

STEPWISE APPROACH TO MANAGING A POISONED PT: stabilization → history → diagnosis → GI decontamination → enhanced elimination → antidotes → disposition

1. STABILIZATION

- ABCs (airway, breathing, circulation)
- Seizure control
- Agitation
- Hypoglycemia
- Hyperthermia
- Hypothermia

INTERVENTIONS SPECIFIC TO TOXICOLOGY:

- BDZ for toxin-induced seizures; phenytoin has no role
- BDZ for toxin-induced agitation; avoid haloperidol/olanzapine if possible
- Sodium bicarbonate for wide complex tachycardia and ↓ BP from TCAs
- Insulin-glucose for ↓ BP from CCBs or BBs
- Avoid flumazenil in most cases

2. HISTORY CONSIDERATIONS

- Pediatric patient with unintentional poisoning (parent, babysitter, siblings)
- Alert patient with deliberate overdose (hx may be incomplete)
- Pt with altered mental status (ambulance, family/friends, bottles, records)

3. DIAGNOSIS - TOXIDROMES

CLINICAL TOXIDROMES:

OPIOID	↓ LOC, ↓ respirations, miosis
CHOLINERGIC	Salivation, lacrimation, vomiting, diarrhea, sweating, miosis, muscle weakness
ANTI-CHOLINERGIC	↑ HR ± ↑ BP, delirium, mydriasis, ↓ bowel sounds; dry, flushed skin
SYMPATHO-MIMETIC	↑ HR, ↑ BP, ↑ T, agitation, sweating, mydriasis
SEROTONERGIC	↑ HR, ↑ T, sweating, mydriasis, tremor, myoclonus

LAB TOXIDROMES:

ESSENTIAL LAB TESTS (overdose panel)	<ul style="list-style-type: none"> • Chem-7: includes lytes, glucose, renal function • Liver function tests • ASA, acetaminophen • +/- others (ethanol, CBC, INR, osmolality) • +/- specific levels (ex// lithium digoxin)
ACETAMINOPHEN LEVEL	<ul style="list-style-type: none"> • Good screening test • Common overdose • Asymptomatic initially • Results can indicate treatment • Effective antidote • Test readily available
SALICYLATE LEVEL	<ul style="list-style-type: none"> • Patients still die from it <ul style="list-style-type: none"> ◦ Mostly elderly on chronic therapy (sx mistaken for sepsis, dementia, etc) • Non-gap acidosis presents in up to 40% of pts • Test readily available • Consider in pts with hx or in those with unexplained acidosis or sx
ANION GAP	<ul style="list-style-type: none"> • Non-specific & insensitive but detects acidosis • Na - (Cl + HCO₃) • Reference range: 6-12 <ul style="list-style-type: none"> ◦ > 12 indicates anion gap acidosis • Anion gap acidosis = accumulation of organic acids or impaired H+ excretion • KULT <ul style="list-style-type: none"> ◦ Ketones (DKA, AKA, starvation ketosis) ◦ Uremia ◦ Lactate ◦ Toxins (MUDPILES/CAT) • MUDPILES/CAT <ul style="list-style-type: none"> ◦ M – metformin, methanol ◦ U – uremia ◦ D – DKA ◦ P – propofol, paraldehyde ◦ I – iron, isoniazid, ibuprofen ◦ L – lactic acidosis ◦ E – ethylene glycol ◦ S – sepsis, starvation ketosis, salicylates

3. DIAGNOSIS - TOXIDROMES (CONTINUED)

LAB TOXIDROMES (CONTINUED):

ANION GAP CONTINUED	<ul style="list-style-type: none"> • MUDPILES/CAT <ul style="list-style-type: none"> ◦ C – carbon monoxide, cyanide, CCBs ◦ A – acetaminophen, AKA ◦ T – theophylline • Ketones, lactic acidosis, ketone +lactic+ other, organic acids 				
OSMOLAL GAP	<ul style="list-style-type: none"> • Screen for toxic alcohols • Definitive levels are only done in 3 labs in BC • Has many pitfalls <ul style="list-style-type: none"> ◦ Low specificity and low PPV for patients requiring antidote or dialysis ◦ Utility extrapolated from non-poisoned patients ◦ “Normal gap” is widely debated • OG = Osm (measured) – Osm (calculated) <ul style="list-style-type: none"> ◦ <u>Osm (measured)</u>: in lab by osmometers ◦ <u>Osm (calculated)</u>: summing individual osmols of substances dissolved in blood <ul style="list-style-type: none"> ▪ 2*Na + BUN + glucose + 1.25 * ethanol • Gap = osmotically active dissolved particles not accounted for by the formula <ul style="list-style-type: none"> ◦ Any non-charged molecule or non-Na cations • Normal reference range: - 15 to + 10 mmol/L <ul style="list-style-type: none"> ◦ Theoretically OG can't really be negative • Normal OG is so large because: <ul style="list-style-type: none"> ◦ Imprecision in measuring molarity (Na, HCO₃) ◦ Imprecision in measuring molality ◦ Serum is not an ideal solution ◦ Subtracting molarity from molality <ul style="list-style-type: none"> ▪ mosm/L – mosm/kg ◦ Variability in labs, equations, devices • Elevated osmolal gap: <table border="1" data-bbox="1068 1131 1498 1434"> <tr> <td>Exogenous</td> <td> <ul style="list-style-type: none"> • Methanol • Ethylene glycol • Isopropanol • Acetone • Propylene glycol </td> </tr> <tr> <td>Endogenous (OG < 30)</td> <td> <ul style="list-style-type: none"> • AKA, DKA • Lactic acidosis • Shock • Multi-organ failure • Sepsis • Renal failure </td> </tr> </table> 	Exogenous	<ul style="list-style-type: none"> • Methanol • Ethylene glycol • Isopropanol • Acetone • Propylene glycol 	Endogenous (OG < 30)	<ul style="list-style-type: none"> • AKA, DKA • Lactic acidosis • Shock • Multi-organ failure • Sepsis • Renal failure
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URINE DRUG SCREEN	<ul style="list-style-type: none"> • Rarely changes management • May be useful in young child if suspect drug exposure (i.e. abuse/neglect) 				

ECG TOXIDROMES: looking for signs of cardiac toxicity

QT prolongation	• Potassium efflux blockers
QRS prolongation	• Sodium channel blockers
Other	<ul style="list-style-type: none"> • Sodium-potassium ATPase blockers • CCBs, BBs

AGENTS WITH SODIUM CHANNEL BLOCKING PROPERTIES:

- Cyclic antidepressants
- Venlafaxine
- Citalopram
- Carbamazepine
- Diphenhydramine/dimenhydrinate
- Cocaine
- Hydroxychloroquine
- Class 1A
 - Disopyramide
 - Quinidine
 - Procainamide
- Class 1C
 - Propafenone
- Propranolol
- Verapamil/diltiazem

4. GI DECONTAMINATION	
CURRENT APPROACH	<ul style="list-style-type: none"> No routine approach for all poisonings Should be targeted for patients who have a potentially life-threatening ingestion Decision based on risk benefit analysis
SINGLE-DOSE ACTIVATED CHARCOAL <i>most useful method</i>	Oral administration to bind toxin, prevent absorption
	BENEFITS <ul style="list-style-type: none"> Binds most agents except Li, Fe, CN, alcohols Best if used within 1-2 hrs post-ingestion Beneficial after 2 hours for: <ul style="list-style-type: none"> Ingestion of SR, XL products Co-ingestion of anticholinergics, opioid Massive ingestions
	RISKS <ul style="list-style-type: none"> Aspiration in 2-5% of patients <ul style="list-style-type: none"> Older age, GCS < 15, spontaneous emesis, seizures Vomiting in 6-26% patients
	DOSE <ul style="list-style-type: none"> Adult/teens: 50 – 100 g Children: 1 g/kg
	BINDS <ul style="list-style-type: none"> 1 part drug : 10 parts charcoal Some suggest 1:40
IPECAC <i>no longer used</i>	<ul style="list-style-type: none"> Emetic, was given orally to “vomit the poison”
	BENEFIT <ul style="list-style-type: none"> Limited
	RISKS <ul style="list-style-type: none"> Minimal in alert patients Increased risk if given to those who may seize, have ↓ LOC, have oral burns Prolonged vomiting (rare) Delays administration of charcoal
GASTRIC LAVAGE <i>not routine, mostly not used</i>	<ul style="list-style-type: none"> “Pumping the stomach” – use of orogastric tube and repeated 100-200 mL saline or water washes
	BENEFITS <ul style="list-style-type: none"> No proven benefit May be useful in recent (1 hr) massive ingestions of life-threatening toxins (CCBs, BBs, TCAs)
	RISKS <ul style="list-style-type: none"> Uncommon (most local MDs are not trained in procedure) Patients require intubation to protect airway Can’t remove large pills Esophageal perforation, aspiration
WHOLE BOWEL IRRIGATION	<ul style="list-style-type: none"> Oral administration of PEG-lyte solution at high flow rate to “wash toxin” through GI tract
	BENEFIT <ul style="list-style-type: none"> No studies showing improved outcome May increase elimination of SR products May be useful for products not bound by activated charcoal
	RISKS <ul style="list-style-type: none"> Will require NG tube administration Vomiting – may require antiemetics Difficult to use in obtunded or unconscious pt who is unable to sit upright and on commode
	METHOD <ul style="list-style-type: none"> PEG-lyte solution via NG tube till rectal effluent clear
	DOSE <ul style="list-style-type: none"> Adult: 1.5 – 2 L/hour Child: 500 mL/hour
	USES <ul style="list-style-type: none"> SR products, cocaine packets (body packers) Products not bound by activated charcoal <ul style="list-style-type: none"> Lithium, iron, lead foreign objects

5. ENHANCED ELIMINATION (rarely needed)
<ul style="list-style-type: none"> Hemodialysis <ul style="list-style-type: none"> Toxic alcohols, Li, salicylate, VPA, metformin, massive acetaminophen Renal failure / deteriorating clinical status despite supportive care Chronic renal replacement therapy (CRRT) <ul style="list-style-type: none"> Only in patients who can’t tolerate hemodialysis Multiple-dose activated charcoal <ul style="list-style-type: none"> Lack of evidence of improved outcome Increases risk of adverse events Urinary alkalinisation <ul style="list-style-type: none"> ↑ urinary excretion of salicylates

6. ANTIDOTES	
TOXIN	ANTIDOTE
Acetaminophen	Acetylcysteine
Cyanide	Hydroxocobalamin
Isoniazid	Pyridoxine
Antifreeze (toxic alcohols)	Fomepizole
Opioids	Naloxone
Sulfonylureas	Octreotide
Digoxin	Digoxin immune Fab
Iron	Deferoxamine
Benzocaine/dapsone/nitrates	Methylene blue

OTHER ANTIDOTES:	
TOXIN	ANTIDOTE
Bradycardia, organophosphates	Atropine
Black widow spider	Antivenin
Calcium channel blockers	Calcium
Rattlesnake	CroFab rattlesnake antivenin
Serotonin syndrome	Cyproheptadine
Heavy metals	Dimercaprol, succimer
Beta blockers	Glucagon
CCBs, BBs	Insulin
Severe cardiac toxicity	Lipid emulsion
Organophosphates	Pralidoxine
LMWH	Protamine
Warfarin, anticoagulant rat poison	Vitamin K

7. DISPOSITION:
<ul style="list-style-type: none"> How to monitor and for how long? Does this patient need admission? When can they be discharged? Any follow-up required? Any change of therapy required?

SUMMARY:
<ul style="list-style-type: none"> Unintentional poisoning & suicide are leading cause of death from injury Nine of top 10 categories of substances causing poisoning death are medications or illicit drugs Stepwise approach can be followed to manage a poisoned patient Some resuscitation interventions are specific to toxicology patients Identification of toxidromes can be useful Serum acetaminophen level <i>essential</i> in all overdose patients GI decontamination not routine for all poisoned patients <ul style="list-style-type: none"> Target patients with potentially life-threatening ingestions Enhanced elimination rarely required Few antidotes exist <ul style="list-style-type: none"> Provincial stocking guidelines available (dpic.org) Poison Control Centres & medical toxicologists available for consultation 24/7