

## H02: Crush Injuries

Tom Zajac

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Reviewed:

### Introduction

Crush injuries result from the entrapment of body parts by compressive forces, resulting in physical trauma and ischemia to tissues. These injuries are most commonly discussed in the context of collapsed structures, however crush injuries can occur even from a patient's own body weight.

If significant muscle mass is involved, crush syndrome can develop following the release of the compression; this is a potentially life-threatening, systemic condition. The major factors that lead to the development of crush syndrome include the degree of compressive force, the amount of muscle mass involved, and the duration of the compression.

The onset of crush syndrome occurs following the reperfusion of the injured muscle upon release. This may have both acute and delayed-onset clinical effects. The three main acute concerns are electrolyte imbalances, which may result in cardiac dysrhythmias (predominantly hyperkalemia), hypovolemia, and metabolic acidosis, both of which can cause shock. The delayed-onset effects include renal failure, acute respiratory distress syndrome, coagulopathies, and severe sepsis.

Delayed medical care or inappropriate rescue management, such as the uncontrolled and rapid removal of the compressive force prior to intervention, may result in rapid clinical deterioration and death of the patient.

### Essentials

- Pre-treatment of crush injury prior to release of forces is essential. Failure to treat can result in death
- On advice of ClinCall, begin aggressive fluid management
- Electrolyte and dysrhythmia management should be undertaken as per license level
- Provide analgesia as appropriate

### Additional Treatment Information

- Paramedics should consider the possibility of other, concurrent injuries beyond the crush, particularly hypothermia and other potential causes of shock.
- Crush injuries that occur in industrial settings, or in the context of a structural collapse or other disasters can come with significant hazards for paramedics. Scene safety is paramount – consider the risks of confined spaces, carbon monoxide, hypoxic environments, or toxic atmospheres.
- Additional pre-hospital resources should be sought early. Paramedics should also consider the need for field amputation in extreme causes – coordinate this through ClinCall.

### Referral Information

All patients with crush should be transported to the closest appropriate trauma receiving hospital with dialysis capabilities per local trauma destination guidelines. Consultation with ClinCall or EPOS for destination advice is encouraged.

### Interventions

#### First Responder

- Provide supplemental oxygen as required
  - → [A07: Oxygen and Medication Administration](#)
- Consider hypothermia. Protect patient from environment. Consider thermal protection, insulation from cold surfaces, and warming blankets as available/appropriate.

**Emergency Medical Responder – All FR interventions, plus:**

- Provide supplemental oxygen to maintain SpO2  $\geq$  94%
  - → [A07: Oxygen and Medication Administration](#)
- **CONSIDER APPLICATION OF A TOURNIQUET PROXIMAL TO THE INJURY SITE ON THE EXTREMITY WITH CLINICAL CONSULT (1-833-829-4099)**
  - → [PR03: Tourniquets](#)
- Coordinate lift with treatments
- Consider waiting until higher licensed paramedic is on scene. Prepare for cardiac arrest on release of weight.

**Primary Care Paramedic – All FR and EMR interventions, plus:**

- Obtain vascular access where possible.
  - → [D03: Vascular Access](#)
- On consultation with CliniCall, normal saline IV, 2 L immediately prior to release of weight
- Consider salbutamol continuously by nebulizer
- Manage pain
  - → [E08: Pain Management](#)

**Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:**

- Obtain vascular access where possible:
  - → [PR12: Intraosseous Cannulation](#)
  - → [PR13: External Jugular Cannulation](#)
- Correct electrolyte disturbances:
  - [Calcium chloride](#)
  - **SODIUM BICARBONATE (REQUIRES CLINICAL CONSULTATION (1-833-829-4099))**
  - Caution: sodium bicarbonate and calcium chloride cannot be administered at the same time through the same IV/IO line

**Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:**

- Induce paralysis and facilitate ventilation if required. Use [rocuronium](#) for paralysis – succinylcholine is contraindicated in crush syndrome
- Intravenous dextrose and insulin (IFT to tertiary care on advice of EPOS)
- [Mannitol](#) 20%: May be considered once ongoing urinary production and output has been verified (IFT to tertiary care on advice of EPOS). Mannitol is contraindicated in anuric states.
- Kayexelate – sodium polystyrene sulfonate (when practical and if prolonged ITF transfer to tertiary care is expected on advice of EPOS)

**Evidence Based Practice**

[General Major Trauma Care](#)

[Limb Amputation / Mangled / Major Hemorrhage](#)

[Extremity Trauma](#)

**References**

1. International Search And Rescue Advisory Group. The Medical Management of the Entrapped Patient with Crush Syndrome. 2012. [\[Link\]](#)

