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Crush injuries include simple mechanical crush injury, compartment syndrome and crush syndrome. There are many causes ranging from isolated limb injuries, multisystem trauma, envenomation, drug and toxin exposure, heat stroke, burns and some bacterial/viral infections.[1]

**Crush injury** – localised tissue injury that occurs when a compressive force is applied.[2]

**Compartment syndrome** – compromised perfusion to tissues within an anatomical compartment due to increased pressure within that compartment. Left untreated, this can lead to tissue necrosis, permanent impairment and crush syndrome.[3]

**Crush syndrome** – is a systemic condition that results from injuries sustained by compressive forces sufficient in duration and pressure to cause widespread ischemia and necrosis to soft tissue.[4] Ischaemia of the muscle leads to increased permeability of cell membranes and the release of potassium, enzymes, and myoglobin into the systemic circulation. Crush syndrome is characterised by rhabdomyolysis, lactic acidosis, hyperkalaemia, renal failure, shock, dysrhythmias and death.[4]

The development of crush syndrome is TIME and PRESSURE dependent. Crush syndrome can develop over a short time period where the compressive force and muscle mass is large and, conversely, over long periods where compressive forces are relatively small.[4]

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**Clinical features**

**Common histories associated with compartment and crush syndrome:**

- Fracture (especially tibial),[5] severe soft-tissue injury, prolonged limb compression
- Fluid infusion, arterial puncture and haemorrhage
- Envenomation
- Electric shock/burns
- Surgical repair of muscle hernia
- Constriction by casts, circumferential dressings, clothing
- Prolonged immobility (e.g. the unconscious patient not discovered for many hours).

**Co-morbidities associated with increased risk:**

- Diabetes
- Hypothyroidism
- Bleeding disorders/anticoagulation
Compartment syndrome is characterised by:[6]

- Palpable tension or swelling of an anatomical compartment
- Pain disproportionate to the injury
- Pain on passive stretching of muscles within the anatomical compartment
- Paraesthesia of skin and paresis of muscles supplied by nerves traversing the compartment
- Pallor of skin over the compartment
- Pulses diminishing as the condition develops is common, but normal peripheral pulses and capillary filling is not uncommon.[1]

Crush syndrome is characterised by:

- Compartment syndrome
- Haemodynamic instability
- Reperfusion injuries leading to:
  - lactic acidosis and hyperkalaemia
  - dysrhythmias
  - myoglobinaemia leading to renal failure
- Shock
- Hypothermia

Additional information

- Compartment syndrome is a surgical emergency. If not diagnosed quickly and treated appropriately it is associated with a high morbidity. Management includes surgical decompression of the affected muscle compartment by fasciotomy and, in the case of circumferential burns, escharotomy.[5]

Risk assessment

- Compressive force removal[1]
- Anticipate the development of crush syndrome following removal of compressive force.
- Anticipate hypovolaemic shock post removal of compressive force.
- Chest involvement requires immediate release of compressive force.
- Hypothermia is a potential risk for patients suffering crush injuries.[1]
CPG: Clinician safety
CPG: Standard cares

Evidence of hyperkalaemia on ECG?

- Y
  - Manage as per:
    - CPG: Hyperkalaemia

- N
  - Compressive force in situ?
    - Y
      - Consider:
        - Analgesia
        - IV fluids
        - Elevate limbs
      - Control compressive force release
      - Anticipate reperfusion injuries
        - hyperkalaemia
        - dysrhythmias
        - shock
      - For trapped patients consider:
        - torniquet
        - IV fluid (20 mL/kg prior to release)
    - Transport to hospital
    - Pre-notify as appropriate

- N
  - Note: Clinicians are only to perform procedures for which they have received specific training and authorisation by the QAS.