



REGION 11 CHICAGO EMS SYSTEM PROTOCOL	Title: Crush Injury – BLS/ALS
	Section: Trauma
	Approved: EMS Medical Directors Consortium
	Effective: July 10, 2024

CRUSH INJURY – BLS/ALS

I. PATIENT CARE GOALS

1. Recognizing traumatic crush injury mechanism.
2. Minimize systemic effects of the crush syndrome such as rhabdomyolysis, hyperkalemia, acute kidney injury.

II. PATIENT PRESENTATION

A. Inclusion Criteria

1. Traumatic crush mechanism of injury
2. Non-traumatic injuries that may cause compartment syndrome include prolonged immobilization, prolonged compression of the torso/limbs, electrical injury, or burns.

III. PATIENT MANAGEMENT

A. Assessment

1. Identify and manage any severe external hemorrhage.
2. Assess airway, breathing, and circulation.
3. Evaluate for additional injury (e.g. fractures, solid organ damage, or spinal injury).
4. Monitor for development of compartment syndrome (pain out of proportion to clinical exam, tense swelling, pain with passive stretch, muscle weakness, absent pulses, paresthesias).

B. Treatment and Interventions

1. The treatment of crushed patients should begin as soon as they are discovered.
2. If severe hemorrhage is present, manage per Extremity Trauma/External Hemorrhage Management Protocol.
3. Administer oxygen as needed to maintain an oxygen saturation of > 94%.
4. Establish IV access. IV fluids should be administered prior to releasing the crushed body part but should not delay extrication. Administer 1000 ml normal saline bolus or 20 ml/kg for pediatric patients. Crush injury without adequate fluid resuscitation develops into crush syndrome.



**REGION 11
CHICAGO EMS SYSTEM
PROTOCOL**

Title: Crush Injury – BLS/ALS
Section: Trauma
Approved: EMS Medical Directors Consortium
Effective: July 10, 2024

5. For significant crush injuries or prolonged entrapment of an extremity, administer sodium bicarbonate 1 mEq/kg (maximum dose of 50 mEq) slow IV push.
6. Attach cardiac monitor. Obtain/interpret 12-lead ECG, if available. Carefully monitor for dysrhythmias or signs of hyperkalemia (elevated potassium) before and immediately after release of pressure and during transport (e.g., peaked T waves, wide QRS, lengthening QT interval, loss of P wave).
7. For pain control, consider analgesics per Pain Management Protocol.
8. Consider the following post extrication:
 - a. Continued resuscitation with normal saline (500-1000 ml/hr for adults, 10 ml/kg/hr for children).
 - b. If ECG suggestive of hyperkalemia, administer:
 - i. Calcium chloride – 1 gm IV/IO slow IV push.
 - c. If not already administered, for significant crush injuries with ECG suggestive of hyperkalemia, administer sodium bicarbonate 1 mEq /kg (max dose of 50 mEq) slow IV push.
 - d. If ECG suggestive of hyperkalemia, consider albuterol 5 mg via nebulizer.

C. Patient Safety Considerations

1. Scene safety for both rescuers and patients is of paramount importance.

IV. NOTES/EDUCATIONAL PEARLS

A. Causes of mortality in untreated Crush Syndrome:

1. Immediate
 - a. Severe head injury
 - b. Traumatic asphyxia
 - c. Torso injury with damage to intrathoracic or intra-abdominal organs
2. Early
 - a. Sudden release of a crushed extremity may result in reperfusion syndrome (acute hypovolemia, electrolyte abnormalities, and subsequent lethal arrhythmia)
 - b. Hyperkalemia (potassium is released from injured muscle cells)
 - c. Hypovolemia/shock
3. Late
 - a. Renal failure (from release of toxins from injured muscle cells)



REGION 11 CHICAGO EMS SYSTEM PROTOCOL	Title: Crush Injury – BLS/ALS
	Section: Trauma
	Approved: EMS Medical Directors Consortium
	Effective: July 10, 2024

- b. Coagulopathy and hemorrhage
- c. Sepsis

B. Key Considerations

1. Rapid extrication and evacuation to a definitive care facility (Level 1 Trauma Center).
2. A patient with a crush injury may initially present with very few signs and symptoms. Maintain a high index of suspicion for any patient with a compressive mechanism of injury.
3. A fatal medical complication of crush syndrome is hyperkalemia. Suspect hyperkalemia if T-waves become peaked, QRS becomes prolonged (greater than 0.12 seconds), absent P wave, prolonged QTc, or sine wave. Continue fluid resuscitation through extrication and transfer to hospital.

C. Pertinent Assessment Findings

1. Mental status/GCS.
2. Evaluation for fractures and potential compartment syndrome development (neurovascular status of injured extremity).
3. Examination of spine.
4. Evidence of additional trauma, potentially masked by with other painful injuries.