Special Consideration of Pre-Hospital Trauma Patient Care

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Scope

• Traumatic brain injury
• Burn
• Confined space medicine
Traumatic Brain Injury
Pathophysiology of CNS Injury

Primary injury
- Direct damage to the brain

Secondary injury
- Systemic causes
- Intrinsic causes
**Pathophysiology of secondary CNS injury**

<table>
<thead>
<tr>
<th>Systemic causes</th>
<th>Intrinsic causes</th>
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<tbody>
<tr>
<td>Hypoxia</td>
<td>Increased intracranial pressure (ICP)</td>
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<tr>
<td>Hypotension</td>
<td>Edema</td>
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<tr>
<td>Anemia (blood loss)</td>
<td>Hematomas</td>
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<tr>
<td>Increased or decreased CO$_2$</td>
<td>Seizures</td>
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<td>Increased or decreased blood glucose</td>
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CNS Injury Management

- A-B-C
- Spinal motion restriction
- D-E
- Transport and destination decisions
Airway

- Open AW under spinal motion restriction: Jaw thrust or chin lift
- Clear AW: suction
- Maintain AW: need of definitive AW
  - Protection: tongue, FB
  - Ventilation
Breathing

Provide 100% oxygen

- Goal → 95% oxygen saturation or higher

Assist ventilations (as needed)

- Maintain normal ETCO$_2$ at 35 to 40 mm Hg
- Ventilation rates
  - Adults: 10 to 12 breaths/min
  - Pediatric: 12 to 20 breaths/min

**No routine hyperventilation**
Hyperventilation indicated for:

- Bilateral dilated and unresponsive pupils or Unequal pupils (with altered LOC)
- Abnormal posturing
- Neurologic deterioration → Decreased GCS ≥ 2 points in patient with initial GCS < 9

Ventilatory rate

- Adult: 20 breaths/min
- Child: 25 breaths/min
- Infant: 30 breaths/min

Hyperventilation target

ETCO₂ 30–35 mm Hg
Circulation

- Control hemorrhage
- Prevent secondary brain injury
- Maintain adequate BP by hypotensive resuscitation,
  maintain SBP 90-100 mmHg
Conduct in the ambulance

The complete neurologic examinations

- Level of consciousness
- Pupillary reaction
- Motor function
- Sensory function
Level of Conscious Assessment

**AVPU**
- Alert
- Responds to Verbal stimulus
- Responds to Painful stimulus
- Unresponsive

**Glasgow Coma Scale (GCS)**
- scored after the A-B-C assess and correct
- Mild-Moderate-Severe
- modified GCS for pediatrics
Pupils Assessment

- Determine **increasing of intracranial pressure**
- Normally equal, round, and 3 to 5 mm in size
- Light in one pupil should constrict both
- Consensual light reflex tests CNs II and III
Motor Function

upper extremities
• Move the hands and arms
• Squeeze your fingers

lower extremities
• Wiggle the toes
• Push and pull their feet against resistance
Sensory Function

in **conscious** patient:

- light touch perception in both upper and lower extremities

in **unconscious** patient

- deep pain response
  - Forehead rub
  - Nailbed compression
Transport and destination

- Minimal scene time < 10 minutes
- Supine position
- Appropriate receiving facility
- Reassessment
Burn
Spectrum of disease

- All severity of burns are not related in size
- Large burns might cause multiple organ systems
- Smoke inhalation can be life-threatening
Burn Assessment: Depth

- Superficial (first-degree)
- Partial-thickness (second-degree)
  - Superficial
  - Deep
- Full-thickness (third- and fourth-degree)

Burn depth may progress over time
Burn Assessment: extension

Burn size estimation

- Percent of body surface area (BSA)
- Rule of nines
Primary Assessment in : A & B

Airway

• swelling in smoke inhalation
• Consider early intubation / surgical airway

Breathing

• compromised from chest wall eschar
• toxic pulmonary injury
• Monitor ventilatory rate, SpO₂, and ETCO₂
Primary Assessment in Burn: C

Circulatory

• fluid leaks into damaged tissue causing swelling
• Hypotension
• Concomitant injury
• IV access and fluid replacement by Parkland’s formula
Primary Assessment in Burn: D & E

Disability

• Altered mentation indicated hypotension or hypoxia

Expose

• loss of body temperature
• Cover patient upon completion of assessment
Burn Management: Specific burn therapy

• Stop ongoing burning: remove cloth
• Cover with dry, sterile dressing
• Do not apply ice
• Do not use any ointments or topical antibiotic
Burn Management: fluid administration

Parkland formula

Total fluid in 1st 24 hrs = (2–4 ml)(body weight: kg)(% BSA burned)

- First ½ given in the first 8 hours after burn
- Second ½ given in the next 16 hours after burn
- Adults: RLS
- Pediatric: 5% dextrose in RLS
Burn Management: transfer to definitive care

• Analgesia
• Transport to burn center as indicated
• Monitor for hyperventilation, fluid overload, heat loss
• Reassess the patient
Confined Space Medicine
Confined space

Cause

- Natural: earthquake, storm, flood
- Manmade: explosion, accident
- Collapsed structure / building
- Rocks, trees
- Trapped in vehicle
Confined Space Medicine (CSM)

- To rescue casualties trapped in confined space
- 35% of casualties are still alive
Factors influence CSM

- Low lighting
- Bad ventilation
- Temperature
- Tight space
- Hazardous material
- Risk for exposure to body fluids
Scene sized up in CSM

Environment

• O2 deficit

• CO2 and other toxic gas from fire

Risk of secondary collapse
Principle of care in CSM

- Might spend hours in limited space along with patient
- Preventing sudden death from hyperkalemia and metabolic acidosis
- Prevent morbidity from infection and compartment syndrome
Prolonged management in CSM

- Decubitus ulcer
- Infection from contaminating own urine and feces
- Animals and insects bite
- Hypothermia
- Dehydration
- Bleeding
Limited access

- ‘Remote assessment’
- Assess and treat only exposed/ accessible part
Increase patient outcome in CSM

- Rapid stabilize and extricate
- Immobilize as necessary
- Pain control
- Restrain for incorporate / unmovable patient
Spectrum of symptoms

- Airway obstruction from impacted dust
- Crush syndrome
- Traumatic amputation
- Hypothermia / burn
- HAZMAT and blast injury
Airway obstruction

- Mostly from **impacted dust**
- #1 cause of death in Kobe earthquake
- Building components: plaster, tiles, silica
- Block ventilation and gas exchange
- Rarely from blood, vomitus or tooth
Blast injuries in CSM

Increased mortality due to explosion in close space

- **Primary blast injury:** PTX, PE, ruptured TM, ARDS (sequelae)
- **Secondary blast injury:** rare
- **Tertiary blast injury:** crush injury, blunt injury, traumatic asphyxia
- **Quaternary blast injury:** burn
- **Quinary blast injury:** toxic
Infection

- Open wound with delayed treatment ➔ wound infection
- Contamination with dirty water, own urine and stool
- Animals and insects bite
- Decontamination, wound cleansing
- Prophylaxis antibiotics
Extremities injury

- Clean and cover all wounds
- **Immobilize** all fractures / dislocation with non-compressive splint
- High index of suspicious for compartment syndrome, neurovascular injuries
- Adequate pain control
- Field amputation only for entrapped extremity with sign of ischemia
Crush and Reperfusion Syndrome

- Initiate treatment before extrication / lifting the overlay object

Cause of death
- Early: cardiac arrhythmia and hypovolemic
- Late: renal failure and infection
Prevention of EARLY death from crush syndrome

• Before extrication / lifting the overlay object
• Initiate IV fluid: NSS load
• connected with T-way
• Syringe filled with **calcium gluconate, Sodium bicarbonate, Rl and glucose**
• ECG monitoring
Prevention of LATE death from crush syndrome

- Treatment of traumatic rhabdomyolysis
- IV fluid load
- Alkalinizing urine?
Question