



**REGION 11
CHICAGO EMS SYSTEM
PROTOCOL**

Title: Crush Injury

Section: Trauma

Approved: EMS Medical Directors Consortium

Effective: July 1, 2021

CRUSH INJURY

I. PATIENT CARE GOALS

1. Recognizing traumatic crush injury mechanism.
2. Minimize systemic effects of the crush syndrome.

II. PATIENT MANAGEMENT

A. Assessment

1. Identify any severe 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.

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. Intravenous access should be established with normal saline initial bolus of 20 ml/kg (prior to extrication if possible) up to one liter.
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:



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- 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.

III. 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. Hyperkalemia (potassium is released from injured muscle cells);
 - b. Hypovolemia/shock.
3. Late:
 - a. Renal failure (from release of toxins from injured muscle cells);
 - 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. Therefore, 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 Twaves become peaked, QRS becomes prolonged (greater than 0.12 seconds), absent P wave, or prolonged QTc.



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4. 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.