



Crush Syndrome Trauma

History

- Entrapped and crushed under heavy load > 30 minutes
- Extremity / body crushed
- Building collapse, trench collapse, industrial accident, pinned under heavy equipment

Signs and Symptoms

- Hypotension
- Hypothermia
- Abnormal ECG findings
- Pain
- Anxiety

Differential

- Entrapment without crush syndrome
- Vascular injury with perfusion deficit
- Compartment syndrome
- Altered mental status

Age Specific Blood Pressure indicating possible shock

Age 0 – 28 days: SBP < 60
 Ages ≥ 1 month: SBP < 70
 Age 1 – 9: SBP < 70 + (2x Age)

Ages 10 – 64: SBP < 90
 Ages ≥ 65: SBP < 100

All ages:
 Shock Index HR > SBP

	Age Appropriate Airway Protocol(s) AR 1 - 7 as indicated
B	12 Lead ECG Procedure
	IV or IO Access Protocol UP 6
P	Cardiac Monitor
	Multiple Trauma Protocol TB 6 if indicated
	Thermal Burn Protocol TB 9 Chemical and Electrical Burn Protocol TB 2 if indicated
	Pain Control Protocol UP 11 as indicated

P Consider
 Midazolam 0.5 – 2 mg IV / IO
 Midazolam 1 – 2 mg IN
 Maximum 5 mg
 Pediatric: 0.1 – 0.2 mg / kg IV / IO / IN
 Pediatric Maximum 2 mg
 Over 2 – 3 minutes as needed

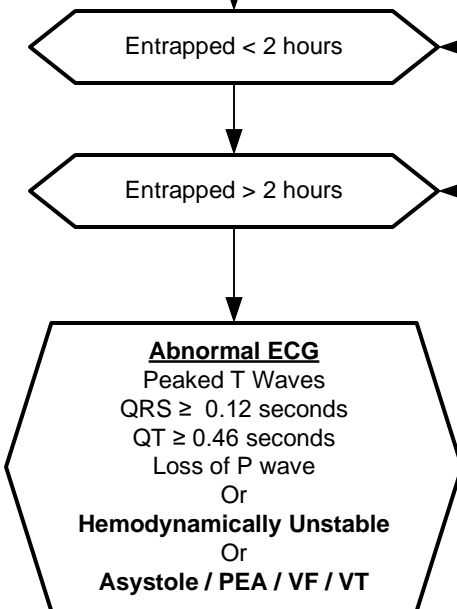
A Normal Saline Infusion
 1 Liter per hour IV / IO
 Pediatric:
 3 x maintenance fluid rate

A Decrease Normal Saline Infusion
 500 mL per hour IV / IO
 Pediatric:
 Maintenance fluid rate

P Calcium Gluconate 2 g IV / IO
 Or
 (Calcium Chloride 1 g IV / IO)
 Pediatric: 20 mg / kg IV / IO
 Over 2- 3 minutes

P Albuterol Nebulizer
 2.5 – 5 mg
 May repeat x 3

P Sodium Bicarbonate
 50 mEq IV / IO
 Pediatric: 1 mEq / kg IV / IO



Rapid Transport to appropriate destination using **Trauma and Burn: EMS Triage and Destination Plan**

Notify Destination or Contact Medical Control

Exit to Age Appropriate Cardiac Arrest Protocol AC 3 / PC 4 Arrhythmia Protocol(s) **if indicated**

Trauma and Burn Protocol Section



Crush Syndrome Trauma

Pearls

- **Recommended exam: Mental Status, Musculoskeletal, Neuro**
- **Scene safety is of paramount importance as typical scenes may pose hazards to rescuers. Call for appropriate resources.**
- **Crush Injury is a localized crush injury with systemic signs and symptoms causing muscle breakdown and release of potentially toxic muscle cell components and electrolytes into the circulation.**
- **Crush syndrome typically manifests after 1 – 4 hours of crush injury.**
- **Fluid resuscitation strategy:**
 - **If possible, administer IV / IO fluids prior to release of crushed body part, especially with crush > 1 hour. If access to patient and initiation of IV / IO fluids occurs after 2 hours, give 2 liters of IV fluids in adults and 20 mL/kg of IV fluids in pediatrics, and then begin > 2 hour dosing regimen.**
 - **If not able to perform IV / IO fluid resuscitation immediately, place tourniquet on crushed limb until IV / IO fluids can be initiated (even if tourniquet is not being used for hemorrhage control).**
- **Pediatric IV Fluid maintenance rate:**
 - **4 mL for the first 10 kg of weight +**
 - **2 mL for the second 10 kg of weight +**
 - **1 mL for every additional kg in weight after 20 kg**
- **Consider all possible causes of shock and treat per appropriate protocol.**
- **Majority of decompensation in pediatrics is airway or respiratory related.**
- **Decreasing heart rate and hypotension occur late in children and are signs of impending cardiac arrest.**
- **Shock may be present with a normal blood pressure initially or even elevated.**
- **Shock often is present with normal vital signs and may develop insidiously. Tachycardia may be the only sign.**
- **Patients may become hypothermic even in warm environments. Maintain warmth.**
- **Hyperkalemia from crush syndrome can produce ECG changes described in protocol, but may also be a bizarre, wide complex rhythm. Wide complex rhythms should also be treated using the VF/ Pulseless VT Protocol if indicated (AC 9 VF Pulseless VT Protocol and/ or PC 7 Pediatric VF Pulseless VT Protocol).**

Example: 28 kg pediatric	
First 10 kg:	4 mL/kg/hr = 40 mL/hr
Second 10 kg:	2 mL/kg/hr = 20 mL/hr
Final 8 Kg:	1 mL/kg/hr = 8 mL/hr
Total: 68 mL/hr rate	