Respiratory Toxicities

Respiratory Toxicities

Problems

- Dyspnoea, lethargy, weakness
- Coughing, pallor, anorexia
- Vomiting
- Mucous membranes
- Pale, Red or Brown

Respiratory Toxicities

Differential diagnoses:

- Nitrites, Onions, Paracetamol
  - Methaemoglobinaemia
- Cyanide
  - cytochrome oxidase complex
- Carbon monoxide (CO)
  - Carboxyhaemoglobin
  - Smoke inhalation

Respiratory Toxicities

Differential diagnoses:

- Anticoagulant Rodenticides
- Paraquat - herbicide
- Selenium – trace mineral
- Zinc Phosphide (Mg & Al phosphide)
- PAPP - new pesticide

Respiratory Toxicities

Differential diagnoses:

- Copper
- Teflon pans (birds)
- L-tryptophan (fog fever, atypical interstitial pneumonia)
- Goats rue (Galega officinalis)

Respiratory Toxicities
NITRATES/NITRITE

Sources:

- Pasture plants
  - weather & fertiliser affects nitrate levels
- Crops (Brassicas, oats …)
- Weeds (especially herbicide treated)
- Water
- Fertilisers
- Dog rolls – nitrite

Respiratory Toxicities
NITRATES/NITRITE

Mechanism of Action:

- Rumen microbes convert nitrate to nitrite
- Nitrite oxidises haemoglobin to methaemoglobin
  - brown blood
- Methaemoglobin reductase has a limited capacity to detoxify

Respiratory Toxicities
NITRATES/NITRITE

Clinical Signs:

- Respiratory Effects
  - Dyspnoea and cyanosis (brown blood)
- Gastrointestinal Effects
  - Irritation to GI tract – Salivation, pain
- Central Nervous System Effects
  - Ataxia, tremors, convulsions
- Vasodilation (contributes to tissue anoxia)

NITRATES/NITRITE

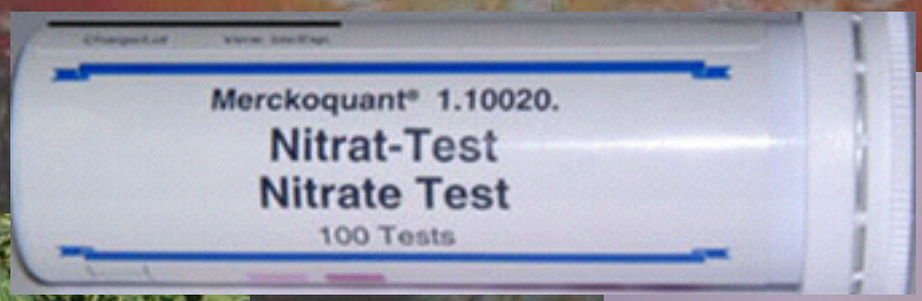
Diagnosis:

- History
  - pasture, crop, weather
- Clinical Signs
  - brown blood, sudden death
- Diphenylamine test on plants

NITRATES/NITRITE

Diagnosis:

- nitrate test strips (Merckoquant)
- aqueous humour up to 60 hours PM (>10ppm)
- Plant Samples to laboratory to quantify



Respiratory Toxicities
NITRATES/NITRITE

Treatment:

- Do NOT stress the animals
  - triage of affected animals
- Provide safe feed (hay or pasture)
- Methylene blue (not licensed)
  - converts methaemoglobin back to oxyhaemoglobin
  - Issues – long default withholding time

Respiratory Toxicities

CYANIDE

- Cyanogenic Plants – Livestock
  - Poa aquatica (S.I.)
  - Apple seeds, cherry pits, peach pits, and plum pits contain cyanide
- Pesticide (Feratox)
- Fast acting death < 30 mins
- Smells like almonds

Respiratory Toxicities

CYANIDE - Mechanism of Action

- Inactivation of cytochrome oxidase
- Cyanide forms complex with Fe+3
- Prevents oxygen exchange
- Initially bright red blood
- Tissue anoxia results

Respiratory Toxicities

CYANIDE - Clinical Signs

- Salivation
- Rapid breathing - dyspnoea
- Rapid heart rate
- Weakness
- muscle fasciculations
- urination, defaecation

Respiratory Toxicities

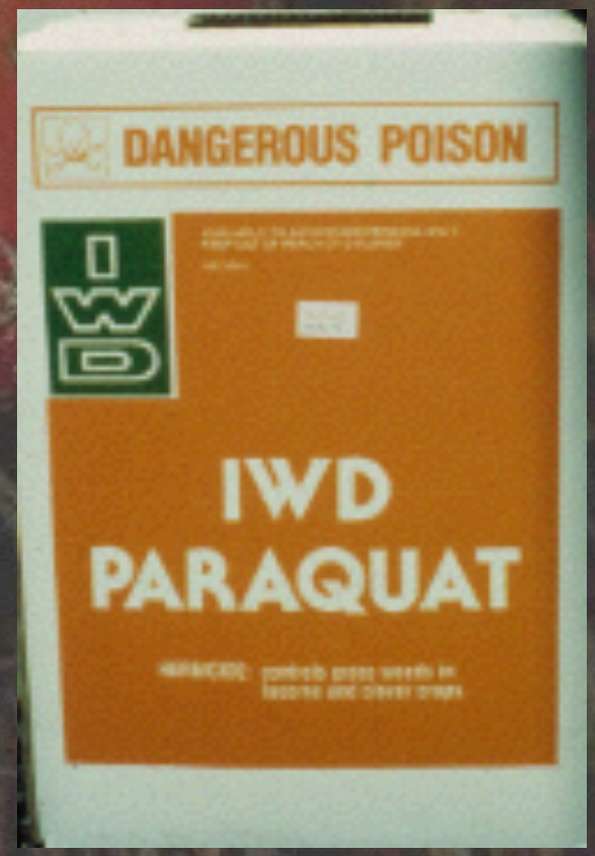
CYANIDE - Treatment

- ABOVE ALL ELSE TAKE CARE TO AVOID HUMAN TOXICITY!!!!
- Do NOT treat unless clinical signs
  - amyl nitrite or sodium nitrite
  - followed by thiosulphate (if available)
- Hydroxycobalamin used in Europe

Respiratory Toxicities

PARAQUAT

- Sources - Herbicide usage
- Toxicity
  - dog 25-50 mg/kg
  - diquat is 100-200 mg/kg
- Pathogenesis
  - irritant orally or dermally
  - accumulates in the lungs
  - fibrosis due to superoxide radicals that induce lipid peroxidation



Respiratory Toxicities

PARAQUAT - Toxicokinetics

- Absorption - poor 20%
- Lung concentrates
  - alveolar cells 10X levels
- Excreted in urine
  - generally unchanged
  - after 24-48 hours not detectable

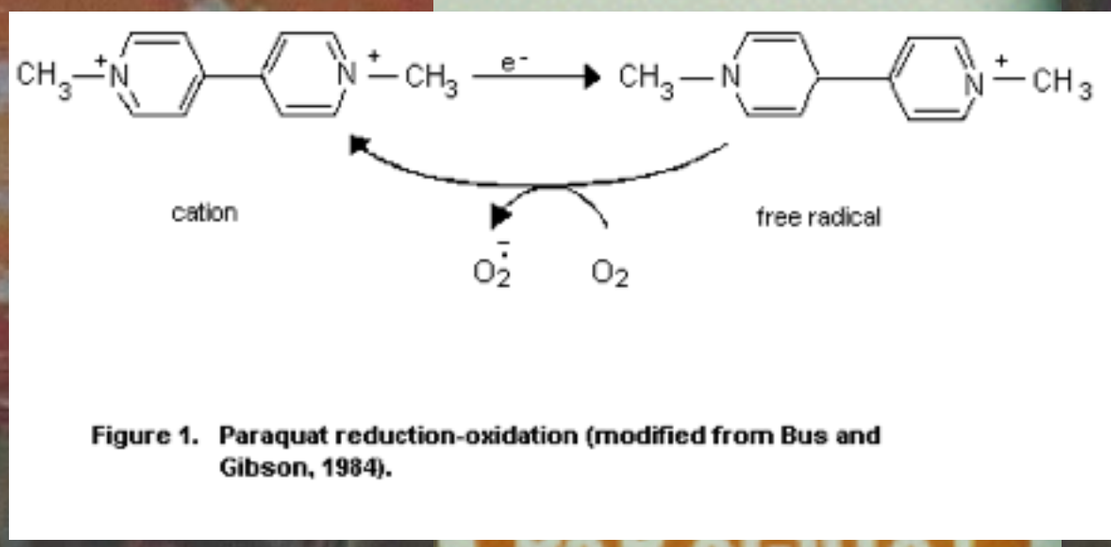
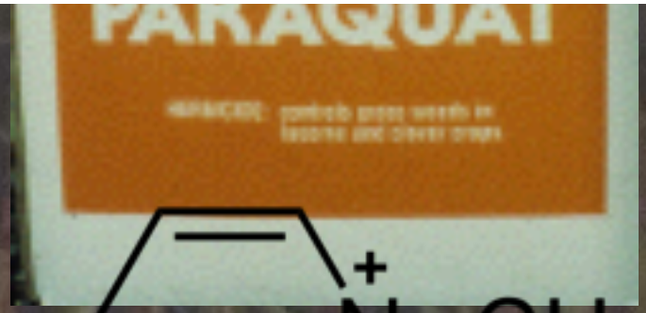


Figure 1. Paraquat reduction-oxidation (modified from Bus and Gibson, 1984).



Respiratory Toxicities

PARAQUAT - Clinical Effects

- Oral lesions-irritation, blisters
- 3 phases in acute poisoning
- 1) Caustic action
  - Vomiting
  - Abdominal pain
- 2) Renal injury + hepatocellular necrosis by 2nd or 3rd day
- 3) Pulmonary Fibrosis
  - poor prognosis

Respiratory Toxicities

PARAQUAT - Diagnosis

- History of exposure
- Collect urine within 24 hours of exposure
- Plasma levels up to 30 hours
- Lung levels detectable 4 days

Respiratory Toxicities
PARAQUAT TREATMENT

- Early decontamination
  - Repeat Activated Charcoal
- Fluid therapy (diuresis)
- captopril ? within 1 hour
- DO NOT give Oxygen!
- Anti-oxidants Vit E, C
- N-Acetyl cysteine (Parvolex)
  - alternative S-carboxymethylcysteine

Respiratory Toxicities
SUMMARY

- Early decontamination
- Nitrate/nitrite
  - Methylene blue
- Cyanide
  - Na nitrite + Na thiosulphate or amyl nitrate
- Paraquat
  - NAC, Anti-oxidant therapy?

What do you do?

- A farmer is grazing dairy heifers on green oats in June.

The farmer discovers one dead this morning and several others in sternal recumbency. You arrive within an hour and examine the heifers. Clinical signs of the recumbent heifers include: dyspnoea, rapid heart rate and "muddy" mucous membranes. You observe that several other heifers in the group have a range of clinical signs from evidence of abdominal pain and diarrhoea, to ataxia, dyspnoea and hyperpnoea with cyanosis.