



University of Colorado **Denver**

What is your name?

Thank you so much for your expert input regarding traumatic crush syndrome diagnosis and management in resource-limited contexts.

In this third and final round, we have summarized the major themes and areas of consensus that have emerged from your previous responses.

**Kindly review and provide your comments in the boxes below each section (optional) if you have any final feedback.**

### **Crush Injury Definition**

Definition with >80% consensus:

*Crush injury is the local manifestation of direct physical trauma, and can present as muscle injury and swelling, along with possible muscle necrosis and neurologic dysfunction in the affected areas. It can be due*

to the primary direct effect of trauma or ischemia-reperfusion injury related to compression.

## Crush Syndrome Definition

Definition with >75% consensus:

*Crush syndrome is the systemic manifestation of extensive skeletal muscle damage, due to the disruption of cellular integrity and release of its contents into circulation. It manifests as haemodynamic and metabolic disturbances, and can result in acute kidney injury, multisystem organ dysfunction or death.*

**Crush injury and syndrome represent a spectrum of disease** [>90% consensus]

Minor crush that can be safely discharged from EC were described as follows:

- Minor mechanism of injury

- Normal GCS
- Soft muscle compartments without severe bruising
- Ambulatory
- Voiding freely with clear urine
- Minimal analgesic requirements
- Labs without significant derangements

Crush warranting hospitalization was described as follows:

- Moderate to severe mechanism of injury: extensive blunt trauma, prolonged ischemia from tourniquet or vascular injury, etc.
- Exam with any of the following:
  - muscle weakness
  - large areas of muscular bruising or swelling
  - pain out of proportion to physical exam
  - hematuria or coca-cola colored urine
  - abnormal GCS
  - abnormal initial vitals: tachycardia, bradycardia, hypotension, or signs of respiratory distress.
- Abnormal labs: pH, CK, creatinine.
- Complicated anticipated course: poor urine output, unable/unwilling to take PO fluids, etc.

Crush requiring dialysis was described as follows:

- Generalized anasarca or pulmonary edema

- Respiratory distress requiring ventilatory support
- Anuric/persistent oliguria
- Severe acidosis or hyperkalemia or symptomatic uremia (pericardial friction rub, frosting, encephalopathy)
- Bradyarrhythmia in setting of hyperkalemia

## Laboratory tests for prognostication of crush syndrome

Serum creatinine, creatine kinase, and pH were rated as most useful labs (selected by >75% respondents)

Serum lactate, bicarbonate, potassium, urea were next most useful (selected by >50% respondents).

## Triage for Crush

The following factors posed challenges for triage of crush patients

1. Polytrauma - presence of burns, hemorrhage, head injury, etc
2. Pre-existing conditions - conditions such as diabetes and peripheral

neuropathy can affect pain perception and influence risk of complications

3. Early presentations - patients very early in the clinical course may have falsely normal labs
4. Middle range lab abnormalities - labs that are slightly deranged can be challenging to interpret and use
5. Limited history or exam - e.g. language barrier, abnormal mental status, intoxication, dark skin pigmentation, and obesity

## Clinical Predictive Tool Timing

A decision tool was felt to be most helpful to identify patients that can be safely discharged versus observed, using data obtained in the early phase of EC care, within 4 to 6 hours of injury. (>75% consensus)

## Clinical Predictive Tool Endpoints

Endpoints of acute kidney injury, need for dialysis and need for respiratory support had greatest consensus (>75% for all).

Use of a composite outcome was favored (>75%).

**Any final feedback, thoughts or comments?**

**Would you like to be acknowledged in the manuscript summarizing this modified Delphi process?**

- ☐ Yes, I consent to having my name included in the acknowledgment.
- ☐ No, I prefer to remain anonymous.