# Trauma:
# Head Injury/Traumatic Brain Injury (TBI)

**Goal:** To aid EMS Providers in the treatment of patients with known or suspected head injury, particularly traumatic brain injury (TBI), in order to optimize patient outcome
**Inclusion Criteria:** All adult or pediatric patients with blunt or penetrating head trauma, with or without loss of consciousness or amnesia
**Exclusion Criteria:** No specific exclusions, although this protocol focuses on moderate-severe TBI
**Refer to:** Hemorrhage Control/Tourniquet, Shock, Trauma and other relevant CPGs; Spinal Motion Restriction, and Destination policies

**Basic Level**

1. Assess and support ABCs according to UNIVERSAL CARE – ADULT or UNIVERSAL CARE – PEDIATRIC and according to the Trauma CPG, as clinically indicated:
    a. A and B (Airway and Breathing): Frequent suctioning of blood or secretions is critical
        i. Place an oro-pharyngeal or nasopharyngeal airway unless contraindicated because of associated injuries
        ii. Avoid over-zealous assisted ventilation (hyperventilation is harmful in TBI)
    b. C (Circulation) and Wound Care: Initiate continuous ECG and $SpO_2$ monitoring
        i. Control active bleeding from penetrating head injury with gentle pressure and moist, sterile dressing, if open skull fracture is NOT suspected
        ii. Apply moist, sterile dressing to known or suspected open skull fracture
        iii. Control active extremity and junctional bleeding per Hemorrhage Control/Tourniquet CPG
    c. D (Disability): Assess and document GCS and pupillary size and reactivity
        i. At least two sets of measurements, 5 to 10 minutes apart, is the absolute minimum
            1. Signs of early deterioration: confusion, agitation, drowsiness, vomiting, severe headache
        ii. Reassess and document every 5 to 10 minutes in patients with significant injury or instability
        iii. Assume associated (cervical) spine injury in patients with moderate/severe head injury
    d. E (Exposure/Environmental): Assess for other traumatic injuries
2. Immobilize patient with cervical collar and long spine board, if indicated, per Spinal Motion Restriction Policy
    a. If severe TBI and spine injury is not suspected, elevate the head of the stretcher 30 degrees
    b. If severe TBI and other spine injury is suspected, consider reverse Trendelenburg (30 degrees)
    c. Young children on a long spine board must have torso padding for neutral spine alignment:
        i. Pad from top of shoulder to bottom of buttocks
3. **Administer supplemental oxygen to maintain $SpO_2$ of at least 94% (with continuous monitoring)**
    a. NOTE: Even brief periods of hypoxia are extremely damaging to injured brain
    b. When in doubt during initial resuscitation or if $SpO_2$ measurement is unavailable, provide high-flow, supplemental oxygen
    c. During *prolonged* transport, titration to maintain $SpO_2$ 94-99% may be appropriate
4. Obtain and document a POC Glucose
    a. Treat hypoglycemia per Diabetic Emergencies-Hypoglycemia CPG
5. Obtain and document SAMPLE History
    a. Patient or bystander history of "loss of consciousness" and duration thereof may be misleading
6. Perform and document secondary survey, with special attention to HEENT for signs of head/facial injury
    a. Examples: "DCAPBLSTICS", skull fracture, CSF drainage from ears/nose, and facial bone instability
7. Once advanced level care arrives on scene, give report and transfer care

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**Advanced Level**

8. Initiate continuous waveform capnography ($PetCO_2$) monitoring: ***avoid hyperventilation!***
    a. With assisted ventilation or after advanced airway placement, maintain $PetCO_2$ 35 to 45 mmHg
        i. Target: 40 mmHg
    b. Avoid even "mild" hyperventilation, even in the setting of "impending cerebral herniation", due to lack of scientific evidence
        i. Risk of harm from over-ventilation outweighs theoretical, unproven benefit
9. Consider advanced airway placement for continually compromised airway:
    a. GCS 8 or less and/or inability to maintain airway with basic airway maneuvers and suctioning
    b. Maintain cervical spine stabilization during advanced airway placement
    c. Nasotracheal intubation is relatively contraindicated in patients with head injury
10. Establish IV/IO access and ***treat hypotension:***
    a. Adults and children at least 14 years of age with SBP less than 110 mmHg and no other source of uncontrolled hemorrhage: Administer Normal Saline 20 mL/kg **(maximum 1000 mL (1L) per bolus)**
        i. Do not wait for hypotension to develop: begin fluid bolus if SBP is dropping or if patient shows signs of progressive shock, such as increasing HR with decreasing SBP

    b. Pediatric patients: Administer Normal Saline 20 mL/kg **(maximum 1000 mL (1L) per bolus):**
        i. Newborn under 1 month of age: Target SBP at least 60 mmHg
        ii. Infant 1 month to 12 months of age: Target SBP at least 70 mmHg
        iii. Child 1 to 10 years of age: Target SBP at least (70 + 2X(age in years)) mm Hg
        iv. Child 11 to 14 years of age: Target SBP at least 90 mm Hg

    c. Reassess for and document clinical response
    d. Repeat IV/IO fluid bolus once, to maintain target blood pressure, if needed
    e. Contact BioTel for authorization for additional fluid boluses
    f. NOTE: For patients with TBI AND suspected, uncontrolled, internal hemorrhage due to other, major trauma, follow resuscitation guidelines and target SBP described in the Trauma CPG
11. Treatment of acute hypertension following TBI:
    a. Restrict IV/IO fluids to "keep open" rate if SBP is greater than 140 mmHg (adults) or above normal range for age (pediatric) (refer to UNIVERSAL CARE – PEDIATRIC for age-specific parameters)
12. Consider treatment of pain, agitation and/or combativeness not due to hypoxia according to Pain CPG
    a. Document GCS, pupillary reaction and neurologic exam before AND after analgesia/sedation administration
    b. First-line treatment: opioids; Second-line/adjunct treatment: ketamine (analgesic dose)
    c. Contact BioTel Online Medical Control Physician for further analgesia/sedation guidance, if needed
13. Monitor for and treat seizures per Seizure CPG
14. Monitor vital signs and transport patients with moderate to severe head injuries to an appropriate Level I or Level II Trauma Center or other appropriate facility, per Destination Policy and Hospital Capabilities Matrix
    a. Consult BioTel, if needed, for additional destination decision-making guidance
    b. Patients with known/suspected mild TBI, no loss of consciousness AND GCS 15 may be transported to the closest, appropriate receiving hospital E.D.
15. For additional patient care considerations not covered under standing orders, contact BioTel