REGION 11 CHICAGO EMS SYSTEM PROTOCOL	Title: Head Injury
	Section: Trauma
	Approved: EMS Medical Directors Consortium
	Effective: July 1, 2021

HEAD INJURY

I. PATIENT CARE GOALS

1. Limit disability and mortality from head injury by:

    a. Promoting adequate oxygenation;
    b. Promoting adequate cerebral perfusion;
    c. Limiting development of increased intracranial pressure;
    d. Limiting secondary brain injury.

II. PATIENT MANAGEMENT

A. Assessment

1. Maintain cervical stabilization (see Spinal Care protocol).

2. Primary survey per the General Trauma Management protocol.

3. Monitoring:

    a. Continuous pulse oximetry
    b. Frequent systolic and diastolic blood pressure measurement
    c. Initial neurologic status assessment and reassessment with any change in mentation;
    d. Moderate/severe head injury: Apply continuous waveform ETCO2, if advanced airway placed.

4. Secondary survey pertinent to isolated head injury:

    a. Head: Gently palpate skull to evaluate for depressed or open skull fracture.
    b. Eyes:
        i. Evaluate pupil size and reaction to light to establish baseline;
        ii. Reassess pupils if decrease in mentation.
    c. Nose/Mouth/Ears: Evaluate for blood/fluid drainage.
    d. Face: Evaluate for bony stability.
    e. Neck: Palpate for cervical spine tenderness or deformity
    f. Neurologic:
        i. Perform neurologic status assessment (GCS or AVPU);
        ii. Evaluate for focal neurologic deficit: motor and sensory.

5. Head injury severity guideline:

    a. Mild: GCS 13-15 / AVPU = (A)
    b. Moderate: GCS 9-12 / AVPU = (V)

c. Severe: GCS 3-8 / AVPU = (P) or (U)

B. Treatment and Interventions

1. Airway:

   a. Administer oxygen as needed to maintain an oxygen saturation of > 94%.
   b. If patient unable to maintain airway, consider oral airway (nasal airway should not be used with significant facial injury or possible basilar skull fracture).
   c. Oral endotracheal intubation or supraglottic airway insertion can be used if BVM ventilation ineffective in maintaining oxygenation or if airway is continually compromised.

2. Breathing:

   a. For patients with a moderate or/severe head injury who are unable to maintain their airway or are hypoxic despite basic airway interventions, initiate BVM ventilation.
   b. Supraglottic airway placement or/endotracheal intubation should only be performed if BVM ventilation is inadequate to maintain adequate oxygenation.
   c. <u>For patients with a severe head injury with signs of herniation</u>: Hyperventilate to a target ETCO2 of 30-35 mmHg as a short-term option, and **only for severe head injury with signs of herniation** and an advanced airway.
      i. Signs of herniation:
         1. Decreasing mental status
         2. Abnormal respiratory pattern
         3. Asymmetric/unreactive pupils
         4. Decorticate posturing
         5. Cushing's response (bradycardia and hypertension)
         6. Decerebrate posturing

3. Circulation:

   a. Wound care:
      i. Control bleeding with direct pressure if no suspected open skull injury.
      ii. Moist sterile dressing to any potential open skull wound.
      iii. Cover an injured eye with moist saline dressing and eye shield if available to protect from further injury.
   b. Moderate/severe closed head injury:
      i. Blood pressure: Administer fluid bolus for hypotension
         1. Adult: Target SBP 110-120 mmHg. Hypotension should be avoided to maintain cerebral perfusion
         2. Pediatric: Maintain SBP:
            a. Less than 1 month: Greater than 60 mmHg
            b. 1-12 months: Greater than 70 mmHg
            c. 1-10 y/o: Greater than 70 + 2x age in years

c. Mild closed head injury:
   i. Consider administering fluid bolus to maintain blood pressure to above numbers and maintain cerebral perfusion.
d. Do not delay transport to initiate IV access.

4. Disability:

   a. Evaluate for other causes of altered mental status - check blood glucose.
   b. Spinal assessment and management, per Spinal Care protocol.
   c. Perform and trend neurologic status assessment:
      i. Early signs of deterioration:
         1. Confusion
         2. Agitation
         3. Drowsiness
         4. Vomiting
         5. Severe headache
      ii. Monitor for signs of herniation
   d. Severe head injury – Elevate head of bed 30 degrees.

5. Transport according to Region 11 Trauma Field Triage Criteria:

   a. Preferential transport to Level 1 Trauma Center:
      i. GCS 3-13, P (pain) or U (unresponsive) on AVPU scale;
      ii. Penetrating head trauma;
      iii. Open or depressed skull fracture.

C. Patient Safety Considerations

1. Do not hyperventilate patient unless signs of herniation.

2. Assume concomitant cervical spine injury in patients with moderate/severe head injury.

3. **Geriatric Consideration**: Elderly patients with ankylosing spondylitis or severe kyphosis should be padded and immobilized in a position of comfort and may not tolerate a cervical collar.

III. NOTES/EDUCATIONAL PEARLS

A. Key Considerations

1. Hypoxia and hypotension are especially dangerous in severe head injury patients.

2. Important that providers be specifically trained in accurate neurologic status assessment.

3. If endotracheal intubation or supraglottic airways are used, continuous waveform capnography is required to document proper tube placement and assure proper ventilation rate.

B. Pertinent Assessment Findings

1. Neurologic status assessment findings
2. Pupils
3. Trauma findings on physical exam