POISONING - PAEDIATRIC

**Introduction**

- Unintentional poisoning is most common in the 12 to 36 month age group.
- Most small children will only take 2 to 3 tablets or one mouthful of substance.
- Serious sequelae are rare.
- Supportive care and observation are the mainstays of treatment.
- Beware of causing harm - a risk assessment is essential before considering decontamination or treatment.
- Small ingestions of some substances can cause very serious injury in a small child.

**One or two tablets that can be lethal to a 10kg toddler**

- Calcium channel blockers (eg Diltiazem, Verapamil), especially high dose slow release (SR) preparations
- Amphtetamines
- Dextropropoxyphene (in “Paradex”)
- Tricyclic antidepressants
- Chloroquine
- Opioids
- Sulphonylureas
- Theophylline

**Small volumes of non-pharmaceuticals than can result in severe toxicity**

- Organophosphates
- Paraquat
- Camphor
- Naphthalene
- Hydrocarbons, Solvents, Eucalyptus oil, Kerosene

Poisoning should be considered in the child with unexplained abnormal vital signs, altered neurology or metabolic disturbance.

Consider non accidental injury (NAI) in non-ambulatory children, older children or large ingestions.

Older children/adolescents may present with deliberate self harm (intentional poisoning).
Approach to Paediatric Toxicology

1. Resuscitation
2. Risk assessment
3. Supportive care
4. Decontamination
5. Enhanced elimination
6. Antidotes
7. Disposition

Resuscitation

Resuscitation takes priority over decontamination and administration of antidotes (unless necessary for resuscitation e.g. NaHCO₃)

Airway
- Intubation likely to be indicated in the following situations:
  - Cardio-respiratory arrest
  - Airway injury
  - Corrosive ingestion
  - Decreased level of consciousness (GCS<8) or anticipated decrease in GCS
  - Prolonged seizures
  - Severe agitation or to facilitate treatment/investigations

Breathing
- Oxygen/ventilation if required

Circulation
- Support perfusion as needed
  - IV fluids (20ml/kg 0.9% NaCl if shocked) (see Shock guideline)
  - Inotropes
- Treatment of hypertension (see Hypertension guideline)
  - Beta-blockers should be avoided in sympathomimetic toxicity
- Arrhythmia
  - NaHCO₃ (1mmol/kg repeated as necessary) if sodium channel blocker ingested
    - Suspect if prolonged QRS, large R wave in aVR
  - Generally poor response to defibrillation in poisoning

Examples of sodium channel blockers

<table>
<thead>
<tr>
<th>Local anaesthetics</th>
<th>Propranolol</th>
<th>Quinidine</th>
<th>Flecanide</th>
<th>First generation antihistamines</th>
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<tbody>
<tr>
<td>Cocaine</td>
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<td>Bupivacaine</td>
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<tr>
<td>Propranolol</td>
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<tr>
<td>Dextropropoxyphene</td>
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<tr>
<td>Carbamazepine</td>
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Author: Dr Emma Batistich, Dr Mike Shepherd
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Editor: Dr Raewyn Gavin
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Disability

- Sedation (benzodiazepines are the mainstay)
  - Midazolam (0.1-0.2mg/kg) is most commonly used
- Seizure control (note – NOT conventional treatment)
  - Repeat doses of Midazolam (0.15mg/kg IV)
  - Phenobarbitone (20mg/kg IV) as second line
  - Phenytoin should NOT be used
    - Prolongs sodium channel blockade
- Treatment of hypoglycaemia
- Maintain normothermia
  - Management of hyperthermia
    - Benzodiazepines
    - Physical cooling
    - May require intubation and paralysis

Risk Assessment

Risk assessment is a distinct cognitive process through which the clinician attempts to predict the likely clinical course and potential complications for the individual patient at that particular presentation.

Risk assessment should be quantitative and take into account agent, dose, time of ingestion, current clinical status and individual patient factors (for example, weight and co-morbidities).

The risk assessment is essential to determine the course of the poisoning and will guide treatment, investigations, period of observation and disposition.

Attempt to elucidate and clearly document:
1) What substance(s) have been ingested?
2) How much of each substance has been ingested – including a calculation of amount of substance per kg?
3) What time the ingestion occurred?
4) What clinical features have occurred thus far?
5) What other relevant patient factors (patient weight, other medical problems etc) are present?

Then discuss with senior staff and/or consult poisons information

If the ingestant is unknown:
- Consider all possible medications or toxins accessible in the house
  - All family members medications
  - Non-pharmaceutical agents
  - Drugs of abuse
- Conduct tablet counts of missing medication

Consider the worst case scenario, including:
- That all the missing tablets were taken
- That the ingestion time is the latest time possible
- That there has not been significant spillage
- That one child has ingested all of the missing poison.
Focused clinical examination
- Especially important if ingestant is unknown
- Toxidromes - See Appendix

Screening tests
No tests are routine
These will be determined by risk assessment and may include:
- Blood sugar level
- ECG
- Paracetamol level
  - Should be requested in all children/young people following any intentional ingestion
- Other screening tests should be guided by risk assessment
  - Other drug levels
  - Blood gases
  - Radiology

Supportive care
For most children the only treatment required is good supportive care
- Observation
- Hydration
- Nutrition
- Sedation
- Treatment of
  - Hypo/hyperthermia
  - Hypo/hyperglycaemia
  - Agitation
  - Seizures

Decontamination
This is rarely required and must not distract from resuscitation and supportive care
- Skin
  - Wash off with soapy water
- Eyes
  - Irrigate with 0.9% NaCl until pH is <8.0
- GI tract
  - Dilution with milk/water is generally not recommended
  - Emesis should never be induced
  - Gastric lavage – is not recommended as no demonstrated benefit compared to a single dose of activated charcoal.
Activated charcoal (AC)
- Is rarely indicated in paediatric poisoning
- The use of AC carries a risk of aspiration and subsequent chemical pneumonitis
- Indicated only if ALL of the following are true:
  - Presentation within 1 hour of Ingestion
  - Toxin is adsorbed by AC
  - Patient is currently maintaining own airway and risk assessment determines that their GCS will remain normal
  - Otherwise only give if airway is protected
  - The substance has **significant toxicity** and is not easily treatable
- Dose = 1g/kg
- Can be made more palatable by mixing with ice-cream

Toxins not adsorbed by activated charcoal
- Acids/alkalis
- Alcohols
- Metals and ionic compounds (iron, potassium, lithium)
- Hydrocarbons

Whole bowel irrigation (WBI)
- Is very rarely performed
- Indicated if:
  - Ingestion of a slow release or extended release substance or a substance not bound to AC and
  - Presentation prior to symptom onset and
  - Ingestion is likely to result in significant toxicity despite supportive care or antidote therapy
- Polyethylene glycol (Golytely) – 30ml/kg/h until effluent runs clear

Possible indications for WBI
- Iron (>60mg/kg elemental iron ingested)
- Sustained release diltiazem/verapamil
- Slow release potassium chloride

**Enhanced Elimination**

This is very rarely required and **must not distract** from resuscitation and supportive care

Multidose activated charcoal
- Can interrupt enterohepatic circulation and promote gut dialysis
- May be indicated with large ingestions of Carbemazepine, Dapsone, Phenobarbital, Quinine, Theophylline
- 1g/kg activated charcoal q4h
Urinary alkalisation
- Alkalisation promotes ionization of highly acidic drugs, therefore prevents reabsorption across tubule and increases renal excretion.
- Indications
  - Salicylates (however if severe toxicity this should not detract from urgent haemodialysis)
  - Phenobarbitone
- Administration
  - 1-2 mmol/kg NaHCO₃ stat then titrate (can infuse further doses over 1-2 hours)
  - Aim for urinary pH >7.5

Extracorporeal elimination (haemodialysis)
- Haemodialysis is effective if toxin is water soluble, low molecular weight, not protein bound and has a small volume of distribution
  - E.g. alcohols, lithium, chloral hydrate, amphetamine, camphor, heavy metals, salicylates, theophylline, valproate or carbamazepine
- Indications are based on drug levels, biochemistry and clinical symptoms
- Intensive care required

Antidotes
- Pharmacological antagonists and chelating agents
- Only useful in a small minority of poisonings
- Administered when the potential therapeutic effect outweighs the adverse effects

Examples of some available antidotes

<table>
<thead>
<tr>
<th>POISON</th>
<th>ANTIDOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>N-acetylcysteine – see guideline</td>
</tr>
<tr>
<td>Opioids</td>
<td>Naloxone</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>Flumazenil</td>
</tr>
<tr>
<td>Sodium channel blockers</td>
<td>NaHCO₃</td>
</tr>
<tr>
<td>Iron</td>
<td>Desferroxamine</td>
</tr>
<tr>
<td>Glipizide</td>
<td>Octreotide</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Digoxin fab-fragments (Digi-bind)</td>
</tr>
<tr>
<td>Organophosphates</td>
<td>Pralidoxime, atropine</td>
</tr>
<tr>
<td>Beta blockers, Ca²⁺ channel blockers</td>
<td>Insulin/dextrose euglycaemic therapy</td>
</tr>
</tbody>
</table>

For further information see Toxicology Handbook (Murray, Daly, Little, Cadogen). Elsevier. 2007

Disposition
- Should be directed by risk assessment
- Some children can be safely discharged after brief or no observation.
- Others may require admission for ongoing observation and treatment
Unknown ingestant
- Assume worst case scenario – a potentially lethal ingestion
- Observe for a minimum of 12 hours
  - Monitor cardio-respiratory status and neurology
  - Cardiac monitoring if any evidence of abnormal vital signs
- IV access can be deferred unless evidence of toxicity present
- Investigations
  - BSL at presentation and discharge
  - ECG
- Discharge only in daylight hours

Other considerations
- Child safety and parental education
  - Safe storage of toxins
  - Supervision
  - Social work review might be indicated
  - Consider non-accidental injury
- Discharge instructions

Deliberate self harm
- Psychiatric review is mandatory prior to discharge

Prevention
- The prevention of unintentional poisoning should be promoted throughout the community.
- Child resistant packaging and safe storage has been shown to decrease the incidence of childhood poisoning.
- Other measures include:
  - Smaller volume prescribing
  - Child resistant lids
  - Education about safe storage of medications, out of reach of children
  - Store in cupboards with child resistant latches
  - Home visits to target this advice

Resources
- Poisons information centre 0800POISON
- Toxins database (www.toxinz.co.nz)
  - This is an extensive database of most toxins
  - Information is generally accurate but generic at times (particularly with regard to decontamination). Consider each case on its merits. If in doubt discuss with ED consultant.
  - Toxicology Handbook (Murray, Daly, Little, Cadogen). Elsevier. 2007.
    - An excellent reference guide with a very sensible approach to poisoning
# POISONING - PAEDIATRIC

- Poisonous plants in New Zealand.
  [http://www.landcareresearch.co.nz/publications/infosheets/poisonplants/Poisonous_plants_nz.pdf](http://www.landcareresearch.co.nz/publications/infosheets/poisonplants/Poisonous_plants_nz.pdf)
  - Excellent resource for prevention information

## Appendix: Toxidromes

<table>
<thead>
<tr>
<th>Toxidrome</th>
<th>Effects</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticholinergic</strong></td>
<td>Delirium + peripheral effects</td>
<td>- 1st generation antihistamines</td>
</tr>
<tr>
<td></td>
<td><em>Mad as a hatter</em></td>
<td>- Tricyclic antidepressants</td>
</tr>
<tr>
<td></td>
<td>- Confusion, hallucinations, seizures, coma</td>
<td>- Antitussives</td>
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<tr>
<td></td>
<td><em>Red as a beet</em></td>
<td>- Antipsychotics</td>
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<tr>
<td></td>
<td>- Flushed skin</td>
<td>- Anticonvulsants</td>
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<tr>
<td></td>
<td><em>Blind as a bat</em></td>
<td>- Antimuscarinics</td>
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<tr>
<td></td>
<td>- Mydriasis</td>
<td>- Atropine, Scopolamine, Ipatropium bromide</td>
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<tr>
<td></td>
<td><em>Hot as a hare</em></td>
<td>- Plants</td>
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<tr>
<td></td>
<td>- Hyperthermia</td>
<td>- Some mushrooms, Datura</td>
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<tr>
<td></td>
<td><em>Dry as a bone</em></td>
<td>- Insecticides</td>
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<tr>
<td></td>
<td>- Dry skin, urinary retention, ileus</td>
<td>- Organophosphates</td>
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<tr>
<td></td>
<td></td>
<td>- Carbamates</td>
</tr>
<tr>
<td><strong>Cholinergic</strong></td>
<td>Diaphoresis</td>
<td>- Chemical warfare agents</td>
</tr>
<tr>
<td></td>
<td>- Diarrhoea (&amp; abdo cramps)</td>
<td>- Ricin, Tabun, Soman, VX</td>
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<tr>
<td></td>
<td>Urination</td>
<td>- Alzheimer's medication</td>
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<td></td>
<td>Miosis (or mydriasis)</td>
<td>- Donepezil</td>
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<tr>
<td></td>
<td>- Bronchospasm</td>
<td>- Agents used for myasthenia gravis</td>
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<tr>
<td></td>
<td>- Bronchorrhoea</td>
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<tr>
<td></td>
<td>- Bradycardia</td>
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<td>E Emesis</td>
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<td></td>
<td>- Emesis</td>
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<td></td>
<td>- Lacrimation</td>
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<tr>
<td></td>
<td>- Salivation</td>
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<tr>
<td><strong>Sympathomimetic</strong></td>
<td>Alpha</td>
<td>- Alpha</td>
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<tr>
<td></td>
<td>o Hypertension</td>
<td>- Phenylephrine, OTC cold preps</td>
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<tr>
<td></td>
<td>o Bradycardia</td>
<td>- Beta</td>
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<tr>
<td></td>
<td>o Mydriasis</td>
<td>- Salbutamol, Theophylline, Caffeine</td>
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<tr>
<td></td>
<td>Beta</td>
<td>- Alpha and beta</td>
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<tr>
<td></td>
<td>o Hypotension</td>
<td>- Amphetamine, Cocaine, Pseudo/ephedrine, OTC cold preps, MDMA (ecstasy)</td>
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<tr>
<td></td>
<td>o Tachycardia</td>
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<tr>
<td></td>
<td>o Miosis</td>
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<tr>
<td><strong>Sedative/hypnotics</strong></td>
<td>Decreased LOC</td>
<td>- Benzodiazepines</td>
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<td></td>
<td>Hypoventilation</td>
<td>- Barbiturates</td>
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<tr>
<td></td>
<td>Hypotension</td>
<td>- Alcohols</td>
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<tr>
<td></td>
<td>Bradycardia</td>
<td>- Opioids</td>
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<tr>
<td></td>
<td>Opioids and barbiturates</td>
<td>- Anticonvulsants</td>
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<tr>
<td></td>
<td>o Miosis</td>
<td>- Antipsychotics</td>
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<td></td>
<td>o Hypothermia</td>
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### Serotonergic

<table>
<thead>
<tr>
<th>CNS</th>
<th>Neuromuscular</th>
<th>Autonomic</th>
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<tbody>
<tr>
<td>Anxiety, agitation, hallucinations, seizures, coma</td>
<td>Tremor, Hyper-reflexia and clonus (LL&gt;UL), Myoclonus, Rigidy</td>
<td>Flushing/sweating, Tachycardia, Hypertension, Hyperthermia</td>
</tr>
</tbody>
</table>

- Antidepressants
  - SSRIs, SSNRIs, MAOIs, TCADs
- Analgesics
  - Tramadol, Pethidine, Fentanyl
- Drugs of abuse
  - Amphetamine, MDMA (ecstasy), LSD
- “Dietary supplements”
  - St John’s Wort, Ginseng

### Hallucinogenic

<table>
<thead>
<tr>
<th>Hallucinations</th>
<th>Psychosis</th>
<th>Panic</th>
<th>Fever</th>
<th>Mydriasis</th>
<th>Hypertension</th>
</tr>
</thead>
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<tr>
<td>Hallucinations</td>
<td>Psychosis</td>
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<td>Hypertension</td>
</tr>
</tbody>
</table>

- Amphetamine
- Cannaboids
- Cocaine
- LSD
- PCP
- Magic mushroom - Psilocybin species