Acute Poisoning - General Approach

Overview

Common presentation and cause of morbidity and death in patients<45. Most at risk are children <5yo and F 15-44yo.

Types of poisoning

- Deliberate (OD, child abuse, Munchausen±proxy, attempted homicide, terrorist, warfare)
- Accidental (Most paed OD, dosage error – iatrogenic/patient, recreational use)
- Environmental (Plants, food, envenomation)
- Industrial exposures

Resuscitation

Airway: Ensure patent/protected. Intubate as necessary.
Breathing: Give O_2. Note ↓RR (opiates, BDZ) or ↑RR (metabolic acidosis).
Circulation: Treat hypotension with fluids initially. Treat arrhythmias usually by antidote rather than conventional antiarrhythmics. E.g. for sodium channel blockade → **$NaHCO_3$.** ↑HR (sympathomimetics, TCA, antihistamine, anticholinergics, digoxin) – avoid β-blockers, or ↓HR (OP, GHB, digoxin, CCB, β-blockers) – atropine may not work unless block above AV node.
Disability: Treat seizures with **BDZ** (then barbiturates or pyridoxine, avoid phenytoin). Check BSL (& treat if low), & for clonus. Check pupils (if pinpoint, ↓RR & comatose: trial **naloxone**).
Exposure: Take temperature (& correct hyperthermia)

Risk Assessment

- Agent: (toxin, dose, when taken, and route)
- Clinical features & course. Sometimes serum drug level.
- Patient factors (age, weight, pregnant, PMHx)

Histories may be taken from patient, family, friends, paramedics, police and observers.
Poison Information Centre (131126) or Clinical Toxicologist may help with risk assessment.

Supportive Care

Continued support of ABCs e.g. intubation, O_2, IV fluids, pacing, inotropes, etc
Sedation and seizure control/prophylaxis (**BDZ**)
Metabolic – maintaining normoglycaemia, acid-base balance
Fluid, electrolyte balance & renal function – adequate hydration, haemodialysis if required.
General – e.g. nutrition, IDC, pressure sore prevention, DVT prophylaxis

Investigations

Screening: ECG (rate, rhythm, PR, QRS width, QTc, terminal aVR), BSL, paracetamol level
Others bloods as indicated: FBC, UEC, anion /osmolar gaps, ABG, COHb, LFT, CK, RBC ChE
Drug levels if appropriate: paracetamol, salicylates, theophylline, digoxin, lithium, Fe, EtOH, ethylene glycol, MeOH, MTX, phenobarbitone, carbamazepine, phenytoin, valproate
Urinalysis: ?rhabdomyolysis, save sample for possible toxicological analysis.
Imaging: CXR (?APO, aspiration), AXR (concretions), CT brain (DDx for ↓LOC).

Decontamination, Enhanced Elimination, Antidotes – see specific articles.

Disposition

Retrieval vs EMU vs ward vs ICU. Other specialist teams (paediatric, medical, psych, SW).

Anticholinergic Syndrome

Agitated delirium (fluctuating LOC, slurred speech, picking at objects, confusion) associated with peripheral muscarinic blockade (mydriasis, ↑HR, dry mouth/skin, flushing, ↑T, ↓bowel sounds, urinary retention). Potentially life-threatening.

Examples: Benztropine, antihistamines, TCA, antipsychotics, atropine, *Datura* species

Mx:

- Resus: ABC, O_2, BDZ for fits, correct ↓BSL or ↑T.
- Supportive: Quiet well lit environment. IV fluids, IDC for retention, **BDZ** for agitation.
- Inv: ECG, paracetamol screening tests. Drug level, UEC, CK may be appropriate.
- Antidote: **Physostigmine** centrally acting acetylcholinesterase inhibitor may aid Dx.

Cholinergic Syndrome

Potentially lethal ↑central & peripheral ACh activity at muscarinic & nicotinic receptors.

Affects CNS (agitation, confusion, fits, coma), NMJ (fasciculation, weakness), parasympathetic (miosis, ↑secretions, D&V, ↑urination, ↓HR) & sympathetic (mydriasis, sweating, ↑HR, ↑BP)

Mnemonics: **DUMBELS** (diarrhoea, urination, miosis, bronchospasm, emesis, lacrimation, salivation) or **SLUDGE** (salivation, lacrimation, urination, diaphoresis, GI upset, emesis)

NB: ↑HR > ↓HR (as may be hypoxic, vasodilated). Usually miosis in warfare nerve agent poisoning.

Examples: OP, carbamates, nerve agents (e.g. Sarin), anti-Alzheimer agents (e.g. donepezil), myaesthenia gravis Rx (neostigmine, physostigmine).

Mx:

- PPE & decontaminate patient for OP
- Resus: ABC, suctioning airway secretions, O_2, atropine++, intubation, **BDZ** for fits.
- Supportive: Well ventilated environment & PPE. IV fluids, IDC for monitoring.
- Inv: ECG, paracetamol screening tests. Cholinesterase level, CXR, ABG, UEC.
- Antidotes: **Atropine** & **pralidoxime** (for OP or nerve agents).

Sympathomimetic syndrome

Features include anxiety, delusions, paranoia, diaphoresis, piloerection, ↑HR, ↑BP, hyperreflexia, tremor, mydriasis, arrhythmias and seizures.

Examples: salbutamol, amphetamines, cocaine, MDMA, ephedrine, pseudoephedrine

Mx:

- Resus: ABC, O_2, BDZ for fits, correct ↑T.
- Supportive: Quiet well lit environment. IV fluids, **BDZ** for agitation.
- Inv: ECG, paracetamol screening tests. Drug level, UEC, CK may be appropriate.
- **B-blockers are contraindicated** as unopposed alpha action may → ↑HT, coronary spasm.

Serotonin Syndrome

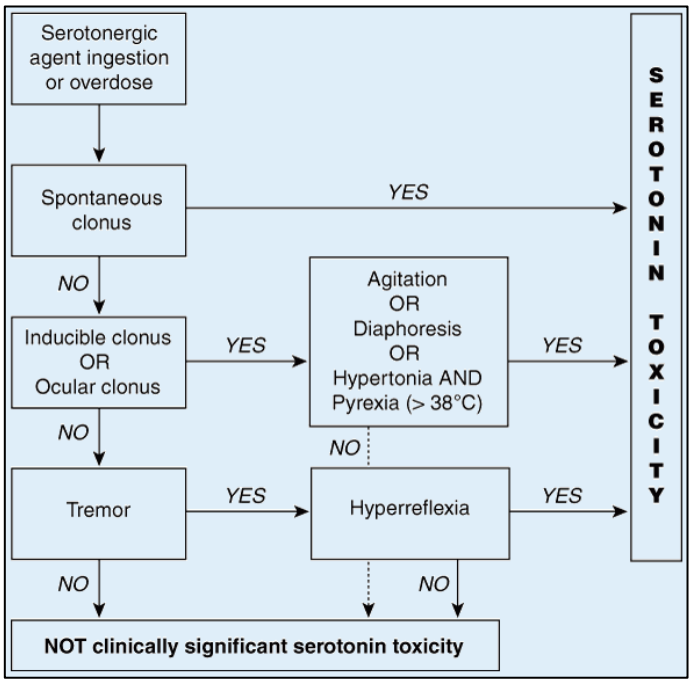
Potentially life-threatening spectrum of serotonin toxicity from therapeutic drug use, inadvertent drug interactions (e.g. MAOI+SSRI), drug OD, or recreational drug use. Results in CNS (anxiety, agitation, confusion), autonomic (hyperthermia, tachycardia, diaphoresis, tremor, flushing), and neuromuscular effects (clonus, hyperreflexia, myoclonus, rigidity).

Sternbach's Criteria.

1. Recent addition or increase in a known serotonergic agent
2. Absence of DDx (infection, drug abuse, withdrawal, etc.)
3. No recent addition or increase of a neuroleptic agent
4. At least three of the following symptoms: Mental status changes, Agitation, Myoclonus, Fever, Hyperreflexia, Diaphoresis, Shivering, Tremor, Diarrhoea, Incoordination

Hunter Serotonin Toxicity Criteria: (see diagram)

1. In the presence of a serotonergic agent:
   - Clonus (inducible, spontaneous or ocular)
   - Agitation
   - Diaphoresis
   - Tremor
   - Hyperreflexia



Examples: Anitdepressants (SSRI, SNRI, TCA, MAOI, St.John's Wort), Li, valproate, MDMA, amphetamine, LSD, tramadol, pethidine, fentanyl, dextromethorphan, metaclopramide, ondasetron

Mx:

- Resus: ABC, O_2, if coma, recurrent seizures or hyperpyrexia (>39.5°C) then intubate
- Treat hyperpyrexia (paralyse, ventilate, cool, consider dantrolene) and ↓BSL
- Supportive: Quiet well lit environment. IV fluids, **BDZ** for agitation/HT.
- Inv: ECG, paracetamol screening tests. Drug level, UEC, CK, Trop may be appropriate.
- Antidotes: **Cyproheptadine** 12mg stat PO then 8mg q8h, **chlorpromazine** 25-100mg IV over 1hr, or **olanzepine** 10mg SL.

Neuroleptic Malignant Syndrome

Rare but potentially lethal complication of neuroleptics characterised by neuromuscular rigidity (lead pipe rigidity, bradykinesia, mutism, staring, dystonia, dysarthria, involuntary movements, incontinence), altered mental status and autonomic instability (↑T, ↑HR, ↑BP, arrhythmias).

Dx: Severe muscular rigidity, pyrexia with 2 of (diaphoresis, ↑BP, ↑HR, incontinence, dysphagia, mutism, tremor, altered LOC, leucocytosis, ↑CK or evidence of muscle injury) in a patient on a antipsychotic where not explainable by another drug, condition or psychiatric disorder.

RF: >1 neuroleptics, haloperidol, depot fluphenazine, young, M, genetics, dehydration, PMH.

DDx: acute lethal (malignant) catatonia, malignant hyperthermia, serotonin syndrome, anticholinergic syndrome, sympathomimetic syndrome, encephalitis, metabolic encephalopathies

Mx:

- Resus: ABC, O_2, if coma or hyperpyrexia (>39.5°C) then intubate
- Treat hyperpyrexia (paralyse, ventilate, cool, consider dantrolene) and ↓BSL
- Usual supportive care. Avoid dopamine antagonists. Cease neuroleptics.
- **BDZs** are controversial but are used in mild cases.
- **GTN** or **nitroprusside** may be used initially for HT
- **Bromocriptine** may be also used for autonomic instability or severe cases.
- Inv: ECG, CXR, ABG, CK, FBC, UEC, CMP, LFT, Cultures, CT/MRI brain, ±LP.
- Antidotes: **Bromocriptine**, **dantrolene**, ECT

Withdrawal Syndromes

Alcohol withdrawal

Usually develops between 6-24hrs after last drink.

Features: Autonomic excitation (tremor, agitation, sweating, ↑HR, ↑BP, N&V, ↑T), neuro-excitation (hyperreflexia, nightmares, hallucinations, generalised seizures), delirium tremens (severe form, mort ~8%, ↓LOC, autonomic & neuro-excitation, respiratory/CVS collapse, death).

Mx:

- Consider other CX of EtOH abuse (Wernicke's, dehydration, malnutrition, infections, pancreatitis, gastritis, liver disease, SDH, ketoacidosis, loss of social support).
- Inpatient (severe, ↓LOC, fits, hallucinations) vs outpatient (motivated)
- If florid DT or fitting – resus, IVC, **BDZ**, treat hypoglycaemia
- Monitor with Alcohol Withdrawal Scale (AWS)
- If significant symptoms by AWS, give **diazepam** 5-20mg PO q1-8h
- Give **thiamine** 100mg PO/IV OD
- Ensure adequate fluids, electrolytes, nutrition
- Consider blood tests (FBC, UEC, LFT, coags, lipase)

Sedative-hypnotic withdrawal

Onset usually 2-10d after abruptly stopping drug – though short acting drugs e.g. GHB may produce symptoms earlier.

Features: Similar to EtOH withdrawal. Agitation, insomnia, inattention, palpitations, hyperacusis/photophobia, hallucinations, spasticity, occasionally severe with seizures/delerium.

Mx:

- Restart sedative or change to longer acting one and taper dose over weeks

Opioid withdrawal

Unlike other withdrawal syndromes, although unpleasant not usually life-threatening. Onset after cessation depends on drug, dose/frequency and degree of dependence. E.g. <6hrs for heroin or >2 days for methadone.

Features: Anxiety, restlessness, insomnia, craving, yawning, lacrimation, rhinorrhoea, salivation, anorexia, N&V, Abdo cramps, diarrhoea, mydriasis, diaploresis/piloerection, flushing, joint/muscle aches, ↑HR & ↑BP if severe.

Mx:

- Usually outpatient management unless severe.
- Opioid replacement – methadone or buprenorphine with slow tapering
- Rapid detoxification using naltrexone, buprenorphine, or clonidine
- Supportive care – may include
    - **Metoclopramide** (N&V)
    - **Buscopan** (abdo cramps)
    - **Paracetamol** (myalgia)
    - **Diazepam** (agitation)
    - **Clonidine** - test with 75mcg PO if no postural hypotension then 50-300mcg PO tds & tapered over 5d.
- Counselling

Gastrointestinal Decontamination

Overview

Risks and required resources have to be balanced against potential benefit.
Risks: Pulm. aspiration, GI obstruction/perforation, ↓supportive/resus care, ↑↑resource use.
Benfits: Improved outcome or clinical course, ↓need for invasive/expensive procedures, ↓LOS
Thus GI decontamination reserved for cases where:

- Sufficient unabsorbed agent remains (usually ≤1hr post ingestion)
- Agent is amenable to removal by selected procedure
- Risk assessment predicts severe or life-threatening toxicity
- Supportive care or antidote treatment insufficient to ensure a satisfactory outcome

Options

- Induced Emesis
- Gastric Lavage
- Single Dose Activated Charcoal (SDAC)
- Whole Bowel Irrigation (WBI)
- Oral binding Agents
- Cathartics
- Surgery

Induced Emesis

Traditonal first line management. **Syrup of Ipecac** (plant –derived emetics) was commonly used. Rarely any indication now. Theoretically could be used if acute ingestion of sig. toxicity with no ↓LOC/seizures and charcoal not available or doesn't bind to the toxin. Amount removed variable.
Dose: 15-30ml (child 15ml) with water. Repeat if no emesis within 30min.
CI: Non-toxic/sub-toxic ingestions, fits/↓LOC (now in next few hrs), charcoal binds toxin & available<1hr, infant, corrosives, hydrocarbons
Cx: Diarrhoea, prolonged vomiting, Mallory-Weiss tear/gastric perforation/pneumomediastinum (all rare), lethargy, pulmonary aspiration if fits/↓LOC.

Gastric Lavage

Sequential admin aspiration of small volumes of fluid from stomach via an OG tube. Also currently out of favour. Amount removed variable and negligible after 1hr. Rarely indicated.
Procedure:

- Resus bay.
- Intubate if any ↓LOC.
- Put in head down left decubitus position.
- Gently pass lubricated 36-40G OG lavage tube.
- Confirm placement (aspiration/litmus, insufflation).
- Repeat 200ml aliquots of warm NS/tap water + dependent drainage until effluent clear.
- Can then give activated charcoal via tube.

CI: Incomplete resus, unprotected airway, risk assessment suggests unnecessary, small children, corrosives, hydrocarbons
Cx: Pulmonary aspiration, hypoxia, laryngospasm, GIT trauma, water intoxication, hypothermia

Single Dose Activated Charcoal (SDAC)

AC produced by super-heating distilled wood pulp→v.large SA. Added to water/sorbitol before administration. Preferred decontamination method but should not be considered routine.

Indicated when adsorbable toxin remains in GIT (<1hr for most agents, but longer if toxin slows gastric emptying or transit time, or a slow-release formulation) and potential benefits > risks. Can be given by NGT/OGT if intubated, however rarely indicated to intubate just for SDAC.
Dose: 50g (child 1g/kg) in cup (may be mixed with ice cream for children).
Toxins not bound:

- Hydrocarbons & alcohols (MeOH, EtOH, ethylene glycol)
- Metals (Li, Fe, K, Pb, As, Hg)
- Corrosives

CI: Non-toxic/sub-toxic ingestions, risk assessment suggests unnecessary, fits/↓LOC (current or imminent), unco-operative, non-binding toxin, corrosive. [NB. can give SDAC if ileus]
Cx: Messy, vomiting, pulmonary aspiration, impaired absof subsequent oral Rx, corneal abrasions

Whole Bowel Irrigation (WBI)

Large volumes of osmotically-balanced **polyethylene glycol-electrolyte solution** (PEG-ELS) administered to flush entire bowel. Aggressive & labour intensive so indicated only when:

- Life-threatening ingestion of SR or EC preparations or of non-SDAC binders
- AND good clinical outcome not expected with supportive/antidote care
- AND patient presents before severe toxicity
- AND not contraindicated e.g. high risk of seizures.

In practice considered for:

- Iron OD >60mg/kg
- SR KCl OD >2.5mmol/kg
- Life-threatening SR verapamil or diltiazem
- Symptomatic arsenic trioxide ingestion
- Lead ingestion
- Body packers

Procedure:

- Assign dedicated nurse & obtain sufficient PEG-ELS
- Insert NG and give **SDAC** via tube if non-metallic ingestion
- Position patient on commode if possible
- Give PEG-ELS 2L/hr (child 25ml/kg/hr) via NGT (can use Kangaroo pump)
- Give **metoclopramide** 10mg IV (adult) to minimise vomiting & ↑gastric emptying
- Continue irrigation until effluent clear (up to 6hrs)
- Cease earlier if abdominal distension or loss of bowel sounds
- AXR may help show clearance of radio-opaque concretions
- Count any expelled packages in body packers

CI: Risk assessment suggests unnecessary, unco-operative, unable to place NGT, uncontrolled vomiting, ileus/GI obstruction likely fits/LOC within 4hr.
Rel CI: Intubated & ventilated (fluid may may pool in oropharynx & leak into lungs)
Cx: N & V, bloating, non-anion gap metabolic acidosis, pulm. aspiration, delayed resus/retrieval.

Oral Binding Agents

Resonium (Sodium Polystyrate), ion exchange resin binds K+ well (± Li, Fe & Te as well).
Fuller's Earth, traditional clay used in paraquat ingestion, but no better than activated charcoal

Cathartics

E.g. sorbitol. Controversial and generally not indicated.

Surgery/Endoscopy

Rarely required – coin-batteries, heavy concretions (lead etc) not removable by other means.

Enhanced Elimination

Overview

Increased rate of removal of an agent to reduce mortality, complications, more invasive interventions, or LOS. In practice useful only when positive risk-benefit analysis and:

- Severe toxicity
- Poor outcome despite supportive care/antidote
- Slow endogenous rate of elimination
- Suitable pharmokinetic properties

Options

- Multiple-Dose Activated Charcoal (MDAC)
- Urinary Alkalinisation
- Extracorporeal Elimination

Multiple-Dose Activated Charcoal (MDAC)

Repeated oral activated charcoal fills GIT → interrupts enterohepatic circulation (effective if small VD) and provides gastrointestinal dialysis (effective if small lipid-soluble molecule with small VD & low protein-binding).

Indications:

- Carbamazepine – reduces duration of intubation & ICU LOS if coma
- Phenobarbitone – reduces duration of intubation & ICU LOS if coma
- Dapsone – V. rare. May reduce prolonged methaemoglobinaemia
- Quinine – Marginal benefit over aggressive supportive care.
- Theophylline – Haemodialysis is more effective.

Procedure:

- 50g (child 1g/kg) PO (OGT/NGT if intubated) initial dose, then 25g (0.5g/kg) q2h
- Check for bowel sounds, and stop if none heard
- Rarely required past 6hrs

CI: ↓LOC without airway protection, bowel obstruction.

Cx: Vomiting, aspiration, constipation, charcoal bezoar formation, bowel obstruction/perforation, corneal abrasion, distraction from Resus/supportive care priorities

Urinary Alkalinisation

Alkalinising urine will promote ionisation of (weak) acids and trap them in renal tubules/collecting ducts. Toxins need to be filtered at the glomerulus and have small VD.

Indications:

- Salicylates – Acute, symptomatic OD. Severe OD should have haemodialysis.
- Phenobarbitone – Inferior to MDAC but may ↓duration of intubation & ICU LOS if coma

Procedure:

- Correct any hypokalaemia first
- 1-2mmol/kg **sodium bicarbonate** IV bolus
- Infuse 250ml/hr (child 50ml/kg/hr) of solution of 100mmol $NaHCO_3$ in 1L **5% dextrose**
- 20mmol **KCl** may be added to each litre of solution to maintain $[K^+]$
- Monitor serum $[HCO_3^-]$ & $[K^+]$ q4h and keep urine at pH>7.5
- Continue until clinical & lab evidence of resolution of toxicity

CI: Fluid overload.

Cx: Alkalaemia (usually well-tolerated), hypoK, hypoCa (mild).

Extracorporeal Elimination

Invasive, specialised equipment/staff, resource intensive techniques with serious potential complications. Reserved for life-threatening poisonings where outcome would otherwise be poor.

Techniques:

- Haemodialysis
- Haemofiltration
- Charcoal Haemoperfusion
- Plasmaphoresis
- Exchange Transfusion

Haemodialysis

Most frequently employed. Requires large double-lumen venous vascath (or A-V fistula), dialyser, dialysate and anticoagulation. Need to be small molecule with small VD, rapid redistribution from tissues and plasma, which has slow endogenous elimination.

Clinical indications: LiCK STAMPS

- **L**ithium – severe, chronic OD
- **C**arbamazepine – massive OD
- **K** (Potassium salt) OD – with life-threatening hyperK+
- **S**alicylates – severe late acute OD or chronic OD with ↓LOC
- **T**heophylline
- Toxic **A**lcohols: Ethylene glycol & methanol
- **M**eformin-induced lactic acidosis
- **P**henobarbitone - coma
- **S**odium valproate – massive OD

Haemofiltration

Continuous A-V or V-V haemodiafiltration (CAVHD, CVVHD) – filters molecules based on fiter pore size. Slower than haemodialysis but less invasive and less impact on haemodynamics.

Charcoal Haemoperfusion

Similar to haemodialysis but blood pumped through a column of activated charcoal. Thrombocytopenia can be a problem. Better clearance rates than haemodialysis and need not be small or water soluble, however need charcoal filter which is not always available.

Indications:

- Higher clearance than dialysis: salicylates, theophylline, phenobarbitone, carbamazepine, paraquat.
- Non-dialysable toxins: phenytoin.

Plasmaphoresis & Exchange Transfusion

Don't appear to be employed very often.