

# Cyanide toxicity in patients with burns

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# Inhalational injury

- Doubles burn mortality
- Direct thermal injury - chemical irritation - carbon monoxide/cyanide poisoning
- Incidence cyanide intoxication with inhalation injury unknown (no blood cyanide levels) but reported up to 75%
- Products of combustion of cyanide containing synthetic substances

# Pathophysiology

- Binds to ferric ions in cytochrome C oxidase and inhibits electron transport chain
- Normal cyanide dissociated slowly from CC oxidase by binding with sulphur from endogenous thiosulfate
- Blood levels  $> 19 - 40 \mu\text{mol/l}$  are toxic and  $> 96 - 115 \mu\text{mol/l}$  potentially fatal

# Clinical features

- Early: sympathetic activation (tachycardia, hypertension, palpitations, anxiety) and nausea, headache, dizziness
- More severe: confusion, drowsiness, seizures, bradycardia, hypotension, pulmonary edema
- Severe: loss of consciousness, fixed pupils, cardiovascular collapse, death
- Smell of bitter almonds

# Diagnosis

- Clinical
- Blood cyanide concentration (rarely done)
- Lactic acidosis (with burn < 15% lactate > 10 sensitive indicator of cyanide toxicity)
- Advise: empiric antidote prehospital in case of burn inhalation and GCS < 14 or hemodynamic instability - in hospital with lactate > 10 mmol/l

# Management

- Supportive including sodium bicarbonate
- Antidotes

# Hydroxycobalamin

- Binds cyanide directly (substitutes hydroxyl group for CN group - excreted by kidneys)
- 5 gram iv over 15 minutes (binds cyanide up to 40  $\mu\text{mol/l}$ ) - repeat with cardiac arrest
- Transient hypertension, headache, bradycardia, skin and urine discoloration

# Sodium thiosulphate

- Upregulation of natural excretion mechanism
- 12.5 gram iv over 10 min
- Nausea, vomiting, headache
- Slow action and probably ineffective as a single agent



# Sodium nitrite, amyl nitrite, 4 DMAP

- Converts haemoglobin to methaemoglobin (oxidise iron from ferrous to ferric) which binds cyanide
- SN 300 mg/iv over 5 - 20 minutes, AN 0.3 ml ampoules crushed and inhaled, 4 DMAP: 250 mg/iv over 1 minute
- Reduces oxygen carrying capacity, vasodilation, hypotension
- Effective use should increase methaemoglobin to 20 - 30%

# Dicobalt edetate

- Binds cyanide directly
- 300 mg/iv over 1 minute
- Anaphylaxis, hypotension, cardiac arrhythmias
- Due to side-effects only in severe confirmed cases

# Conclusions

- Only animal RCT's and case series - low level of evidence
- Hydroxycobalamin first choice

