Paraquat

Overview

Widely used hydrophilic herbicide which may cause GI corrosive injury, fulminating multi-organ failure, pulmonary fibrosis & death with a single mouthful. Supplemental O_2 must be avoided.

Toxic mechanism

Caustic actively taken up by pneumocytes and produces free radicals & reactive oxygen species (incl superoxide, hydroxyl, nitrite & peroxinitrite) leading to oxidative damage, lipid peroxidation, mitochondrial damage, inflammation via activation of NF-κB, and apoptosis

Toxicokinetics

Rapid but poor abs (<5%) reduced further by food in stomach. Minimal dermal/inhalational abs. V_d ~1.4L/kg. Distributes to highly vascular organs (liver, kidneys, heart, muscle & lungs). Renal elim unchanged. $T_{\frac{1}{2}}$ init 6h but ↑ to 4d 24h post OD with renal & other organ damage.

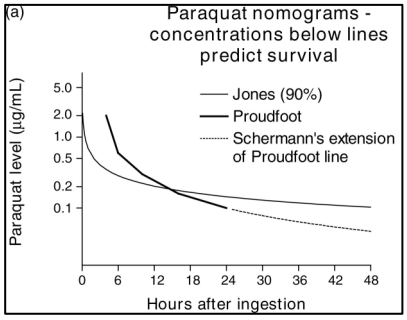
Clinical features

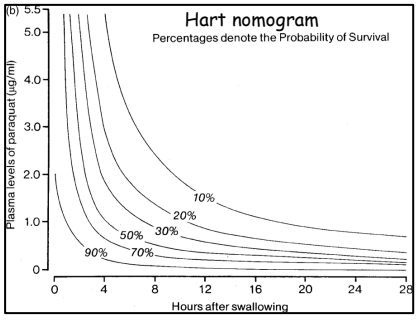
Tongue, oral burns, vomiting, upper GI perforation. Large ingestions: multi-organ effects within hrs: ↑HR, ↑RR, alveolitis, met acidosis (↑lactate), hypoK, death within 24hr.

Time	Effect
Immediate	Vomiting, GI injury
Hours	Corrosive injury to lips & oral cavity. Metabolic acidosis in large ingestions
24-48hr	Progressive acidosis, shock, RF, hepatic injury, hypoxaemia in large ingestions
>48hr	Progressive pulmonary injury and rapid development of pulmonary fibrosis

Investigations

Screening: ECG, paracetamol, BSL
Specific bloods: SaO_2 & spirometry, ABG, lactate, FBC, EUC, LFT, CXR, urine dithionite test (if turns blue – poor prog) and plasma/serum paraquat (useful for prognosis using nomograms/formulas)





Sawada: SevIdxPQPoisoning=[serum PQ(μg/ml)]×[hrs from ingestion to Rx]: <10 may survive, 10-50 late death (resp failure), >50 early death (CVS failure)
Ikebuchi: D = 1.3114 – 0.1617 (ln [hrs from ingestion]) – 0.5408 (ln [ln([plasma PQ(μg/ml)] × 1000)]): >0.1=survival, <0.1=death
Jones: Survival probability = exp(logit)/[1 + exp(logit)] where logit = 0.58 – 2.33 × log(plasma PQ(μg/ml)) – 1.15 × log(hrs from ingestion)

Risk assessment

Dose	Effect
<30mg/kg (<0.15ml/kg of 20% sol)	GIT symptoms with expected full recovery
30-50mg/kg (0.15-0.25ml/kg of 20% sol)	Significant corrosive GI injury, multi-organ failure, followed by pulmonary fibrosis after several days.
>50mg/kg (>0.25ml/kg of 20% sol)	Fulminant multi-organ failure and alveolitis. Death within 12h-7d

Management

Decontamination: Time-critical. Only poisoning where decontamination comes first. At scene give food, soil, or Fuller's earth. In hospital give immediate charcoal if <2-4h post OD.
Resus & Supportive Care: ABCs if req. **Only give O_2 if SaO_2<90%.** ↓GCS in severe cases. NGT.
Enhanced Elimination: Early (<2-4hrs) haemodialysis (or haemoperfusion) if dose near lethal threshold, futile if severe or late.
Antidotes: All unproven: 'Immunosuppresion'-**dexamethasone** or cyclophosphamide; Antioxidants-**N-acetylcysteine**, **salicylates**, **vitamins C** & E, desferrioxamine, superoxide dismutase, or NO

Disposition

If well & negative dithionite test at 6h →d/c, otherwise→ICU or palliate if >3.5ml/kg of 20%