

SECTION: T-04

PROTOCOL TITLE: Crush Injuries

REVISED: November 1, 2017

GENERAL COMMENTS: This protocol covers isolated extremity crush injury with entrapment.

BLS SPECIFIC CARE: See General Trauma Care Protocol T-1

- Assess for the "Six P's
- Place (but do not tighten) tourniquet on the entrapped extremity. If this is not possible, have the tourniquet standing by.
 - o Follow *Appendix 18: CAT Tourniquet or other similar device*
- Be prepared for significant bleeding and sudden cardiac arrest when patient is freed, especially in prolonged incidents

AEMT/O.M. SPECIFIC CARE: See General Trauma Care Protocol T-1

Vascular Access

- IV access (to a max of 3 attempts) with 2 large bore lines preferred.
- IV: Crystalloid solution at a TKO rate.
 - o May administer 200-500 ml if S/S of dehydration are present, repeat as needed to a maximum of 2 liters. If the patient has been entrapped for more than 1 hour, fluid therapy 20 ml/kg rapid IV bolus (up to 2 liters) using normal saline
 - o Withhold fluids and maintain IV at TKO rate if patient is hemodynamically stable or signs and symptoms of fluid overload are present
 - o Ongoing fluid therapy 5 ml/kg/hr (300 to 500 ml/hr). Increase as needed for hypotension

Respiratory Support (if appropriate and available)

- Consider Assisted/Intermittent Positive Pressure Ventilation
- Consider Placement of SGA

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ALS SPECIFIC CARE: See General Trauma Care Protocol T-1

For Crush Injuries of major extremities with active entrapment greater than 2 hours:

- Sodium Bicarbonate
 - IV: 1 meq/kg IV (minimum 50 meq for adults) given *IMMEDIATELY PRIOR TO RELEASE FROM ENTRAPMENT*
 - *OPTIONAL INFUSION: 50-100 meq/1000 cc, run at 150 cc/hr, titrated for effect*
- **Calcium Chloride (for crush injuries with hyperkalemia changes on EKG)**
 - IVP (Slow): 500-1000 mg,
 - **DO NOT GIVE IN SAME LINE AS BICARB INFUSION.**

CRUSH INJURIES

PHYSICIAN PEARLS:

Victims entrapped and crushed due to heavy objects, (e.g. fallen debris from a structural collapse) present a unique challenge. These crushing objects place prolonged and continuous pressure on the extremities resulting in skeletal muscle death (rhabdomyolysis) with release of its cellular contents (myoglobin) into the plasma.

These adverse effects are known as *Acute Crush Syndrome*. After the skeletal muscle injury occurs and the crushing object is removed, the accumulated cellular toxins (myoglobin) and electrolytes (potassium) are released into circulation and may cause lethal cardiac arrhythmias, acute renal failure and sudden death. The systemic effects of Acute Crush Syndrome only occur after the object is removed and the injured extremity is reperfused. Removal of the object causes a massive fluid shift into the injured muscle, resulting in acute hypovolemia and hypotension.

Large volumes of NS (avoid LR) must be given to the patient intravenously both before and after the patient is released. The addition of a buffering agent, such as sodium bicarbonate, to the IV solution can help prevent the myoglobin deposition in the renal tubules and may counteract hyperkalemia as well. A tourniquet may slow the spread of toxins from the injured extremity, and result in improved outcomes as well as preventing catastrophic blood loss.

Sodium bicarbonate should not be used in crush injuries of short duration (less than 30 minutes). *Its use is indicated when evidence of distal ischemia is present. These signs are commonly known as the six "Ps."*

- *Pain*
- *Pallor*
- *Pulselessness*
- *Paralysis*
- *Paresthesia*
- *Poikilothermia (cool to touch)*

Trauma patients are very susceptible to heat loss. Preservation of body heat is critical

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