Toxicology

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TOXICOLOGY:
OVERVIEW AND TOXIDROMES

I. APPROACH TO THE POISONED PATIENT

A. History (what, when, how much)

1. Patient often thought to be unreliable
   a. Too young
   b. Too old
   c. Suicidal
2. Ask family, friends, paramedics
3. Examine all available medicine bottles
4. Call primary physician (or private therapist)
5. Consider occupational history
6. Consider hobbies

B. Physical Exam (especially vital signs, eyes, skin, odors)

C. Vital Signs and Common Differentials

1. Bradycardia
   a. Mnemonic is PACED
      P= Propanolol (and other β-blockers),
      phenylpropanolamine (PPA)
      A= Anticholinesterases (herbicides, nerve gases)
      C= Clonidine, calcium channel antagonists
      E= Ethanol
      D= Digoxin, Darvocet (and other opioids)

2. Tachycardia
   a. Mnemonic is FAST
      F= Free-base cocaine (and other sympathomimetics)
      A= Anticholinergics, amphetamines, alcohol withdrawal
      S= Sympathomimetics, sedative withdrawal
      T= Theophylline, thyroid supplements

3. Hypotension
   a. Mnemonic is CRASH
      C= Cardiac drugs, clonidine
      R= Rodenticides (arsenic, red squill)
      A= Antidepressants, antipsychotics
      S= Sedative hypnotics, sticky patches (e.g., fentanyl)
      H= Heroin (and other opioids)
4. Hypertension
   a. Mnemonic is **CTSCAN**
      - C= Cocaine
      - T= Theophylline
      - S= Sympathomimetics, sedative withdrawal
      - C= Caffeine, clonidine withdrawal
      - A= Anticholinergics, alcohol withdrawal
      - N= Nicotine

5. Hypoventilation
   a. Mnemonic is **GASP**
      - G= GHB (and analogs like GBL, 1,4-BD)
      - A= Alcohol
      - S= Sedative hypnotics
      - P= Percocets (and other opioids), psych drugs (all)

6. Hyperventilation
   a. Mnemonic is **PANT**
      - P= Paints (and other solvents)
      - A= Aspirin, anticholinesterases, alcohol withdrawal
      - N= Nicotine
      - T= Thyroid supplements

7. Hypothermia
   a. Mnemonic is **COOLS**
      - C= Carbon monoxide (CO)
      - O= Opioids
      - O= Oral hypoglycemics (and insulin)
      - L= Liquor
      - S= Sedative hypnotics

8. Hyperthermia
   a. Mnemonic is **NASA**
      - N= Nicotine, neuroleptic malignant syndrome (NMS)
      - A= Anticholinergics, amphetamines
      - S= Sympathomimetics
      - A= Aspirin, antidepressants

** Terminology ALERT: Anticholinesterase drug = Cholinergic**
   (Cholinesterase breaks down Ach, so inhibited cholinesterase leads to increased Ach and *Cholinergic* findings)

D. Neurologic Findings and Common Differentials

1. Level of consciousness
   a. **Coma** - alcohol, antidepressants, antiepileptics, antipsychotics, carbon monoxide, clonidine, lithium, opioids,
organophosphates, salicylates, sedative hypnotics, solvents

b. **Agitation** - alcohol, anticholinergics, hallucinogens, sympathomimetics (e.g. amphetamines, caffeine, cocaine), PCP, solvents, withdrawal states

2. Pupils
   a. Miosis- mnemonic is **COPS**
      
      C= Cholinergics, clonidine
      O= Opioids, organophosphates
      P= Phenothiazines, pilocarpine
      S= Sedative hypnotics
   
   b. Mydriasis- mnemonic is **SAW**
      
      S= Sympathomimetics
      A= Anticholinergics, antidepressants
      W= Withdrawal (alcohol, opioid, sedative hypnotic)

E. Skin Findings

1. Dry skin- **anticholinergics** (antihistamines, jimson weed)
2. Diaphoretic skin- mnemonic is **SOAP**
   
   S= Sympathomimetics
   O= Organophosphates
   A= Aspirin
   P= PCP
3. Red skin- carbon monoxide, boric acid
4. Blue skin- methemoglobinemia
5. Bullae- barbiturates, carbon monoxide

F. Toxic Odors (from breath, skin, vomitus)

1. Fruity – isopropanol
2. Pear-like – chloral hydrate
3. Bitter almonds – cyanide
4. Garlic – arsine, organophosphates
5. Rotten eggs – hydrogen sulfide
6. Fresh hay – phosgene
7. Wintergreen mint - methylsalicylate

II. TOXIDROMES (TOXIC SYNDROMES)

A. **Anticholinergic** (diphenhydramine, TCAs, jimson weed)

1. HOT as a hare
2. DRY as a bone
3. RED as a beet
4. BLIND as a bat
5. MAD as a hatter
B. **Cholinergic** (organophosphates, carbamates, nerve agents)

1. A useful mnemonic is **DUMBELS**
   - D= Diarrhea, diaphoresis
   - U= Urination
   - M= Miosis, muscle fasciculations
   - B= Bradycardia, bronchospasm
   - E= Emesis
   - L= Lacrimation
   - S= Salivation

2. Alternative mnemonic is **SLUDGE**
   - S= Salivation
   - L= Lacrimation
   - U= Urination
   - D= Diaphoresis
   - G= GI motility
   - E= Emesis

C. **Sympathomimetic** (cocaine, amphetamines) and withdrawal states

1. Mydriasis
2. Tachycardia
3. Hypertension
4. Hyperthermia
5. Diaphoresis
6. Seizures

D. **Narcotic / Opioid** (heroin, morphine, hydrocodone)

1. Miosis
2. Hypoventilation
3. Bradycardia
4. Hypotension
5. Coma

III. **DIAGNOSTIC TESTING**

A. Routine Labs/Tests

1. Glucose (**Accuchek all patients**)!
2. Electrolytes
3. BUN/Cr
4. Serum osmolality
5. Alcohol (ETOH)
6. CBC
7. ABG
8. EKG
9. Urine or serum HCG
10. Urine drugs of abuse screen
11. Acetaminophen
12. Aspirin

B. Anion Gap (AG) Calculation

1. \( AG = Na - (Cl + HCO3) \)
2. **Normal:** 8 to 12
3. Differential of high anion gap acidosis mnemonic is **ACAT MUDPILE**
   - A= Alcoholic ketoacidosis
   - C= Cyanide, carbon monoxide
   - A= ASA
   - T= Toluene
   - M= Methanol, metformin
   - U= Uremia
   - D= DKA
   - P= Paraldehyde
   - I= Iron, INH
   - L= Lactic acidosis
   - E= Ethylene glycol

C. Osmol Gap (OG)

1. **OG = Measured osmols minus calculated osmols**
2. **Calculated osmols = 2 (Na) + BUN/2.8 + Glu/18 + ETOH/4.6**
3. **Normal:** OG < 10
4. An abnormal OG (>10) warrants evaluation for osmotically active substances remembered by the mnemonic **ME DIE A**
   - M= Methanol
   - E= Ethylene glycol
   - D= Diuretics (e.g., mannitol)
   - I= Isopropanol
   - E= Ethanol
   - A= Acetone

D. Radiologic Exams

1. CXR
   a. Non-cardiogenic pulmonary edema: opioids, barbiturates, sedative hypnotics, salicylates, irritant gas inhalation
2. KUB: mnemonic **CHIPS**
   - C= Choral hydrate
   - H= Heavy metals (e.g., lead)
   - I= Iron tablets
   - P= Packets (body packers/stuffers)
   - S= Sustained release medications

E. Urine Screens (drugs of abuse)
1. Best for traditional drugs of abuse (e.g., cocaine, heroin, PCP)
2. Decent sensitivity/specificity
3. **Not an indicator of when substance was ingested**
4. Negative screen does not rule out toxic overdose
5. Negative screen does **not** rule out NEW drug use (e.g., GHB)

F. Serum Levels/Concentrations

1. Specific serum levels may guide *disposition* (e.g., APAP level => admit vs discharge) and/or *treatment* (e.g., Digibind for digoxin poisoning)
2. Depending on the hospital and the toxin to be assayed, can be a very long turn around time

IV. PRINCIPLES OF EMERGENCY TOXICOLOGY TREATMENT

A. The treatment pathways of the poisoned patient can be divided into:

1. Decontamination
2. Enhanced elimination
3. Antidotal therapy
4. Supportive care
5. Disposition

B. **Decontamination**: Elimination from the gut to decrease absorption

1. **Syrup of Ipecac (SOI)**
   a. Indications - in the hospital setting = NONE
   b. Even American Academy of Pediatrics no longer supports routine use of ipecac

2. **Gastric lavage**
   a. Indications – ingestion of a potentially life-threatening amount of a poison only if the procedure can be done **within 60 minutes** of exposure
   b. Contraindications – unprotected airway, corrosives, patients at risk for GI hemorrhage or perforation (e.g. recent surgery, varices), patient resistance or refusal

3. **Activated charcoal (AC)**
   a. Indications – effective at bonding a wide variety of toxins, most beneficial if used **within 60-120 minutes** of exposure
   b. Contraindications – unprotected airway, high aspiration potential (e.g., hydrocarbons), perforation
   c. Relative contraindications because of relative lack of efficacy: iron, lithium, other metals, solvents, alcohols, corrosives, hydrocarbons, pesticides
   i. Dose: 1 gram/kg
   ii. Caution: read labeling carefully, some preparations contain cathartics, some do not (see next section)
4. Cathartics
   a. Osmotic cathartics (sorbitol) and saline cathartics (mag citrate, mag sulfate, and sodium sulfate) supposed to accelerate toxin expulsion through GI tract
   b. Indications -- No research data shows any clinical benefit to cathartic use. By convention given only with first dose of charcoal to make it palatable, *not to be used in repeated doses.*
   c. Contraindications
      i. Absent bowel sounds, obstruction, or perforation
      ii. Magnesium containing cathartics should not be used in renal failure, renal insufficiency, or heart block

5. Whole bowel irrigation (WBI)
   a. Polyethylene glycol products (GoLytely ®) reduce drug absorption by rapidly cleansing the entire GI tract, efficacy data limited
   b. Indications
      i. Illicit drug packets
      ii. Sustained release or enteric coated drugs
      iii. Drugs not well absorbed by AC (e.g., iron, lithium)
   c. Contraindications
      i. Unprotected airway
      ii. Bowel obstruction, ileus, perforation
      iii. Intractable vomiting
      iv. Hemodynamic instability (especially low BP)
   d. Dosing
      i. 9 mo-6 yo  500 ml/hr
      ii. 6-12 yo  1000 ml/hr
      iii. Adolescents/Adults  1500-2000 ml/hr

C. Enhanced Elimination: Elimination of toxins already systemically absorbed (**this is different from Decontamination in IV. B**)

1. Urinary alkalinization – works by ion trapping molecules within the renal tubules and increasing renal elimination -- *there is no role for forced diuresis*
   a. 3 amps NaHCO3 in 1L D5W at twice maintenance
   b. Alkalinization leads to hypokalemia, so adding potassium in the form of a K-rider will be needed, otherwise alkalinization will be difficult to maintain
   c. Most useful for aspirin, phenobarbital, chlorpropamide

**Tox Clarification**

*Serum* alkalinization (instead of urine alkalinization) is used as *antidotal* treatment for TCA poisoning. This does not *eliminate* the TCA, but treats the clinical effects of TCA poisoning (dysrhythmias, hypotension, seizures).
2. **Multidose activated charcoal (MDAC)** -- works by disrupting the enterohepatic circulation of certain drugs. *Never order MDAC with cathartics.*
   a. Theophylline
   b. Carbamazepine
   c. Phenobarbital
   d. Dapsone
   e. Quinine
   f. Controversial if effective for aspirin, digoxin

3. **Hemodialysis/charcoal hemoperfusion (HD/CHP)**
   a. HD and CHP work best if small molecule size, low Vd, low protein binding, high water solubility
   b. Mnemonic for hemodialysis (HD) is **I STUMBLED**
      
      I= Isopropanol
      S= Salicylates
      T= Theophylline, Tegretol (carbamazepine)
      U= Uremia
      M= Methanol
      B= Barbiturates (phenobarbital)
      L= Lithium
      E= Ethylene glycol
      D=Depakote (valproic acid)
   c. Charcoal Hemoperfusion (HP) most useful for theophylline, carbamazepine, valproic acid, and phenobarbital, *but rarely available in hospitals today. HD is almost as effective*

**D. Antidotal Therapy**

<table>
<thead>
<tr>
<th>Compound</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen</td>
<td>N-acetylcysteine, Acetadote ®</td>
</tr>
<tr>
<td>Cyanide</td>
<td>CN Kit, Hydroxocobalamin</td>
</tr>
<tr>
<td>Iron</td>
<td>Deferoxamine</td>
</tr>
<tr>
<td>Sulfonylurea hypoglycemics</td>
<td>Dextrose, Octreotide</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>Flumazenil</td>
</tr>
<tr>
<td>Opioids</td>
<td>Naloxone</td>
</tr>
<tr>
<td>β-blockers</td>
<td>Glucagon</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td>Calcium, insulin/glucose</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Digibind</td>
</tr>
<tr>
<td>Toxic alcohols</td>
<td>Fomepizole, ETOH</td>
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<tr>
<td>Anticholinergics</td>
<td>Physostigmine</td>
</tr>
<tr>
<td>Warfarin (and derivatives)</td>
<td>Vitamin K</td>
</tr>
<tr>
<td>INH</td>
<td>Pyridoxine (B6)</td>
</tr>
<tr>
<td>Gyromitra mushrooms</td>
<td>Pyridoxine (B6)</td>
</tr>
<tr>
<td>Methemoglobinemia</td>
<td>Methylene blue</td>
</tr>
<tr>
<td>Hydrofluoric acid</td>
<td>Calcium</td>
</tr>
<tr>
<td>Organophosphates</td>
<td>Atropine, pralidoxime</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>Oxygen, Hyperbaric Oxygen</td>
</tr>
<tr>
<td>Envenomation (reptiles, spiders)</td>
<td>Antivenin</td>
</tr>
<tr>
<td>Heavy metals (Pb, Hg, As)</td>
<td>BAL, Ca-EDTA, Succimer</td>
</tr>
</tbody>
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E. Supportive Care

1. ABCs
2. Antiemetics: metoclopramide (Reglan) up to 1 mg/kg, ondansetron (Zofran) 0.15 mg/kg (up to 32 mg)
3. Seizures: benzodiazepines, phenobarbital, pyridoxine (phenytoin[ Dilantin] not indicated in toxin-induced seizures)
4. Pressors (skip dopamine, use other pressors)
5. Aggressive cooling if hot, rapid rewarming if cold

V. VITAL SIGNS, TOXIDROMES, DECONTAMINATION QUESTIONS

1) Which of the following medications is likely to cause hypotension and tachycardia in overdose?
   a) Clonidine
   b) Digoxin
   c) Morphine
   d) Nadolol
   e) Nifedipine

2) Which of the following can cause respiratory stimulation?
   a) Lorazepam
   b) Opioids
   c) Propofol
   d) Salicylates
   e) Secobarbital

3) Which of the following can cause a non-anion gap acidosis?
   a) Acetazolamide
   b) Cyanide
   c) Ethylene glycol
   d) Iron
   e) Metformin

4) Bradycardia has been associated with which of the following ingestions?
   a) Diltiazem
   b) Diphenhydramine
   c) Iron
   d) Isoniazid
   e) Phencyclidine
5) Mydriasis, tachycardia, and urinary retention would be expected is which of the following ingestions?
   a) Atenolol
   b) Diphenhydramine
   c) Metronidazole
   d) Pindolol
   e) Pyridostigmine

6) Hypotension, tachycardia, and pinpoint pupils may be seen in which of the following overdoses?
   a) Amitriptyline
   b) Cocaine
   c) Diphenhydramine
   d) Quetiapine
   e) Verapamil

7) All of the following cause pinpoint pupils in overdose except:
   a) Clonidine
   b) Heroin
   c) Imipramine
   d) Olanzapine
   e) Organophosphates

8) All of the following can cause hyperthermia except:
   a) Aspirin
   b) Carbon monoxide
   c) Cocaine
   d) Diphenhydramine
   e) MDMA (ecstasy)

9) All of the following are commonly seen *initially* after organophosphate poisoning except:
   a) Bronchorrhea
   b) Diaphoresis
   c) Miosis
   d) Salivation
   e) Tachycardia

10) The treatment of severe organophosphate poisoning includes:
    a) Albuterol, physostigmine
    b) Albuterol, 3-PAM
    c) Atropine, physostigmine
    d) Atropine, pralidoxime
    e) Atropine, pyridoxine
11) Which of the following statements about syrup of ipecac is correct?
   a) Ipecac has no role in the hospital setting
   b) The use of outdated ipecac syrup will delay emesis following its administration
   c) If the first bottle of ipecac does not cause emesis within 15 minutes, a second bottle is indicated
   d) In clinical studies involving life-threatening toxicities, ipecac has been shown to improve patient outcomes
   e) Available outcome data support the routine use activated charcoal immediately after ipecac

12) Which of the following is an indication for gastric lavage?
   a) Ingestions that involve a potentially life-threatening amount of a poison within 60 minutes of the gastric lavage procedure
   b) Patients who are at risk for hemorrhage or gastrointestinal perforation
   c) Ingestion of strong acids or strong bases
   d) Ingestions in combative patients who refuse lavage
   e) Patients with a decreased level of consciousness who have not been intubated

13) Which of the following statements regarding the recommendations for a single dose of activated charcoal is correct?
   a) Activated charcoal is absolutely contraindicated if the toxic ingestion occurred more than 1 hour before ED arrival
   b) Activated charcoal is likely to produce most decontamination benefit if administered within 2 hours of a toxic ingestion
   c) There are extensive clinical outcome data showing activated charcoal effectively adsorbs metals
   d) Activated charcoal administration is contraindicated in patients with a decreased level of consciousness who have a protected airway
   e) A single dose of activated charcoal has been reported to cause gastrointestinal obstruction

14) Which of the following antidotes should be considered for a patient with bradycardia and hypotension after ingestion of an unknown cardiac medicine?
   a) Calcium chloride
   b) Digibind
   c) Glucagon
   d) High dose insulin
   e) All of the above
15) Which of the following is a contraindication for whole bowel irrigation?
   a) Bowel obstruction
   b) Bowel perforation
   c) Ileus
   d) Uncontrollable intractable vomiting
   e) All of the above

VI. VITAL SIGNS, TOXIDROMES, DECONTAMINATION ANSWERS

1. E
2. D
3. A
4. A
5. B
6. D
7. C
8. B
9. E
10. D
11. A
12. A
13. B
14. E
15. E

VII. CASE STUDIES

CASE #1
A 78 y/o female with “heart problems” arrives with weakness, nausea, vomiting, and seeing yellow halos around objects.

T=98.7  P=30  RR=22  BP=70/40
HEENT: dry mucosa
Lungs: clear
CV: bradycardia
Abdomen: benign
ECG: 3rd degree AV block with rate ~ 30, no STEMI
CASE #2
A 16 y/o male ingested 30 tablets of an OTC medicine because he was upset with girlfriend. In ED 90 minutes later he is delusional and confused.

T=99.5  P=140  RR=30  BP=120/80
Pupils: dilated and non-reactive
Oropharynx: so dry he has difficulty speaking
Skin: flushed and dry

CASE #3
A 34 y/o male in police custody is transferred to the ED because of an abnormal mental status. The patient became acutely confused, extremely agitated, and needed to be placed in leather restraints for staff safety.

T=100  P=100  BP=140/90
Gen: Alert but uncooperative (wild)
Pupils: 4 mm bilaterally with bidirectional nystagmus
Neuro: muscles rigid, no response to pain stimulus

CASE #4
A 33 y/o male arrives with the sensation that he is being bitten by bugs. His speech is pressured as he describes his problem.

T=98  P=120  RR=22  BP=160/100
Pupils: enlarged, no nystagmus
Oropharynx: rotten teeth
Skin: antecubital track marks, multiple excoriations

CASE #5
A 48 y/o female arrives in the ED 1 hour after ingesting a liquid from a carton she mistook for milk. She now complains of abdominal cramping, diarrhea, emesis, dyspnea, and drooling.

T=98.2  P=55  RR=32  BP=150/80
Gen: Agitated but alert and oriented X 3
HEENT: pupils small, drooling
Lungs: visible retractions, diffuse wheezes
Abd: soft, diffuse tenderness, hyperactive BS
Skin: diaphoretic
CASE #6
A 32 y/o male chemist was rushed to the ED after collapsing in one of the university research labs across the street.

- P=100  RR=28  BP=130/90
- Gen: unresponsive, “burnt nut” odor on breath
- Pupils: dilated
- Rest of exam is non-focal and unremarkable

A nurse remarks his venous blood from the IV site is “bright red.” A resident whose hobby is lepidoptery made the diagnosis on the basis of the unusual odor emanating from the gastric fluid during lavage.

CASE #7
A 55 y/o alcoholic female arrives with the following findings:
- Renal failure
- Crystals in urine
- Anion gap acidosis
- Elevated osmol gap

CASE #8
A 23 y/o woman with a witnessed overdose has the following findings:
- Vomiting with bloody diarrhea
- Hypotension
- CNS depression
- Elevated LFTs
- Radio-opaque pill fragments on X-ray

CASE #9
A 28 y/o patient with severe depression has the following ED findings:
- Coma
- Convulsions (intermittent)
- Cardiac wide complex dysrhythmias

CASE #10
A 17y/o patient is confused, smells “minty,” and has the following ED findings:
- Hyperventilation
- Acidosis
- Low grade fever
- Skin bruising
CASE #11
Another patient addicted to prescription pain medicines now has the following complaints in the ED:
  Anorexia
  Nausea and vomiting
  Easy bruising
  Yellow-tinted skin

CASE #12
A well-known homeless patient with alcoholism has the following new findings in the ED:
  Severe gastritis
  Fruity breath odor
  Normoglycemia
  Non-acidotic
  High osmol gap
  Acetonemia

CASE #13
A teenager with a history of substance abuse has the following ED findings:
  Pear-like breath odor
  CNS depression
  Respiratory depression
  Cardiac dysrhythmias
  Opacities on abdominal radiograph

CASE #14
A non-English speaking patient brought in by EMS has the following clinical problems:
  Coma
  Refractory seizures
  Anion gap acidosis
  Cavitary lesion on CXR

CASE #15
A 19 y/o suddenly became unconscious outside of a dance club. Pre-hospital naloxone is unsuccessful. He has the following findings:
  Bradycardia (HR 40)
  Bradypnea (RR 6)
  Unresponsive to verbal and painful stimuli

When you examine his oropharynx as you prepare to intubate him, he immediately awakens and sits upright. Repeat exam is now normal.
CASE #16
A 40 y/o female from Eastern Europe picked some mushrooms at a local forest preserve and ate them. 8 hours later she developed nausea and vomited, when she arrives in the ED she has intermittent generalized tonic-clonic seizures.

CASE #17
A healthy 17 y/o is rushed down from ENT clinic because of sudden cyanosis. Patient was being prepped for an intra-oral I&D. Patient is awake and has the following findings:
- Pulse ox 85%
- Tachycardia
- Blue skin

No pulse ox improvement despite 100% non-rebreather face mask.

CASE #18
A 38 y/o male with a “mood problem” arrives with tremulous extremities, nausea, thirst, and trouble walking straight. His psychiatrist recently increased his med dose because of increasing pressured speech. His exam is significant for dry mucosa and fine tremors in hands and feet.

CASE #19
A family of four arrive with nausea, weakness, palpitations, and headaches. It is early autumn, none report URI symptoms. Vital signs are normal and by the time they are brought back for MD evaluation from the waiting room, all feel better and want to leave. Worried?

CASE #20
Currently in your ED, a patient has the following findings:
- Depressed sensorium
- Depressed respirations
- Flushed face
- Characteristic breath odor
- Bad smelling feet
1. Accu-check any overdose patient with an altered mental status.

2. Propoxyphene, fentanyl, and methadone require larger doses of naloxone (Narcan) to reverse their effects than other narcotics.

3. Alkalis cause liquefaction necrosis with full thickness damage; acids cause coagulation necrosis. Alkalis are generally worse.

4. Hydrofluoric (HF) acid burns are treated with topical or systemic calcium. Beware cardiac conduction abnormalities.

5. Ethylene glycol (antifreeze) causes renal failure; methanol (windshield washer fluid) causes blindness. ED treatment for both is same.

6. Increased hydrocarbon toxicity occurs with low viscosity, high volatility, and low surface tension (e.g., pine oil, turpentine).

7. Aspiration pneumonitis is the most common complication of hydrocarbon ingestion. X-rays may be normal for up to 6 hours.

8. Delayed GI symptoms (>6 hours) occur with hepatotoxic Amanita or seizure-causing Gyromitra esculenta mushrooms, whereas early symptoms (<3 hours) are typical for non-toxic GI irritant mushrooms.

9. Urine drug test is only a screen: false negatives and false positives are common.

10. A mixed metabolic acidosis and respiratory alkalosis is common with salicylate overdose.

11. Urine acidification is never indicated for any overdose patient.

12. Acute acetaminophen overdose results in LFT abnormalities 24-36 hours after the ingestion.

13. N-acetylcysteine (Mucomyst, NAC, or Acetadote) treatment for acetaminophen replenishes body stores of glutathione.


15. Consider intravenous sodium bicarbonate for any toxicologic cause of wide-complex tachycardia, especially for TCAs.
REFERENCES


