oxygen - check pulse oximetry, administer supplemental oxygen
Monitor - cardiac, BP, pulse ox

This second grouping regards interventions in those patients with altered mentation
Narcan
Glucose – either administer or check fingerstick glucose level
Thiamine – not only in alcoholics, but also in cancer patients and the chronically ill

Consider the need for immediate skin decontamination. This is particularly important in cutaneous exposures, most commonly seen in organophosphate toxicity. If suspected:
Undress patient completely
Flush the skin with water, scrubbing patient down with soft brush
Don protective clothing, for the entire health care team
Properly dispose of clothing and all potentially contaminated material

Evaluation: History
The history in poisoning, particularly intentional ingestions, is notoriously unreliable, and yet of critical importance. Talk with EMS personnel, family, friends, etc.
Try to determine what was taken (or to what patient was exposed), how much, and when.
Ask specifically about other meds (including over-the-counter) and substances of abuse taken coincidentally – especially salicylates and acetaminophen, as well as alcohol
Examine pill bottles, if brought with patient - date prescribed, pill count
Use medical record, regular MD, or pharmacy records to look for other possible drugs
Send someone back to the scene if necessary
Try to establish intent – was this suicidal, homicidal, accidental?
Get a feeling for onset and progression of symptoms
Establish PMH:
Other medical problems
Alcohol or drug abuse
Psychiatric history, past ingestions
Pregnant?
Toxicology

**Evaluation: Physical Exam**
Do a complete exam on a fully exposed patient
Look for any vital sign abnormalities. These can be valuable clues (see Toxidromes below), as well as indicators of severity
Check pockets and clothing (carefully – look out for needles)
Skin for cyanosis, flushing, dryness or diaphoresis, tracks, bullae, signs of injury
Eyes for pupil size/reactivity, nystagmus
Oropharynx for hypersalivation or dryness
Chest for wheezing
Cardiovascular for rate, rhythm, regularity
Abdomen for bowel sounds, bladder distention, muscle rigidity
Extremities for tremor/fasciculation, pulses
Complete neuro exam

**Evaluation: Reassessment**
Frequent reassessment for complications or progression of toxicity is essential. Frequently seen developments include:
Airway compromise
Ventilatory insufficiency
Bronchospasm
Pulmonary edema
Dysrhythmia
Hypotension / Hypertension
Altered mental status
Seizure

**Toxidromes**
This is a term referring to toxicologic syndromes, or complexes of signs and symptoms. It is inserted here because looking for these signs or symptoms during the course of your assessment can guide you identifying the toxic agent and intervention. The major four toxidromes are:

- **Anticholinergic**
- **Sympathomimetic**
- **Opiate/Sedative -hypnotic/Ethanol**
- **Cholinergic**

See the included Table 1 for further elaboration

**Evaluation: Ancillary Testing**
There is no set template regarding what testing to do on every toxicologic presentation
Not everyone needs a **urine drug screen** (though they usually get one)
The screen is not comprehensive
Results are often delayed
Possible false negatives - i.e., low urine concentration of recently taken agent
Possible false positives - i.e., incidental positives
Multiple studies show that results of screens do not change clinical management or patient outcome
Salicylate and acetaminophen levels in all is debatable
Availability of specific levels of other toxins is rather limited
Look for metabolic complications as indicated by specific toxins (anion or osmolar gaps, etc)
ABGs and EKGs are often helpful
Pregnancy testing in all women capable of childbearing is advisable

**Management: GI Decontamination**
- **Syrup of Ipecac – to induce emesis**
  - Essentially never indicated in ED
  - Many parents have ipecac in the home, and you may see it used before presentation in pediatric patients
  - Home use contraindications:
    - Ingestion with potential to alter mental status (so not vomiting with compromised airway)
    - Toxin with more pulmonary than GI toxicity (as with hydrocarbons, to avoid aspiration of already-ingested agent)
Toxicology

Caustic ingestion (similar to above, as well as to avoid esophageal and oropharyngeal re-exposure)
Prior or current vomiting

- Activated Charcoal (AC)
  Almost always indicated
  Adsorbs toxins in the gut
  Establishes a drug concentration gradient favoring movement back into GI tract (“GI dialysis”) for some toxins, as well as adsorbing from bile
  Administer 1 gm/kg PO
  Contraindications: alkalis/acids, metals, hydrocarbons. (Charcoal can obscure subsequent attempts at endoscopy in alkali/acid ingestion, and is not very effective with metal and hydrocarbon exposure. That said, keep in mind that many toxic presentations are multidrug, history is unreliable, and the AC may help with another agent taken)
  Complications: aspiration, bowel impaction.

- Cathartics
  Sorbitol: Adult - 1gm/kg 70% solution, Child - 0.5gm/kg 35% solution, not used if <5 years old
  Generally given with first dose AC, and comes pre-mixed with some commercial preparations of AC
  Can also use magnesium citrate
  Contraindications: intestinal obst/ileus, diarrhea, caustics, abdominal trauma

- Multi-dose activated charcoal (MDAC) – or repeated doses of AC
  Administer 0.5 gm/kg q4-6 hours, without cathartics
  Only if gut working, and good bowel sounds
  Indications: theophylline (best evidence), salicylates, barbiturates, heterocyclics, sustained release formulations, bezoar formers, or very large ingestions.

- Orogastric lavage
  Demonstrated drug removal 35-56%
  However, the clinical efficacy is debatable, and use of lavage variable
  Indications:
    Life-threatening ingestion
    Within 1 hour of ingestion
  Contraindications:
    Caustic agent or low-viscosity hydrocarbon
    Nontoxic ingestion
    Airway not protected (to avoid aspiration)
  Complications:
    Tracheal insertion
    Aspiration
    Perforation
    Knot formation of tube in stomach.
    Intubate first if any question about airway.
    Position patient left lateral decubitus – delays gastric emptying, and helps if emesis does occur.
  Use a 36-40 French orogastric tube (commonly called an Ewald tube).
  Confirm placement by insufflation of air with auscultation.
  Use a room-temperature water lavage (250cc or so at a time) until the return is clear.
  Administer AC down tube (many do this both before and after the lavage)

- Whole bowel irrigation.
  Controlled studies of efficacy are still lacking.
  Indications:
    Lithium, Iron, Heavy metals
    Sustained-release formulations
    Agents that form bezoars
    Body stuffers / packers (respectively, pts who swallow packets of drugs to avoid police seizure, and pts who are “mules”, swallowing many packets of drugs for smuggling purposes).
  Contraindications:
    Intestinal obstruction/ileus
    Preceding diarrhea
    Administer polyethylene glycol (Golytely) at 0.5 - 2 liters per hour PO or NG until rectal effluent is clear.
Management: Enhanced Elimination

Acidification – essentially not efficacious and not used.

Alkalization
  of blood -
    Heterocyclics (antidepressants) - improves/prevents cardiac effects primarily
  of urine -
    Salicylates
    Phenobarbital
    Chlorpropamide
    Enhances elimination by ion trapping

Hemodialysis
  Indicated, in short, in a life-threatening ingestion that is amenable to dialysis (a toxin with a small
  volume of distribution, small molecular weight, and which is not highly protein bound).
  Ethylene glycol
  Methanol
  Salicylates
  Lithium
  Theophylline

Charcoal hemoperfusion
  Molecular weight and protein binding are not as relevant here. Less widely available.
  Theophylline
  Barbiturates

Management: Antidotes

Relatively few available
See Table 2 for a list of some of these

Management: Disposition

Depends on ingestion, intent, and patient status
### TABLE 1 Toxic Syndromes Seen in the ED

<table>
<thead>
<tr>
<th></th>
<th>Common signs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticholinergic syndromes</strong></td>
<td>Delirium with mumbling speech, tachycardia, dry, flushed skin, dilated pupils, myoclonus, slightly elevated temperature, urinary retention, and decreased bowel sounds; seizures and dysrhythmias may occur in severe cases.</td>
</tr>
<tr>
<td>Common causes</td>
<td>Antihistamines, antiparkinson medication, atropine, scopolamine, amantadine, antipsychotic agents, antidepressant agents, antispasmodic agents, mydriatic agents, skeletal-muscle relaxants, and many plants (notably jimson weed and <em>Amanita muscaria</em>).</td>
</tr>
<tr>
<td><strong>Sympathomimetic syndromes</strong></td>
<td>Common signs</td>
</tr>
<tr>
<td></td>
<td>Delusions, paranoia, tachycardia (or bradycardia if the drug is a pure α-adrenergic agonist), hypertension, hyperpyrexia, diaphoresis, piloerection, mydriasis, and hyperreflexia. Seizures, hypotension, and dysrhythmias may occur in severe cases.</td>
</tr>
<tr>
<td>Common causes</td>
<td>Cocaine, amphetamine, methamphetamine (and its derivatives 3,4-methylenedioxyamphetamine, 3,4-methylenedioxyethamphetamine, and 2,5-dimethoxy-4-bromoamphetamine), and over-the-counter decongestants (phenylpropanolamine, ephedrine, and pseudoephedrine). In caffeine and theophylline overdoses, similar findings. except for the organic psychiatric signs, result from catecholamine release.</td>
</tr>
<tr>
<td><strong>Opiate, sedative, or ethanol intoxication</strong></td>
<td>Common signs</td>
</tr>
<tr>
<td></td>
<td>Coma, respiratory depression, miosis, hypotension, bradycardia, hypothermia, pulmonary edema, decreased bowel sounds, hyporeflexia, and needle marks. Seizures may occur after overdoses of some narcotics. notably propoxyphene.</td>
</tr>
<tr>
<td>Common causes</td>
<td>Narcotics, barbiturates, benzodiazepines, ethchlorvynol, glutethimide, methyprylon, methaqualone, meprobamate, ethanol, clonidine, and guanabenz.</td>
</tr>
<tr>
<td><strong>Cholinergic syndromes</strong></td>
<td>Common signs</td>
</tr>
<tr>
<td></td>
<td>Confusion, CNS depression, weakness, salivation, lacrimation, urinary and fecal incontinence, gastrointestinal cramping, emesis, diaphoresis, muscle fasciculations, pulmonary edema, miosis, bradycardia or tachycardia, and seizures.</td>
</tr>
<tr>
<td>Common causes</td>
<td>Organophosphate and carbamate insecticides, physostigmine, edrophonium, and some mushrooms.</td>
</tr>
</tbody>
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<tr>
<th>Antidote</th>
<th>Toxin used for</th>
<th>Dose and comments</th>
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<tbody>
<tr>
<td>Naloxone</td>
<td>Opiates</td>
<td>2 mg: less to avoid narcotic withdrawal, more if inadequate response; same dose in children</td>
</tr>
<tr>
<td>Nalmefene</td>
<td>Opiates</td>
<td>2 mg: much longer half-life than naloxone</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>Tricyclics</td>
<td>44-88 mEq in adults; 1-2 mEq/kg in children; best used IV push and not by slow infusion</td>
</tr>
<tr>
<td>Flumazenil</td>
<td>Benzodiazepines</td>
<td>0.2 mg, then 0.3 mg, then 0.5 mg, up to 5 mg; not to be used if patient has signs of TCA toxicity; not approved for use in children but probably safe</td>
</tr>
<tr>
<td>Calcium</td>
<td>Calcium channel blockers</td>
<td>1 gm calcium chloride IV in adults, 20-30 mg/kg/dose in children, over a few minutes with continuous monitoring</td>
</tr>
<tr>
<td>Glucagon</td>
<td>Beta-blockers and calcium channel blockers</td>
<td>5-10 mg in adults, then infusion of same dose per hour</td>
</tr>
<tr>
<td>Physostigmine</td>
<td>Anticholinergics</td>
<td>1-2 mg IV adults, 0.5 mg in children over 2 min for anticholinergic delirium, seizures, or dysrrhythmias</td>
</tr>
<tr>
<td>Ethanol</td>
<td>Methanol and ethylene glycol</td>
<td>Loading dose 10 ml/kg of 10%; maintenance dose 0.15 ml/kg/hr of 10%; double rate during dialysis</td>
</tr>
<tr>
<td>Atropine</td>
<td>Organophosphates and carbamates</td>
<td>Test dose 1-2 mg IV in adults, 0.03 mg/kg in children; titrate to drying of pulmonary secretions</td>
</tr>
<tr>
<td>Protopam</td>
<td>Organophosphates and carbamates</td>
<td>Loading dose 1-2 gm IV in adults; 25-50 mg/kg in children; adult maintenance 500 mg/hr or 1-2 gm q 4-6 hr</td>
</tr>
<tr>
<td>Pyridoxine</td>
<td>Isoniazid, Hydrazine, and trimethyldihydrazine</td>
<td>5 gm in adults, 1 gm in children, if ingested dose unknown: antidote may cause neuropathy</td>
</tr>
<tr>
<td>Pyridoxine</td>
<td>Ethylene glycol</td>
<td>100 mg IV daily</td>
</tr>
<tr>
<td>Thiamine</td>
<td>Ethylene glycol, chronic eth-mol</td>
<td>100 mg IV</td>
</tr>
<tr>
<td>Digoxin-specific FAB fragments</td>
<td>Digitalis glycosides</td>
<td>10-20 vials if patient in ventricular fibrillation; otherwise dose is based on serum digoxin concentration or amount ingested</td>
</tr>
<tr>
<td>N-acetylcysteine</td>
<td>Acetaminophen</td>
<td>140 mg/kg, then 70 mg/kg q 4 hr; IV form still investigational</td>
</tr>
<tr>
<td>Sodium nitrite</td>
<td>Cyanide, H2S</td>
<td>10 ml of 3% (300 mg; 1 ampule) in adults: 0.33 ml/kg in children, slowly IV</td>
</tr>
<tr>
<td>Sodium thiosulfate</td>
<td>Cyanide</td>
<td>50 ml of 25% (12.5 mg; 1 ampule) in adults: 1.65 ml/kg in children, IV</td>
</tr>
<tr>
<td>Deferoxamine</td>
<td>Iron</td>
<td>15 mg/kg/hr IV; higher doses reported to be safe</td>
</tr>
<tr>
<td>EDTA</td>
<td>Lead</td>
<td>75 mg/kg/day by continuous infusion: watch for nephrotoxicity, best done in hospital</td>
</tr>
<tr>
<td>DMSA</td>
<td>Lead</td>
<td>Reported useful for arsenic and lead as well: one 100 mg capsule per 10 kg body weight tid for 1 wk then bid, with chelation breaks</td>
</tr>
<tr>
<td>BAL</td>
<td>Arsenic, mercury, and lead</td>
<td>3-5 mg/kg IM only</td>
</tr>
<tr>
<td>D-Penicillamine</td>
<td>Arsenic, lead, and mercury</td>
<td>20-40 mg/kg/day; 500 mg tid in adults: may cross-react with penicillin in allergic patients</td>
</tr>
<tr>
<td>Methylene blue</td>
<td>Methemoglobin-forming agents</td>
<td>1-2 mg/kg IV, one 10 mL 10% solution (100 mg) is initial adult dose</td>
</tr>
<tr>
<td>Folate or leucovorin</td>
<td>Methanol</td>
<td>50 mg IV q 4 hr in adults while patient has serious toxicity</td>
</tr>
<tr>
<td>Cyproheptadine</td>
<td>Serotonin syndrome</td>
<td>4 mg PO as needed; no parenteral form available; antidote may cause anticholinergic findings</td>
</tr>
<tr>
<td>Crotalidae antivenin</td>
<td>Rattlesnake bite</td>
<td>5 vials minimum dose, by infusion in normal saline, at increasing rate dependent on patient tolerance; may cause anaphylaxis</td>
</tr>
<tr>
<td>Latrodectus antivenin</td>
<td>Black widow spider bite</td>
<td>1 vial, by slow IV infusion. usually curative; may cause anaphylaxis</td>
</tr>
</tbody>
</table>