



 Mines Rescue

# Crush Injury Management

In the Underground Environment

## Background

- 1910 - Messina Earthquake
- WW2 - Air Raid Shelters fell on people crushing limbs - First time called Crush Syndrome
- Granville Rail Disaster - Sydney Australia
- Chain Valley Bay Colliery fatality 2011



## What is it?

### Definition: Crush Injury

- Injury that occurs because of pressure from a heavy object onto a body part
- Squeezing of a body part between two objects



### Definition: Crush Syndrome

The shock-like state following release of a limb or limbs, trunk and pelvis after a prolonged period of compression



### Crush Syndrome

- Muscle groups are covered by a tough membrane (fascia) that does not readily expand
- Damage to these muscle groups cause swelling and/or bleeding; due to inelasticity of fascia, swelling occurs inward resulting in compressive force
- Compressive force leads to vascular compromise with collapse of blood vessels, nerves and muscle cells
- Without a steady supply of oxygen and nutrients, nerve and muscle cells die in a matter of hours
- Problem is local to a limb or body area

# Traumatic rhabdomyolysis

- Crush syndrome - loss of blood to supply muscle tissue → toxins produced from muscle metabolism without oxygen as well as normal intracellular contents
- Muscles can withstand approx. 4 hours without blood flow before cell death occurs
- Toxins may continue to leak into body for as long as 60 hours after release of crush injury
- The **major problem** is not recognising the potential for its existence, then removing the compressive force **prior** to arrival of medical assistance
- Systemic (body-wide) but due to a local problem

## Issue for Mining

- Different training recommending many different treatment regimes causing confusion
- What is the difference between crush injury and crush syndrome?
- Differences in underground medical support and surface operations - availability of rapid rescue resources and tools



## Management of Crush Injury / Crush Syndrome made easy

**Under  
1 hour**

**Over  
1 hour**

**Post  
release**



## Management of Crush Injury / Crush Syndrome made easy

**Under  
1 hour**

- BLOOD LOSS
- FRACTURES
- DRSABCD
- Remember 000

**Over  
1 hour**

- Stop obvious blood loss
- Remove force ASAP
- Pain relief **Advanced Pain relief**
- Treat fractures

**Post  
release**



Red denotes paramedic intervention



## Management of Crush Injury / Crush Syndrome made easy

**Under  
1 hour**

**Over  
1 hour**

**Post  
release**

- CARDIAC ARREST
- DRSABCD
- Stop obvious blood loss
- Remove force under controlled conditions with paramedics

- Pain relief (advanced pain relief)
- ECG
- IV Line
- Sodium Bicarbonate



Red denotes paramedic intervention

## Management of Crush Injury / Crush Syndrome made easy

**Under  
1 hour**

**Over  
1 hour**

**Post  
release**

- Hospital
- RENAL FAILURE
- Dialysis



Red denotes paramedic intervention

## Management

- Ensure the scene is safe, and that there is no risk of injury to the rescuer or bystanders
- Call an ambulance
- If it is safe and physically possible, all crushing forces should be removed from the victim as soon as possible
- A victim with a crush injury may not complain of pain, and there may be no external signs of injury. All victims who have been subjected to crush injury, including from their own body weight, should be taken to hospital for immediate investigation
- Keep the victim warm, treat any bleeding

# Australian Resuscitation Guidelines

## Management

- Continue to monitor the victim's condition. If the victim becomes unresponsive and is not breathing normally (**cardiac arrest**), follow Australian Resuscitation Council and New Zealand Resuscitation Council Basic Life Support Flowchart if possible
- **DO NOT** leave the victim except if necessary to call an ambulance
- **DO NOT** use a tourniquet for the first aid management of a crush injury



## Signs & Symptoms

- Compression in excess of 60 minutes
- Involvement of a large muscle mass
- Absent pulse and capillary refill return to distal limb
- Pale, clammy, cool skin
- Weak, rapid pulse
- Usually absence of pain in affected region
- Onset of shock

**Maintain high index of suspicion!**

## Summary

- Remove the force as soon as possible
- If you can't access due to roof instability, and the casualty has been trapped for a long period (greater than 1 hour) make the scene safe and rescue with paramedic support
- Treat bleeding and fractures and other potential issues such as spinal care

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