Trauma’s Trauma

Essential assessment, recognition and treatment of less common injury pathologies.
Objectives

• Understand the fundamentals of effective trauma triage and its application to ensure a proper destination decision every time
• Thorough, rapid assessment of obscure traumatic injuries
• Identify and prioritize critical pre-hospital management for burns and crush processes
General Standard of Care

- Scene Safety!!
- Remember that when trauma is present and load and go is determined, scene time should be <10 min unless extrication delays.
- Unsecured extremity fractures are a significant life threat and need to be managed accordingly.
Trauma Destination Policy

• Last updated in 2004….that’s right it’s been around that long.
• Outlines the conditions and assessment findings that warrant bypass to nearest Trauma center.
• Shall be followed unless adequate airway cannot be obtained or pt is VSA.
## Pre-Hospital Index

<table>
<thead>
<tr>
<th>Clinical Finding</th>
<th>Value</th>
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<tbody>
<tr>
<td>LOA</td>
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<td>Normal</td>
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<td>Confused or combative</td>
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<td>No intelligible words</td>
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<td>&lt;10 per min/needs</td>
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<tr>
<td>intubation</td>
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<tr>
<td>Pulse Rate</td>
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<td>Carotid Pulse</td>
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<tr>
<td>Total</td>
<td>0–20</td>
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</table>
Look out Vic...Here we come!

- A PHI score >3 requires transport to Trauma Center
- Watch out for Mechanism of injury
  - MVC with
    - Occupant ejected
    - Rollover
    - Co-occupant fatality
  - Fall > 6 meters
  - Obvious limb paralysis
  - Pedestrians and cyclists that are felt by paramedic to have suffered significant injury
Crush Syndrome

- Occurs when a muscle mass has sustained a crushing force large enough to preclude perfusion.
- Symptoms develop with reperfusion of ischemic and necrotic tissue.

(17)
• What is the most common cause of crush syndrome in the United States?
• Skeletal muscle can generally tolerate warm ischemia for up to 2 hours without permanent damage
• 2–4 hours → irreversible damage
• Necrosis after 6 hours
• Maximal effect of crush mechanism will typically be seen after 24 hours

(13)
Pathophysiology

- Uncomplicated CS has limited systemic effects until crush mechanism is released and reperfusion takes place
- Rhabdomyolysis occurs and cell contents including potassium, calcium and myoglobin are released into systemic circulation
- Third space fluid loss at the injury site leads to rapid onset of hypovolemia, which can be severe if a large enough tissue mass is involved

(17)
...more patho

- Lactic acid, which builds up from anaerobic metabolism during the crush period is instantaneously released into systemic circulation.
- When acidosis is coupled with hyperkalemia they become an excellent recipe for arrhythmia \((17)\).
- Hyperkalemia is second only to hypovolemia as the leading acute cause of death in CS patients \((13)\).
Hyperkalemia

- Symptoms of Hyperkalemia typically present once serum values reach 6.5 mEq/L (19)
- S+S include GI complaints, muscle weakness leading to an ascending paralysis (20)
- Once serum levels reach 8.5 mEq/L respiratory paralysis or cardiac arrest are imminent (7)
ECG Changes

- Initial presentation with peaked T waves
- Increasing PR interval leading to loss of P wave
- Idioventricular rhythm, widened QRS with deep S waves and finally a “Sine wave will precede V-fib.

(19)
On the bright side…

• Myoglobin is a protein molecule but is still small enough to be filtered by the glomerulus.
• If GFR remains high enough myoglobin can be flushed however a decrease in GFR coupled with the lactic acidosis causes the myoglobin to form a gel in the renal tubules and will lead to renal failure.

(17)
How are we going to treat this?
Field Treatment

- Maintain a high level of suspicion
- Consider additional resources. DM, Ornge, BHP patch
- In the case that a patient is hopelessly entangled, a trauma team may be requested to the site
- Literature suggests that all interventions be initiated prior to extrication, this is ideal however scene time should not be extended to do so (21)
More Field Tx

• Complete physical assessment and perform any necessary A/W or breathing interventions
• O2 via NRM whether pt appears to need it or not
• C–spine and board/KED if possible
• Establish multiple large bore IV’s, unilateral if possible and don’t forget EJ/IO possibilities
• Prepare for arrest and definite need for high volume 0.9% NaCl,
• consider patch to initiate bolus prior to removal of crushing force as preemptive treatment for hypovolemia (6)
• When all preparations are complete; extricate, Load and Go
Hyperkalemia management

• Potassium is of immediate concern and a patch for Sodium Bicarbonate should be considered with large/prolonged crush injuries or with signs of hyperkalemia (6).

• Beta 2 agonists will encourage skeletal muscle uptake of potassium and could be considered as well, but are not ideal (20, 6).
Final Notes on Crush

• Crush syndrome may not necessarily jump up and smack you in the face. Remember that it can occur in small limbs with just a person’s body weight to preclude perfusion

• When the destination policy is considered you may be treating these people for an extended time, management may become quite complex
Thermal Burns
Assessment of Burns
Why do it?

- Crucial early step in treatment planning (2)
- Treatment plan based on assessment
- Hospital needs to know type of burn
  - Thermal
    - Scolds, flame, contact
  - Inhalation
    - Closed space, open space, thermal, smoke
  - Electrical
    - Voltage, Amps
  - Chemical
    - Type
TBSA and Depth of Burn

• Initial estimation of the surface area burned & depth of injury is essential (2,6)
• Total body surface area (TBSA) burned
  • more important during initial assessment
  • The most important predictors of clinical outcome (2)
  • % TBSA affect is used to calculate the pts fluid
• Depth of injury
  • a concern for surgical tx
Rule of Nines

• Quick estimate of burn size
• Usually over estimate of burn size (2)
• Under the age 15 yrs underestimating the head surface area and overestimating the extremities in children
Pediatric % TBSA

- Lund and Browder chart
- More accurate for Pediatric (14)
- Difficult to use in field
- Can use rule of nine’s over 9 yrs old (14)
**Burn Depth**

- **Degree’s of Burn**
  - Superficial epidermal 1\textsuperscript{st}–degree
  - Superficial partial thickness 2\textsuperscript{nd}–degree
  - Deep partial–thickness 2\textsuperscript{nd} degree
  - Full thickness subdermal 3\textsuperscript{rd} degree
- **Burns are dynamic wounds**
  - are in a state of change for up to 72hrs (2, 8)
  - may be influenced resuscitation conditions (15)
Local Response

- Three Zones (8)
- Zone of Coagulation
- Zone Of Stasis
  - Potentially salvageable
- Zone Of Hyperaemia
- They are 3 dimensional and constantly changing
Three Zones

Clinical image of burn zones. There is central necrosis, surrounded by the zones of stasis and of hyperaemia.
Zone of Stasis

• Goal is to increase tissue perfusion

• Inflammation
  • Immunologic responses
    • altered macrophage function along with activation of platelets & leukocytes (2)

• Active edema formation (Fluid Shift)
  • 12 to 24hrs post burn, local microcirculation is compromised due to permeability vasodilation and increased microvascular permeability (2)
  • Increase hydrostatic pressure results in leakage of water, protein, and electrolytes (14, 20)

• Causes reduction in perfusion
  • leading to more local tissue ischemia
Local Response

• Electrolyte imbalances
  • Major burn with cell necrosis = Release of $K^+$ into ECF from injured cells (11, 9, 7)
  • cellular energy levels fall after burn injury (2)
    • sodium and potassium pump is altered
    • resting cell membrane potential decreases
    • cellular accumulation of sodium, calcium, and water
    • a loss of cellular potassium.
Systemic Response

- 20 to 30 % = systemic effect
- Pain
  - Stimulation of the skin nociceptors (10,18)
- Vascular Changes (8, 16, 11)
  - Capillary permeability ↑
  - Loss of proteins and fluids into interstitial (↓intravascular oncotic pressure)
  - Peripheral, renal and splanchnic vasoconstriction
  - Hypotension
Systemic Effect

- Cardiac output
  - $\text{CO} = \downarrow$ in arterial pressure + $\uparrow$HR
  - Altered CO & Stroke Volume
  - 15 to 20% Burn = Hypovolemic shock! (15)
  - Burn Shock
- Metabolic response
  - Basal metabolic rate increase up to 3 times (8)
  - Poor perfusion = anaerobic environment
  - Metabolic acidosis
- Respiratory
  - Histamine release = Bronchoconstriction (8)
  - Hyperventilation, and respiratory alkalosis (2)
Prehospital Treatment

• Stop the burn process
  • BLS: >10–15% 2nd degree: wet dressing for transport times <30min
  • Lonnecker, S. & Schooder, V. (2001) state hypothermia is not a problem of the non-anaesthetized and cold water treated pts

• Hypovolemic shock
  • Patch for Fluid and fluid and more fluid
  • Parkland Formula
    • 4cc/kg x % TBSA
    • First half in 8 hours
    • Second half in 16 hours
  • Elderly = Limited Cardiac Reserves
    • Beware of increased workload & CHF
Treatment Continue

- Pain Management
  - Morphine VS Fentanyl
  - Which would be appropriate in this case?
  - **Patch** for the increase doses of pain medication
- Hyperkalemia
  - It can happen with major burns (9, 7)
  - Large amount of K+ in ECF
  - With the uses of succinylcholine
  - Peak T waves or Widen QRS complex with peak T waves
References


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