INSECTICIDES

GLYPHOSATE:

WIDELY USED HERBICIDE

SEVERE TOXICITY RESULTS FROM DELIBERATE INGESTION OF CONCENTRATED FORMULATION

MAINFESTS WITH GI CORROSIVE SYMPTOMS → IN LARGE INGESTIONS, SEVERE METABOLIC ACIDOSIS AND CARDIOVASCULAR COLLAPSE CAN OCCUR

RISK ASSESSMENT:

- Ingestion of concentrated formulation pose greatest risk
- Acute corrosive injury to the upper airway poses an immediate threat to life
- Poor prognostic features → ↑HR, abnormal CXR, metabolic acidosis, ↑K and rising creatinine
- Dilute → minor GI irritation
- Dermal → skin irritation only
- >150mL of concentrate → severe GI symptoms, risk of early airway swelling, may develop multi-system toxicity → MODS within 24 hours
- >300mL concentrate → potentially fatal, death usually from refractory shock

TOXIC MECHANISM:

- Toxicity is thought to be due to surfactant effect rather than glyphosate itself, with uncoupling of mitochondrial oxidative phosphorylation, direct myocardial depression and hypotension

CLINICAL FEATURES:

- **GI** → irritation occurs early with GI upset, oropharyngeal/oesophageal erosions
- **CV** → hypotension and myocardial depression
- **Respiratory** → URT irritation/drooling, aspiration pneumonitis, non-cardiogenic pulmonary oedema
- **May develop MODS due to myocardial depression and systemic acidosis**

MANAGEMENT:

- Intubate early if any evidence of airway compromise from corrosive injury
- Treat hypotension with volume replacement and then vasopressors if unresponsive
- Dialysis enhances elimination, but is not often used (other than in worsening acidosis or refractory shock)

ORGANOCHLORINES:

PESTICIDES THAT ARE WIDELY USED IN AGRICULTURE

ACUTE INGESTION OR REPEATED LARGE DERMAL EXPOSURE CAUSES NEUROLOGICAL TOXICITY INCLUDING SEIZURES AND COMA

RARELY, VENTRICULAR ARRHYTHMIAS OCCUR DUE TO SENSITISATION OF MYOCARDIUM TO CATECHOLAMINES

MANAGEMENT IS SUPPORTIVE

RISK ASSESSMENT:

- Estimated lethal ingested dose is 125mg/kg in adults, but toxic dose for dermal absorption is not well defined. Kids will develop symptoms after 50mg.

TOXIC MECHANISM:

- Cyclodienes are non-competitive antagonists acting at the chlorine channel of GABA-a receptors. DDT act by inhibiting sodium channel closure following depolarisation → BOTH ARE NEUROEXCITATORY

TOXICOKINETICS:

- Rapidly absorbed following oral ingestion, but degree of dermal absorption depends on agent, concentration, solvent and skin integrity
- HIGHLY LIPID SOLUBLE

CLINICAL FEATURES:

- Main features are N+V, anxiety, agitation, confusion, perioral paraesthesiae, myoclonus → seizures/coma
- Features develop within hours of acute ingestion and over hours to days following dermal exposure
- Hypotension, cardiac dysrhythmia and ventricular ectopy are rare complications → hypoxaemia and acidosis contribute to myocardial sensitisation to catecholamines
- Hepatitis and AKI reported rarely

MANAGEMENT:

- Good supportive care paramount
- Early life threats → coma, seizures (benzo) and ventricular arrhythmia

PARAQUAT:

WIDELY USED HERBICIDE THAT IS POTENTIALLY LETHAL FOLLOWING INGESTION OF LITTLE AS A MOUTHFUL

IF THE DOSE IS INSUFFICIENT TO CAUSE FULMINANT MULTI-ORGAN FAILURE AND DEATH, THEN SEVERE GASTROINTESTINAL CORROSIVE INJURY AND RAPID ONSET OF PULMONARY FIBROSIS ARE COMMON

IMMEDIATE DECONTAMINATION AND AVOIDANCE OF SUPPLEMENTAL OXYGEN ARE MAINSTAYS OF TREATMENT

RISK ASSESSMENT:

- Deliberate self-poisoning with more than a mouthful is INVARIABLY FATAL
- Taste/splash unlikely to cause problems
- No problems with dermal or inhalational exposure
- <30mg/kg or <0.15mL/kg of 20%→ mild to moderate GI effects with full recovery
- 30-50mg/kg or 0.15-0.25ml/k of 20% → significant GI corrosive injury followed by multi-organ failure (including renal/hepatic injury) than pulmonary fibrosis several days post ingestion
- >50mg/kg or >0.25mL/kg of 20% → fulminant multi-organ failure and alveolitis resulting in progressive refractory hypoxia, metabolic acidosis, renal/hepatic injury with CV collapse → death within 12 hours – 7 days

TOXIC MECHANISM:

- It is a caustic agent specifically transported into pneumocytes, where it causes superoxide production and depletes superoxide dismutase and NADPH with oxygen free-radical related lipid peroxidation

TOXICOKINETICS:

- Dermal and inhalational absorption are minimal
- Distributed to highly vascular tissues (kidney, liver, lungs, heart, muscle)
- Oral absorption is small, but rapid

CLINICAL FEATURES:

- Following large ingestions, multi-organ effects become apparent within hours
- ↑HR, ↑RR accompany metabolic acidosis/hypokalaemia → CV collapse/MOF/death
- Patients with moderate ingestion may not develop systemic toxicity but then go on to develop a delayed progressive pulmonary injury characterised by pulmonary fibrosis → dyspnoea/hypoxia which progresses until death occurs within days to weeks

INVESTIGATIONS:

- Urinary paraquat is accurate within first 12 hours, but it confirms exposure only

MANAGEMENT:

- Paraquat intoxication is a TIME-CRITICAL EMERGENCY
- It is the ONLY POISONING IN WHICH DECONTAMINATION TAKES PRIORITY OVER RESUSCITATION (IDEALLY IT SHOULD TAKE PLACE AT THE SCENE PRIOR TO TRANSPORT)
- In those with close to the lethal threshold dose, the aim of management is to improve prognosis by reducing dose that reaches the lungs with EARLY DECONTAMINATION AND HAEMODIALYSIS
- DO NOT ADMINISTER SUPPLEMENTAL OXYGEN UNLESS SATS <90%
- DECONTAMINATION:
    - At the scene → administer food/soil to adsorb paraquat and reduce GI absorption
    - CHARCOAL immediately on arrival
- ENHANCED ELIMINATION:
    - Haemodialysis with greatest urgency in those with close to lethal dose but will not prevent death following large deliberate self-poisoning
    - Haemodialysis will prevent paraquat if performed early before distribution to tissues
- NO ANTIDOTES AVAILABLE
- PATIENTS WITH HISTORY MASSIVE INGESTION AND EARLY CLINICAL FEATURES OF INTOXICATION HAVE A HOPELESS PROGNOSIS AND ARE MANAGED PALLIATIVELY FROM THE OUTSET