



Treatment Protocol: CRUSH INJURY/SYNDROME

Ref. No. 1242-P

Base Hospital Contact: Required for patients at risk for crush syndrome ① or prolonged entrapment > 30 minutes. ②

1. For multi-system trauma, treat in conjunction with [TP 1244-P, Traumatic Injury](#)
2. Assess airway and initiate basic and/or advanced airway maneuvers prn ([MCG 1302](#))
3. Provide spinal motion restriction (SMR) if indicated ([MCG 1360](#))
For alert patients, logroll patient off backboard (if used during extrication) and onto gurney prior to transport ③
4. Administer **Oxygen** prn ([MCG 1302](#))
5. For anticipated prolonged extrication (> 30 minutes)
Consider activating the Hospital Emergency Response Team (HERT), [Ref. 817](#)
6. Establish vascular access immediately ([MCG 1375](#))
CONTACT BASE to discuss placement of an IO if unable to establish IV access ④
7. **Normal Saline 20mL/kg IV/IO rapid infusion** per [MCG 1309](#) as soon as possible and prior to release of compressive force
Repeat x1 for a **total of 40mL/kg IV/IO**, maximum prior to Base contact 2L
CONTACT BASE to obtain order for additional **Normal Saline 20 mL/kg IV/IO** if persistent entrapment ④
8. Initiate cardiac monitoring ([MCG 1308](#))
Assess for signs of hyperkalemia
9. Apply blanket to keep patient warm ⑤
10. If evidence of hyperkalemia (peaked T-waves in multiple leads, absent p-waves, and/or widened QRS complex) administer: ⑥
Calcium Chloride (100mg/mL) 20mg/kg slow IV/IO push, dose per [MCG 1309](#)
Repeat x1 for persistent ECG abnormalities
Sodium Bicarbonate (1mEq/mL) 1 mEq/kg slow IV/IO push, dose per [MCG 1309](#)
Repeat x1 for persistent ECG abnormalities
Albuterol 5mg (6mL) via neb, repeat continuously until hospital arrival ⑦
CONTACT BASE for persistent ECG abnormalities to obtain order for additional medications ⑧
11. For pain management: refer to [MCG 1345, Pain Management](#)
Dose per [MCG 1309](#)



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12. For nausea or vomiting in patients ≥ 4 years old:
Ondansetron 4mg ODT
13. For CRUSH INJURY without risk of crush syndrome
Release compression and extricate patient
Monitor cardiac rhythm for signs of hyperkalemia
14. Consider pre-positioning a tourniquet prior to extrication in order to prevent hemorrhage upon release of compression
15. For patients at risk for CRUSH SYNDROME ①, administer the following medications 5 minutes prior to extrication: ⑥ ⑧ ⑨
Calcium Chloride (100mg/mL) 20mg/kg slow IV/IO push, dose per [MCG 1309](#)
Sodium Bicarbonate (1mEq/mL) 1 mEq/kg slow IV/IO push, dose per [MCG 1309](#)
Albuterol 5mg (6mL) via neb, repeat immediately x1

If unable to establish vascular access while entrapped
Place tourniquet PRIOR to extrication ⑩



SPECIAL CONSIDERATIONS

- ❶ Crush syndrome is a systemic illness characterized by dysrhythmias and shock. It results from toxins released from crushed muscle tissue into the blood stream. Patients are at risk for crush syndrome if they have all of the following: 1) circumferential compression causing crush injury; AND 2) involvement of a large muscle group (lower extremity including the thigh(s) and/or pelvic girdle or upper extremity including the pectoral girdle); AND 3) entrapment for at least 1 hour. The risk of crush syndrome increases with the amount of muscle involved and the duration of the entrapment.
- ❷ For patients requiring transport to a Pediatric Trauma Center per [Ref. 506](#), which is also a Base Hospital, contact receiving Pediatric Trauma Center for Base Medical Direction and notification. If the Base Hospital is contacted and the Base redirects transport to a Pediatric Trauma Center, Base personnel will notify the Pediatric Trauma Center.
- ❸ A backboard is not required for spinal motion restriction (SMR) and may cause harm as well as increased pain. Patients should not be transported on a backboard for the purpose of SMR. If a backboard is used for extrication, patients who are alert should then be logrolled onto the gurney prior to transport. The backboard may be used during patient transport for splinting of multiple simultaneous extremity fractures or to assist with maneuvering the unconscious patient. In all cases, the backboard should be removed immediately if causing respiratory compromise.
- ❹ Patients with crush injury require large volumes of fluid resuscitation. Patients with prolonged entrapment will require maintenance fluids. IO access should be considered when attempts at IV access are not successful if: 1) prolonged entrapment is likely (> 30 minutes) and/or 2) there are signs of hyperkalemia and/or 3) there is risk of crush syndrome requiring medication administration.
- ❺ Infants and small children are at high risk for hypothermia due to their large surface area to body mass ratio, reduced ability to shiver, and limited body fat.
- ❻ Flush the IV line with normal saline after each medication. Administration of Calcium and Bicarbonate together will cause precipitation of the medication.
- ❼ Dosing differs from MCG 1309; higher doses of albuterol are required to treat hyperkalemia. Consider blow-by to avoid agitation in pediatric patients if a mask cannot be tolerated (e.g., infants and toddlers).
- ❽ The duration of action of the medications is approximately 30 minutes. Contact Base to discuss re-dosing the medications if persistent signs of hyperkalemia or if the patient will not arrive at the hospital within 30 minutes.
- ❾ These medications should be administered prior to release of the compressive force to prevent complications from the cellular toxins that enter the circulation upon extrication of the patient. Calcium stabilizes the cardiac muscle and should be administered first.
- ❿ Tourniquet placement PRIOR to extrication is a last resort for patients who are at risk for crush syndrome in whom vascular access cannot be established or when transport time is anticipated to be > 30 minutes. The tourniquet must completely occlude venous and arterial flow in order to protect the patient from crush syndrome. Establish vascular access and cardiac monitoring immediately after extrication and be prepared to treat symptoms of crush syndrome.