

### Pathophysiology

- Crush injury can follow prolonged continuous pressure on muscle tissue → crush syndrome.
- Ischaemia reperfusion is the main mechanism of muscle injury in crush syndrome.
- ↑ Permeability of cell membrane & traumatic rhabdomyolysis → large quantities of  $K^+$ ,  $PO_4^{3-}$ , myoglobin, CK and urate to released into circulation.
- Fluid &  $Ca^{2+}$  is sequestered into the injured muscle cells.
- Results in hypovolaemia, hyperkalaemia, metabolic acidosis, ARF (pre-renal & renal), DIC
- Compartment syndrome can occur from muscle fluid uptake within tight compartment.

### Presentation

- Obvious muscle injury with pain, swelling, bruising and tenderness
- There may be loss of sensation, muscle power or pulses in the affected body part
- Tea-coloured urine (myoglobinuria)
- Nausea, vomiting, confusion and agitation, hypovolaemic shock

### Investigations

*Urine:* UA for myoglobin/haemoglobin (only pos in 50% cases of rhabdo)

*Blood tests:* UEC, CK, BSL, CMP, ABG, Urate, FBC, coags/D-dimer/FDP, LFT

*ECG:* Hyper $K^+$  changes

*Imaging:* Trauma & limb XR

*Other investigations:* Assessment of compartment pressures may be needed

### Management

#### Resuscitation

- The patient may have multiple/severe injuries
- ABCD assessment & life-threatening injuries managed. Avoid sux if intubating.
- Early IVC access, ideally before the trapped limb is freed and decompressed.
- Aggressive fluid management e.g. 1.5L/hr NS infusion initiated during extrication.
- As very high risk of ARF, IDC to monitor urine output. CVP line is usually required

#### Medical

- Maintain urine output 2-5ml/kg/hour until myoglobinuria has ceased.
- Urinary alkalinisation with  $NaHCO_3$  may help to prevent myoglobin precip & ARF
- A forced mannitol-alkaline diuresis may help to protect the kidneys against damage from myoglobin and may reduce the risk of hyperkalaemia. Mannitol protects the kidney by enhancing renal perfusion and may reduce muscle injury as well. Beware ↓BP.
- Treat hyper $K^+$  ( $Ca^{2+}$ , insulin/dextrose, resonium, salbutamol, bicarbonate PRN)
- Renal dialysis may be required
- Treat DIC with FFP, cryoprecipitate and platelets.

#### Surgical

- Early fasciotomy if compartment syndrome.
- Amputation of crushed limbs may be necessary.

### Prognosis

- Hyper $K^+$  & infection are commonest causes of death.
- CK levels peak within 24h and should then decrease by 30-40% per day.
- Mortality rate for crush syndrome in some earthquakes has been ~15%.
- Adequate rehydration reduces the risk of acute renal failure in crush syndrome.