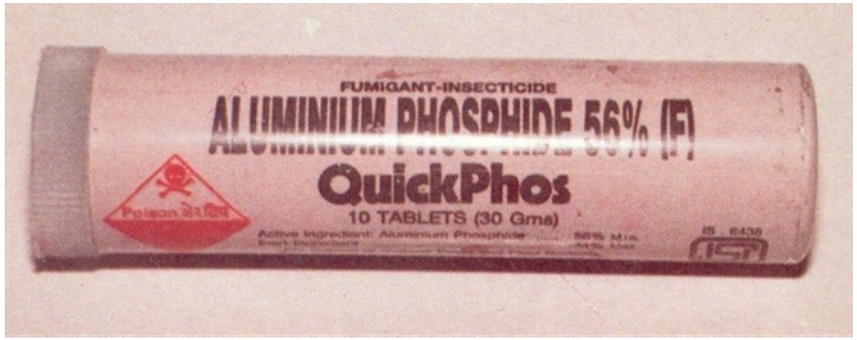
Approach to a Patient with Poisoning

Praveen Aggarwal

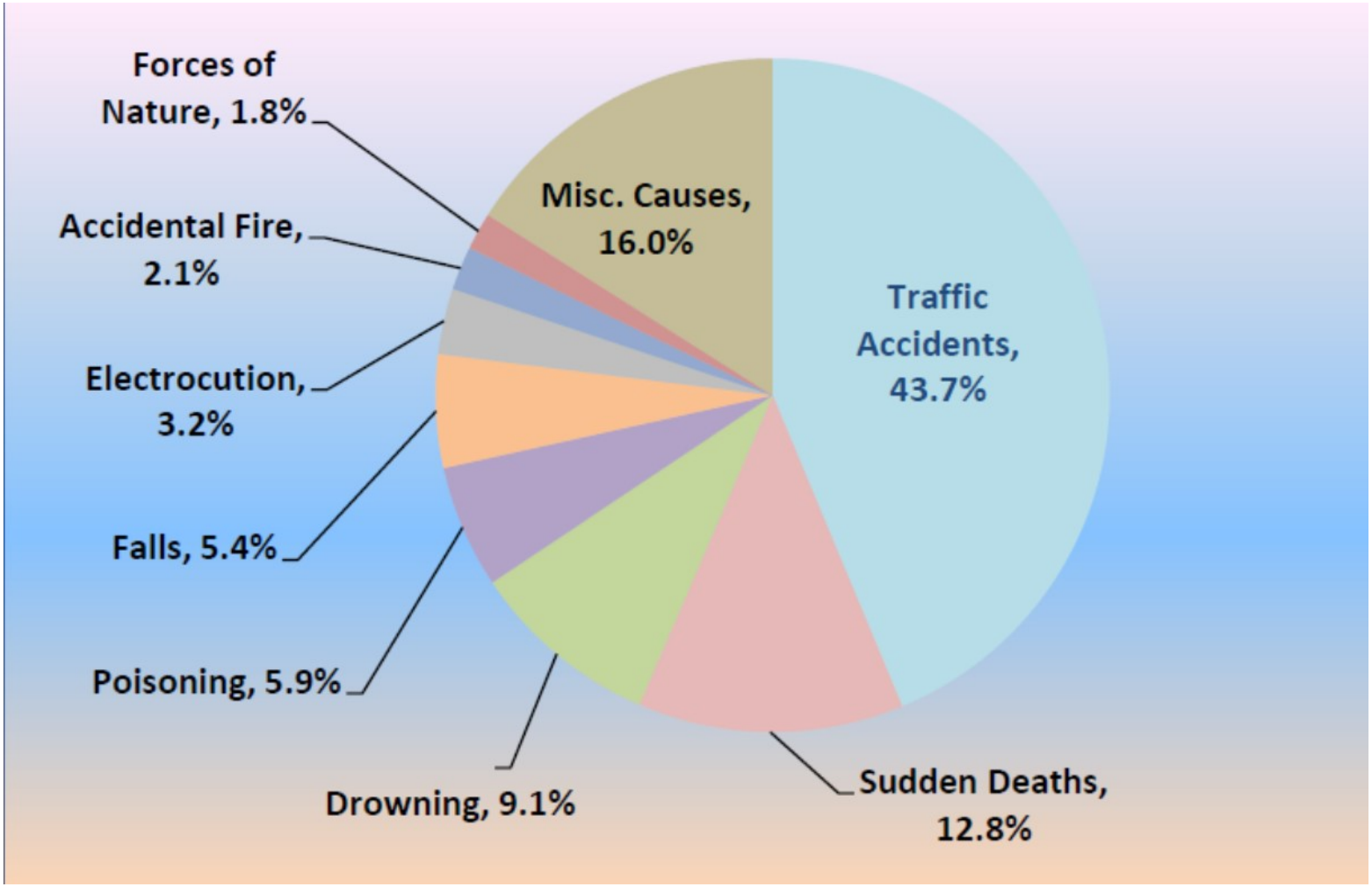
Department of Emergency Medicine

All India Institute of Medical Sciences, New Delhi

Common Poisons (India)



Major Causes of Accidental Deaths (India)



National Crime Records Bureau Report 2021 (n= 3,97,530)

Major Modes of Suicides (India)

Percentage of Means/Mode Adopted by Victims to Commit Suicide during 2020-2021

SL.	Means/Mode Adopted	Percentage & Number	
		2020	2021
(1)	(2)	(3)	(4)
7	By Self inflicting Injury	0.3% (457)	0.3% (492)
8	By Jumping	1.2% (1,843)	1.1% (1,757)
9	By Coming under Running Vehicles/Trains	1.7% (2,626)	2.4% (3,974)
10	By Touching Electric Wire	0.4% (629)	0.4% (627)
11	By Other Means	4.4% (6,795)	5.3% (8,718)
12	**Total**	**100.0**	**100.0**

National Crime Records Bureau Report 2021 (n= 3,97,530)

When to Suspect Poisoning?

- Acute gastroenteritis
- Altered sensorium or behavior
- Seizures
- Respiratory or muscle paralysis
- Acute renal or liver failure
- Cardiac arrhythmias
- Hyperthermia or hypothermia
- Bradypnea or tachypnea
- Sweating, salivation
- Urine retention or incontinence
- Dry or wet skin
- Pupillary changes
- Metabolic acidosis
- Injuries
- Breath odor

Principles of Management

- Reduce exposure
- Resuscitation and stabilization
- Diagnose type of poison
- Reduce absorption
- Increase elimination
- Specific therapy (antidotes)
- Supportive care

Cardiac Arrest in Poisoned Victim

Toxin/Class of Toxin	Intervention
Toxins with a specific antidote: ○ Digoxin ○ Organophosphates ○ Envenomation	○ Digoxin Fab ○ Atropine ○ Antivenom
Na+ channel blocker/WCT	○ Sodium bicarbonate
Calcium channel or β-blocker	○ High-dose insulin
Local anesthetic agents	○ IV lipid emulsion
Other Therapies to Consider	○ Cardiac pacing/IABP/ECMO

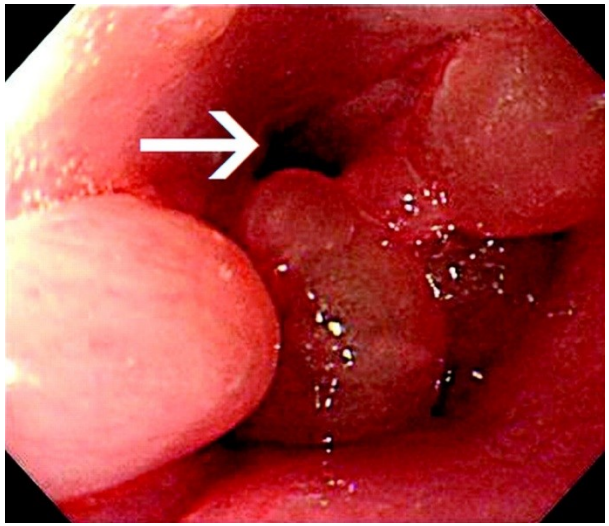
Prolonged CPR in young patients

General Management: A B C

- Initial A B C
- External decontamination before A B C

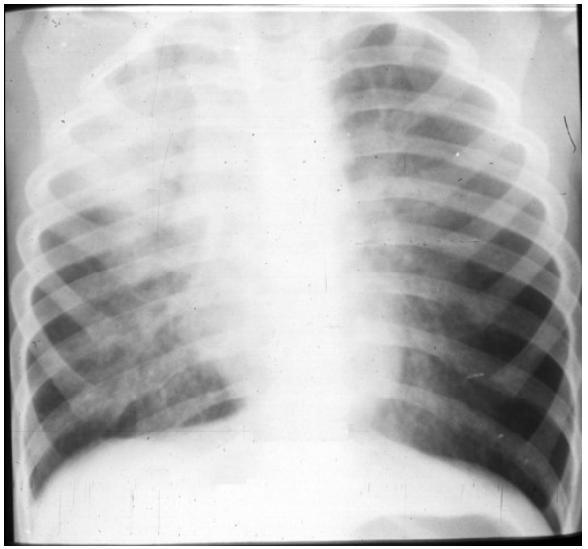
A – Airway

- Cervical spine
- Intubation by RSI
  - Rocuronium preferred
- Unique issues in:
  - Caustic ingestion



B – Breathing

- Hypoventilation
- Aspiration of hydrocarbons
- ARDS/ALI with opioids/salicylates



C – Circulation

- Volume replacement in most patients
- Salicylates:
  - For urinary alkalinization, volume repletion
- Precautions with beta blockers & calcium channel blockers
- Cardiac arrhythmias

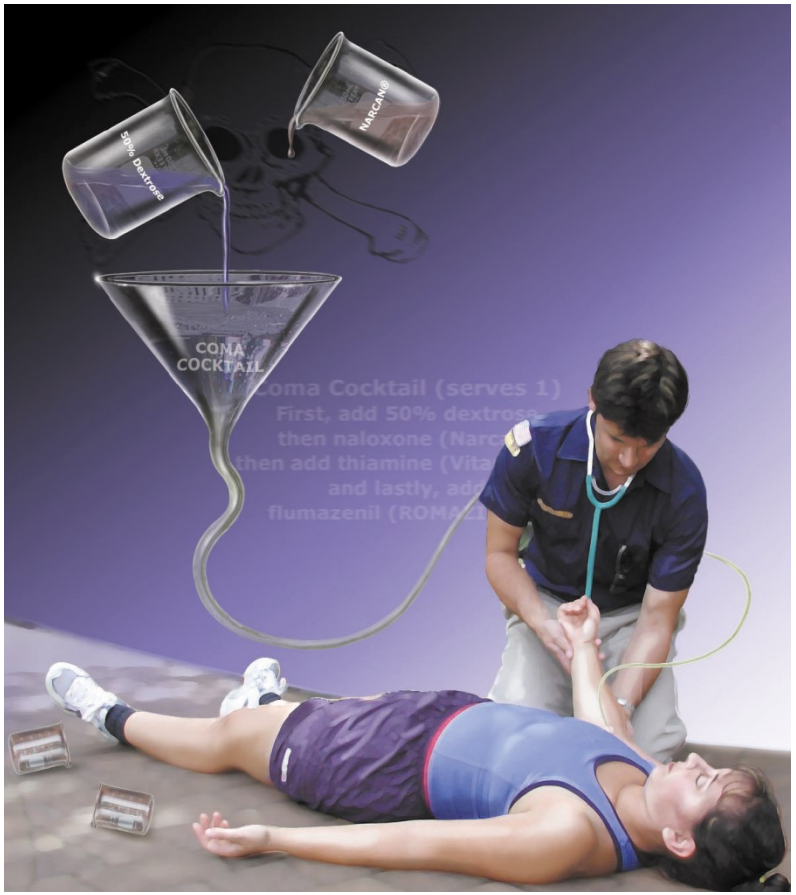
D – Disability

Seizures:

- First line treatment with benzodiazepines
- Exclude hypoglycemia/hyponatremia
- Second-line agents – Barbiturates/Propofol
- No role for phenytoin

D – Drugs

- Dextrose
- Naloxone
- Thiamine
- Flumazenil



D – Drugs (Dextrose)

- Hypoglycemia – A great mimicker
- Insulin, OHAs, Alcohol, Salicylates, Quinine

Check glucose in patients with altered mental status

D – Drugs (Dextrose)

- Indications of hypertonic dextrose:
  - Blood glucose < 80 mg/dl
  - Focal neurological examination and glucose < 100 mg/dl
  - Rapid tests not available
- Glucagon: 1 mg IV
- Octreotide: 50 – 100 µg SC/IV

D – Drugs (Naloxone)

- Empirical therapy if:
  - Pin-point pupils
  - Respiratory depression
  - Comatosed
- Initial dose: 0.1 mg (Watch for withdrawal reaction)
- Subsequent doses of 0.4-2 mg every 2 minutes
- 2 mg if resp. depression; subsequent doses of 2 mg
- Duration of action – 30-60 minutes (recurrence)

D – Drugs (Thiamine)

- Wernicke's encephalopathy a rare cause of coma
- Anaphylactic reaction
- May be administered in those with low thiamine reserves

D – Drugs (Flumazenil)

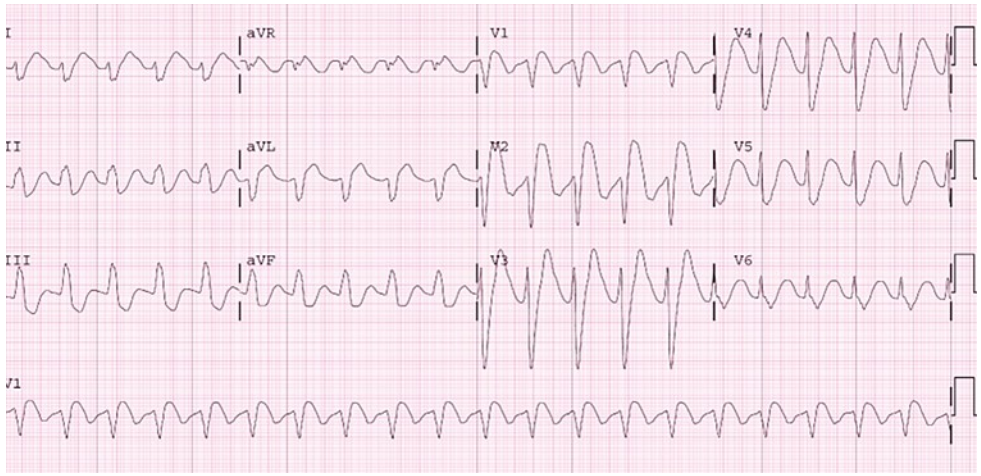
- Empiric use of flumazenil in comatose??
- Risk in mixed/unknown overdose
- May precipitate withdrawal (life-threatening)

E – Electrocardiogram

- A screening test for TCA poisoning
- Associated electrolyte imbalance
- Useful in:
  - Digoxin overdose
  - Aluminium phosphide, OP poisoning
  - Cocaine poisoning

E – Electrocardiogram

- Tricyclic Antidepressants:
  - Tachycardia
  - Terminal 40 ms RAD
  - QRS widening

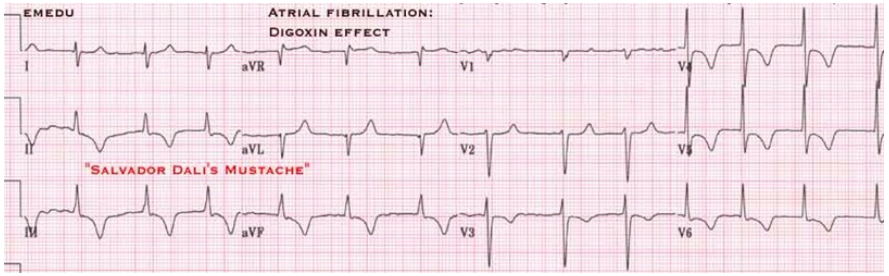


QRS duration	Risk of seizures	Risk of arrhythmias
< 100 ms	0%	0%
100-160 ms	33%	0%
> 160 ms	85%	55%

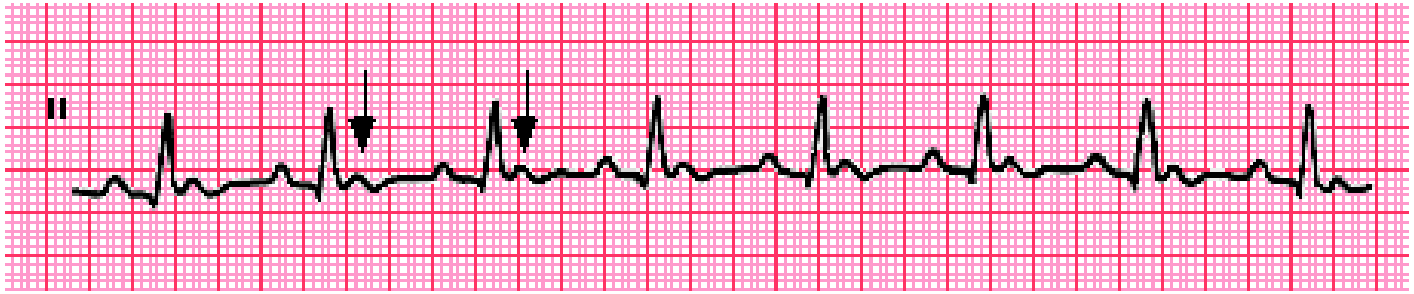
Amoxapine can produce status without QRS prolongation

E – Electrocardiogram

- Digoxin effect: slurred ST depression



- Digoxin toxicity:
  - Any arrhythmia (except rapidly conducted SVT)



F – F(Ph)ysical Examination

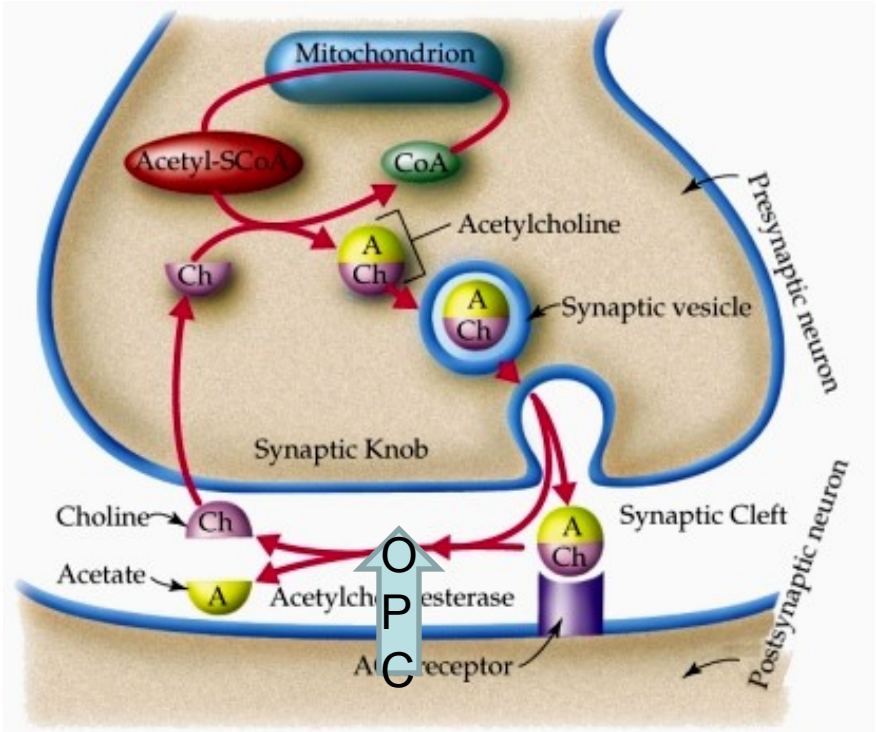
- Vital signs; Mental status; Pupils; Skin
- Urinary bladder (F for Foley's catheterization); Bowels

Toxidromes:

- Cholinergic
- Anticholinergic
- Sympathomimetic
- Opioid
- Sedative/hypnotic

Cholinergic

- Organophosphates & carbamates, mushrooms (Clitocybe), chemical warfare agents, *scorpions*
- Inhibit cholinesterases, increase acetylcholine



Cholinergic

- Muscarinic effects: *DUMBELS:*
  - Diarrhea, Urination, Miosis, Bronchorrhea, Bronchospasm, Bradycardia, Emesis, Low BP, Lacrimation, Salivation

Cholinergic

- Nicotinic effects: muscle weakness, fasciculations, respiratory failure
- CNS effects: confusion, coma, convulsions
- Cholinesterase levels not helpful in management
- Treatment: atropine, pralidoxime (2-PAM)??

Cholinergic – Atropine

- Initial assessment:
  - Miosis
  - Excessive sweating
  - Bronchorrhoea/bronchospasm
  - Bradycardia
  - Hypotension

If no features, observe for delayed development of cholinergic features

Cholinergic – Atropine

- 1.8 – 3.0 mg IV (even if oxygen not available)
- Double dose every 5 minutes if no consistent improvement
- **Target points:**
  - Clear chest with no wheeze
  - Heart rate > 80 beats/min
  - Pupils no longer pinpoint
  - Dry axillae
  - Systolic blood pressure > 90 mmHg

Cholinergic – Atropine

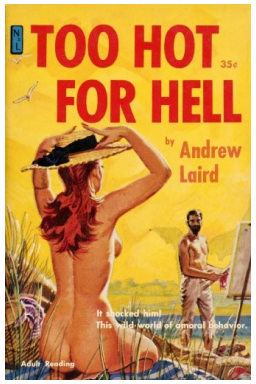
- IV normal saline 500-1000 mL over 1 hours
- Once atropinized, infusion at 10-20% of total dose/hour
- Assess five parameters every 15 min

Case Scenario

- 34 y male; found to be confused, delirious
- Pulse = 120; B.P. = 156/100
- Alert; disoriented to person, place, time, and event
- Pupils dilated
- Blood Sugar = 176
- Possible ETOH/Drug withdrawal
- CT planned
- Temp. = 103.8°F; face bright red!; dry mucous membranes

Anticholinergic

- Atropine, TCAs, phenothiazines, antihistamines, antiparkinsonian drugs, Jimsonweed
- Dry, flushed skin, dry mucus membranes, mydriasis, reduced bowel sounds, urinary retention, tachycardia, arrhythmias, hyperthermia, confusion, delirium, seizure



Anticholinergic

- Agitation, delirium, seizures:
  - Treatment: benzodiazepines; avoid phenothiazines
- Wide-complex tachycardia:
  - Treatment: sodium bicarbonate
- Ventricular dysrhythmias:
  - Treatment: lidocaine, amiodarone; avoid procainamide
- Torsades de pointes:
  - Treatment: magnesium sulphate, overdrive pacing

Case Scenario

- A 28-year-old man, arrested for ? Smuggling drugs
- Agitated and sweating
- Pulse = 140; B.P. = 220/130; Temperature = 39.6°C
- Pupils dilated and reactive
- Skin warm and diaphoretic
- ECG: sinus tachycardia

Case Scenario

Sympathomimetic

- Amphetamines, cocaine, PCP, nasal decongestants
- CNS excitation, seizures, hypertension, tachycardia, sweating, dilated pupils, hyperthermia

Anticholinergic: dry skin; retention of urine
Sympathomimetic: diaphoresis; no urinary retention

Sympathomimetic

- IV fluids, external cooling, cardiac monitoring
- Chest pain & HT:
  - Benzodiazepines (also for hyperthermia, seizures)
  - Nitroglycerine
  - Labetalol
- Whole bowel irrigation

Case Scenario

- A 20 year male presents with AMS
- RR = 8, shallow; SpO_2 = 82%; pulse = 60; B.P. = 90/60
- Chest: clear
- Pupils = 1 mm
- GCS 11/15 (E2, V4, M5)
- Blood sugar = 97 mg/dl

Opioids

- Respiratory depression, hypotension, coma, miosis
- ARDS (heroin)
- Seizures (tramadol, propoxyphene, pethidine)
- Hypoglycemia, ALF (tramadol)
- Pinpoint pupils (not always seen)
- Treatment: naloxone

Pethidine: Serotonin syndrome

Case Scenario

- A 25 year female, symptomatic for last 18 hours
- Diarrhea, insomnia, abdominal cramps, sweating, agitation and piloerection
- Mydriasis, hypertension, tachycardia

G – Gastrointestinal decontamination

- Gut decontamination should not be considered unless patient has ingested a potentially life-threatening amount of a toxic agent within the last 60 minutes

American Academy of Clinical Toxicology

G – Gastrointestinal decontamination

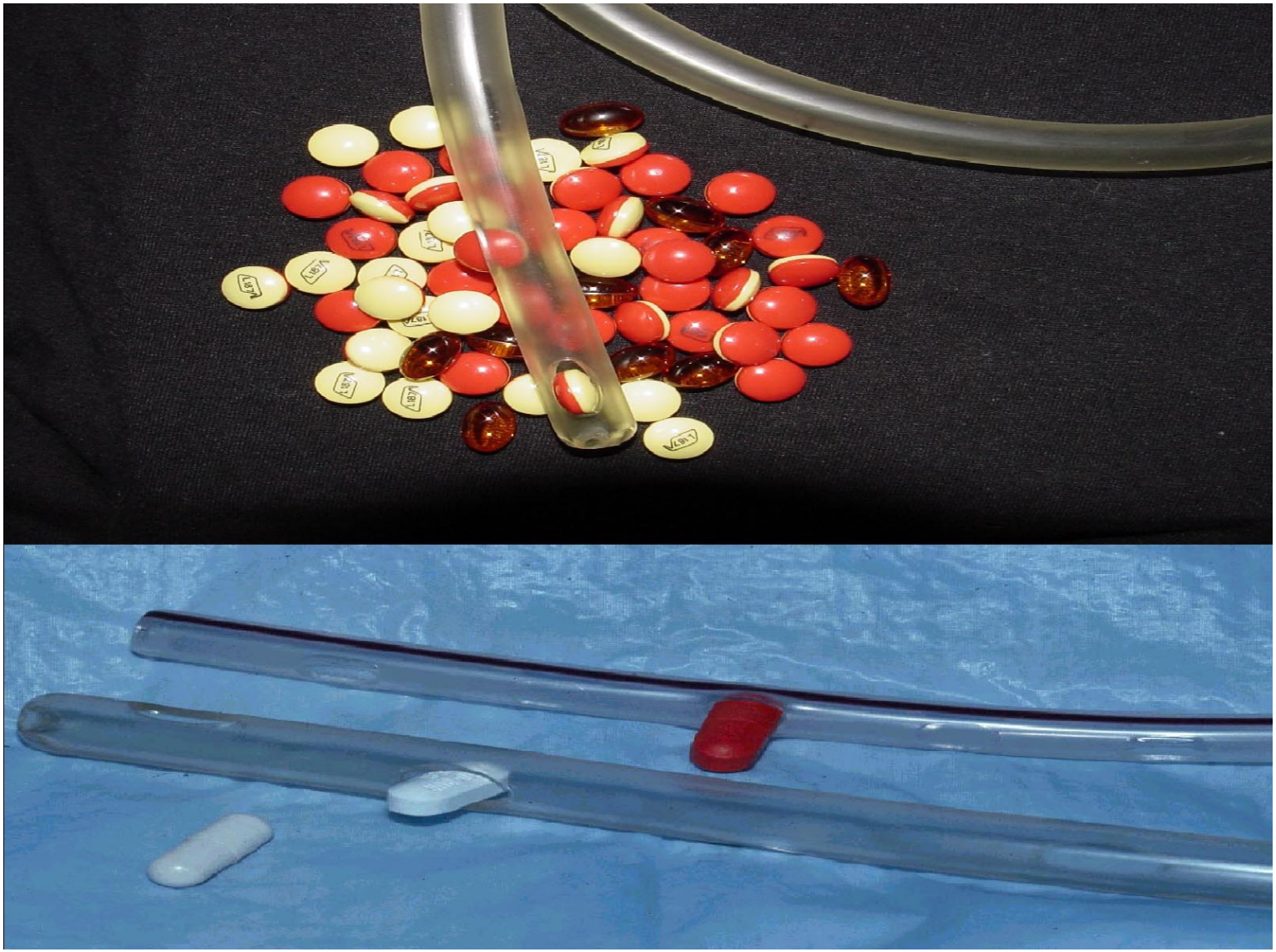
- Consider:
  - Is the ingestion potentially dangerous?
  - Can emptying remove a significant amount?
  - Do benefits outweigh the risk of emptying?


NDC 0574-0012-01
IPECAC SYRUP USP
1 FL OZ 29.5 mL

G – Gastrointestinal decontamination

Syrup of Ipecac:

- Many limitations; not recommended in EDs
- Contraindications:
  - Caustics, low viscosity hydrocarbons
  - Bleeding disorder, seizures, < 6 months
  - Altered mental status, unprotected airway



G – Gastrointestinal decontamination

Gastric lavage:

- Indications:
  - Recent (<1hr) life-threatening ingestion
  - Agent not bound by charcoal
- Method:
  - Large-bore orogastric tube
  - Protect airway

G – Gastrointestinal decontamination

Gastric lavage:

- Contraindications
  - Unprotected airway
  - Caustics
  - Nontoxic agents
  - Hydrocarbons (unless containing a dangerous additive)
  - Punitive action
- Complications:
  - Aspiration / esophageal tears

G – Gastrointestinal decontamination

Activated charcoal:

- Dose:1-2 g/kg (max 100 g)
- Optimal ratio of charcoal to toxin - 10:1
- In massive overdoses, extra dose
- Little risk; hence low threshold for use (unless Cx)
- Mechanism

G – Gastrointestinal decontamination

Activated charcoal:

- Poorly bound: Li, Fe, caustics, CN, hydrocarbons, alcohols
- Contraindications: Caustics, ileus
- Multidose: SR drugs, theophylline, phenobarbital, salicylates, carbamazepine

Avoid multidose cathartics

G – Gastrointestinal decontamination

Whole bowel irrigation:

- Iron, lithium, drug packers, lead
- Sustained release preparations, bezoars
- Contraindications: ileus, obstruction

H – Help

- Consult:
  - Toxicologist
  - Poison Control Centre (1800116117)
- Hypothermia/Hyperthermia (Rectal temperature)

I – Increased Excretion

- Multiple doses of activated charcoal
- No role of forced diuresis in most patients
- **Change in urinary pH (alkalinization):**
  - Chlorpropamide, 2,4-D, salicylate, phenobarbital
  - Urine pH 7-8
  - Need to replace K+ for alkaline urine

Avoid urine acidification and forced diuresis

I – Increased Excretion

Hemodialysis:

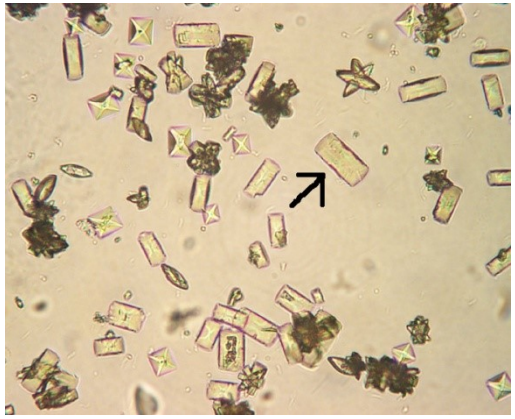
- Salicylates, lithium, methanol, isopropanol, ethylene glycol, theophylline, phenobarbital, valproate
- AKI
- Severe electrolyte imbalance; MALA

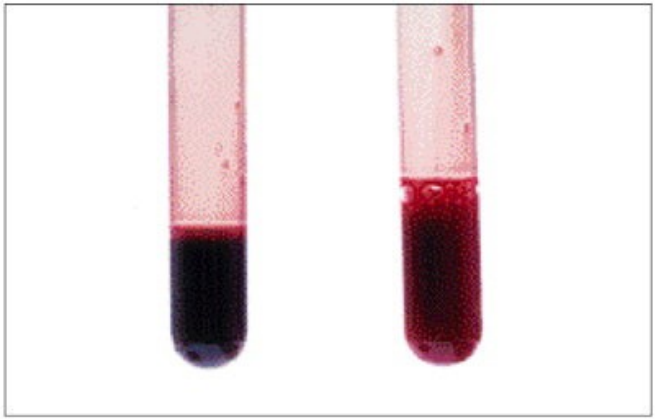
Charcoal hemoperfusion:

- Theophylline, phenobarbital, carbamazepine
- Protein-bound

L – Laboratory Investigations

- Silver nitrate test – Aluminium phosphide
- Oxalate crystals (ethylene glycol)
- Methemoglobinemia (chocolate blood)





L – Laboratory Investigations

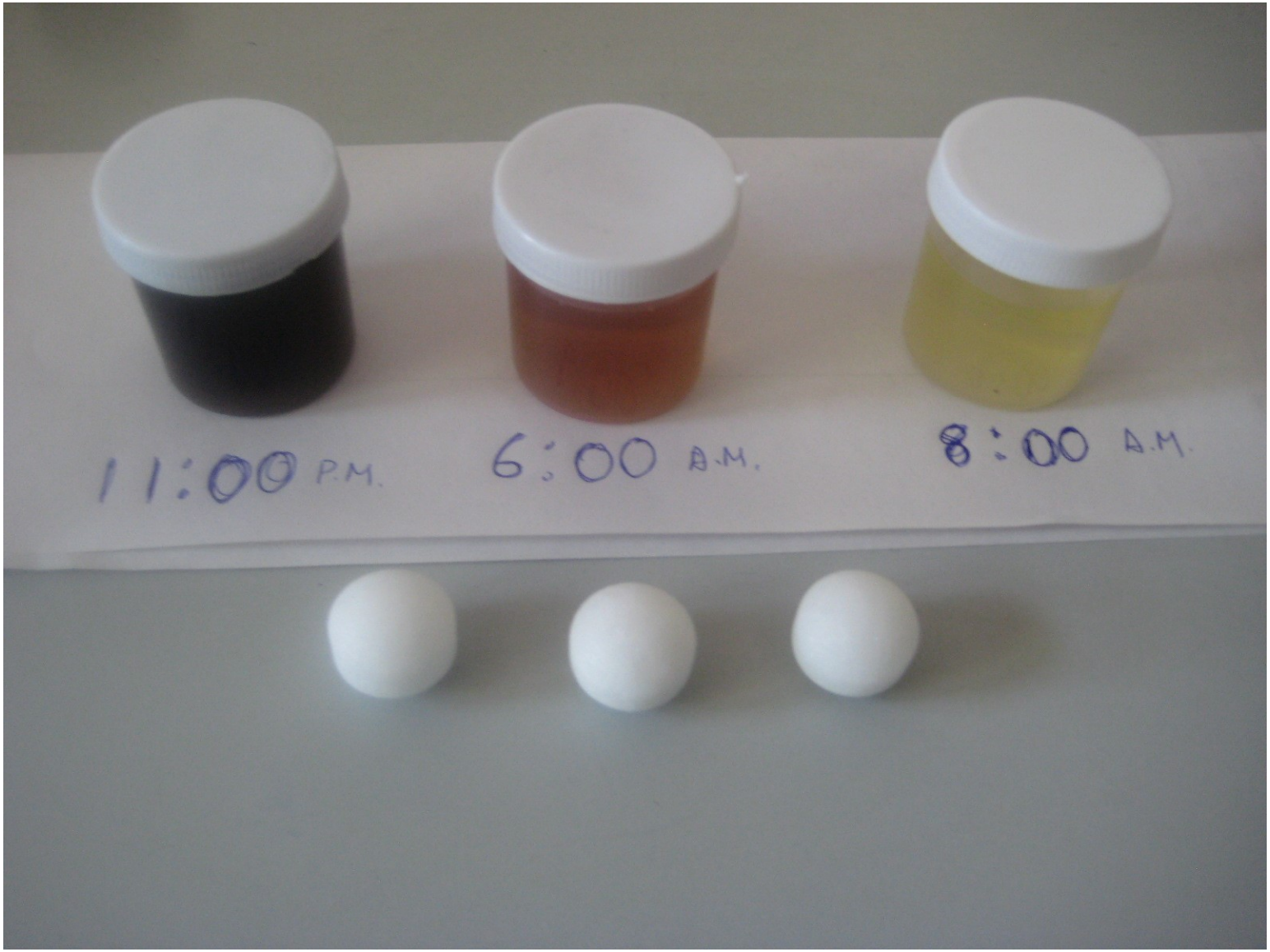
Anion gap (normal : 10-14 mmol/L): $(Na^+) – (Cl^- + HCO_3)$

- ↑ AG:
  - M methanol, metformin, massive ingestions
  - U uremia
  - D DKA
  - P paracetamol
  - I iron, INH
  - L lactic acidosis (CO, CN)
  - E ethylene glycol
  - S salicylates

L – Laboratory Investigations

Osmolal gap: Measured osmolality – Calculated osmolarity

- Calculated (nl 285-295) = 2Na + $\frac{BUN}{2.8}$ + $\frac{Glu}{18}$ + $\frac{EtOH}{4.6}$
- Normal gap <10 mosmol/L
- Increased gap: MADGAS (mannitol, alcohols, dyes, glycerol, acetone, sorbitol); methanol/3.2; Ethylene glycol/6.2
- Also increased in diabetic ketoacidosis


11:00 P.M.
6:00 A.M.
8:00 A.M.

L – Laboratory Investigations

- Qualitative analysis
- Urine superior to blood specimens
- Urine screens specifically designed for drugs of abuse
- A positive or negative screen – does not rule in or rule out an overdose

L – Laboratory Investigations

- Quantitative blood tests if levels predict subsequent toxicity or guide specific therapy
- Iron, lithium, paracetamol, digoxin, aspirin, theophylline, phenobarbital, methanol

Antidotes

Toxin	Antidote
Antidepressants	Sodium bicarbonate
Calcium channel blocker	Ca^{++}, glucagon, high-dose insulin
Cholinesterase inhibitors	Atropine (PAM??)
Digitalis	Digoxin-specific Fab
INH	Pyridoxine
Iron	Deferoxamine
Methanol	Ethanol
Methemoglobin-inducing agents	Methylene blue
Paracetamol	N-acetylcysteine
Opioids	Naloxone
Snakebite	Antivenom

Intravenous Lipid Emulsion

- Evidence robust in local anaesthetic systemic toxicity
- ILE often used as one of the last interventions in several other poisonings
- Bolus of 1-1.5 mL/kg of 20% ILE solution over 2-3 minutes
- If no response, repeat same dose every 3-5 min (maximum total of 3 boluses)
- Following bolus, infusion at 0.25-0.5 mL/kg/minute
- Maximum of 12.5 mL/kg of 20% ILE

High-Dose Insulin-Dextrose Therapy

- Also called hyperinsulinemic/euglycemic therapy
- No guidelines on its use
- Often used in CCB and BB poisonings; others: TCA, SSRIs
- Additional treatment to improve myocardial contractility

High-Dose Insulin-Dextrose Therapy

- 1 U/kg of insulin followed by infusion at 1 U/kg/h
- Concurrent infusion of 50 ml 50% dextrose
- Titrate dextrose infusion to maintain glucose 100-250 mg/dl
- Potassium replacement not needed unless <3.3 mEq/L

Supportive Care

- Support of central nervous system
- Support of cardiovascular functions
- Support of respiratory functions
- Support of renal/liver functions
- Fluid, electrolyte, acid-base status
- Temperature control

Medico-Legal Issues

- Inform police AFTER initial management
- Prepare medico-legal report
- Preserve blood, urine, lavage (if done), vomitus
- Properly label and affix signature

Psychiatric Evaluation

- Essential before discharge:
  - From emergency department
  - From ward (after admission)

Case Scenario

- A 25-year old patient presented with altered sensorium after consuming an unknown agent around 1½ hours ago
- Oral cavity full of secretions
- Clothes soiled with urine and stools
- Suction
- RR: 28; SaO_2: 80%; bilateral crepitations and rhonchi
- Pulse: 110; BP: 70 mmHg systolic
- Pupils constricted; No fasciculations
- Blood sugar = 95 mg/dl

Take Home Messages

- Resuscitation and Supportive treatment most important
- Antidotes wherever required
- Gut decontamination in very selected cases
- No role of forced diuresis
- Benzodiazepines for seizures
- Sodium bicarbonate for QRS prolongation
- Magnesium for QT prolongation

Treat the patient and not the poison

THANK YOU