Head Trauma

History
- Time of injury
- Mechanism (blunt vs. penetrating)
- Loss of consciousness
- Bleeding
- Past medical history
- Medications
- Evidence for multi-trauma

Signs and Symptoms
- Pain, swelling, bleeding
- Altered mental status
- Unconscious
- Respiratory distress/ failure
- Vomiting
- Major traumatic mechanism of injury
- Seizure

Differential
- Skull fracture
- Brain injury (Concussion, Contusion, Hemorrhage)
- Epidural hematoma
- Subdural hematoma
- Subarachnoid hemorrhage
- Spinal injury
- Abuse

Prevent hypoxia, hypotension, and hyperventilation

A single episode of hypoxia, hypotension, and hyperventilation increases mortality

Hyperventilation:
Hyperventilation is NOT recommended in patients who require BVM, BIAD, or ETT.

Maintain ventilation rate to target EtCO2 of 35 – 45 mmHg
See Pearls

Age Specific Blood Pressure indicating possible shock

Age 0 – 28 days: SBP < 60
Ages ≥ 1 month: SBP < 70
Age 1 – 9: SBP < 70 + (2x Age)

Ages 10 – 64: SBP < 90
Ages ≥ 65: SBP < 110

All ages Shock Index:
SI = HR ÷ SBP

Use Shock Index, Pediatric Adjusted (SIPA)for children <12 (see pearls)

Age Appropriate Airway Protocol(s) AR 1, 2, 3, 5, 6 ***if indicated***

Obtain and Record GCS

All patients

Titrate **target SpO2 100%**

Monitor HR, BP and O2 every 3-5 minutes

Blood Glucose Analysis Procedure

B — Maintain EtCO2 35 – 45 mmHg

A — IV or IO Access - UP 6 ***if indicated***

P — Cardiac Monitor

Altered Mental Status - UP 4 ***if indicated***

Multiple Trauma - TB 6 ***if indicated***

Age Appropriate Hypotension/ Shock - AM 5/ PM 3 ***if indicated***

Seizure - UP 13 ***if indicated***

Spinal Motion Restriction Protocol TB 8 Procedure WTP 2 ***if indicated***

Pain Control - UP 11 ***if indicated***

Monitor and Reassess

Rapid Transport to appropriate destination using
Trauma and Burn:
EMS Triage and Destination Plan

Notify Destination or Contact Medical Control

A

Evidence of moderate TBI:
GCS <12 or GCS initially 15 and dropping
Objective evidence of head trauma (hematoma, laceration, etc)

TXA 1 - 2 g over 1 minute IV

Peds: Age 1 and above only
15 mg/kg IV - Max 1 gram

P

Signs of Impending Herniation:

If GCS 8 or less
Unilateral or Dilated/Fixed Pupil And / Or Posturing, Seizures And / Or Cushing's Triad
(widened pulse pressure bradycardia, and irregular respirations)

3% Hypertonic Saline Infusion

Adult: 250 mL IV / IO
Over 20 minutes

Pediatric: 5 mL / kg IV / IO
Over 20 minutes

Levetiracetam (Keppra)

Adult: 1 gram IV / IO
over 5 minutes

Peds: 15 mg/kg IV / IO
over 5 minutes
Max 1 gram

*** Don't Forget to check a Blood Glucose
Low BSG can mimic head injuries ***

Head Trauma

Eye Opening Response	Verbal Response	Motor Response
4 = Spontaneous	5 = Oriented	6 = Obeys commands
3 = To verbal stimuli	4 = Confused	5 = Localizes pain
2 = To pain	3 = Inappropriate words	4 = Withdraws from pain
1 = None	2 = Incoherent	3 = Flexion to pain or decorticate
	1 = None	2 = Extension to pain or decerebrate
		1 = None

Age	HR	SBP	SIPA cutoff value
1–3 years	70–110	90–110	1.2
4–6 years	65–110	90–110	1.2
7–12 years	60–100	100–120	1.0
>12 years	55–90	100–135	0.9

SIPA, shock index, pediatric age-adjusted; HR, heart rate; SBP, systolic blood pressure.

3% Hypertonic Saline is reserved for severe head injuries GCS <8 – Hypertonic saline is not to be used outside of head trauma. If 3% Hypertonic Saline is unavailable may utilize 100mEq of 8.4% Sodium Bicarb. 2 Amps of Bicarb is equivalent to 200cc of 3% Hypertonic Saline

Pearls

- **Recommended Exam: Mental Status, HEENT, Heart, Lungs, Abdomen, Extremities, Back, Neuro**
- **Hypoxia:**
  - **Single episode of hypoxia can worsen head injury and double mortality.**
  - **Titrate SpO_2 as close to 100% as possible.**
- **Hyperventilation in head injury requiring advanced airway:**
  - **Hyperventilation lowers CO2 and causes vasoconstriction leading to increased intracranial pressure (ICP).**
  - **Hyperventilation is not recommended and can worsen the brain injury.**
  - **In patients requiring BVM, BIAD, or endotracheal tube, titrate ventilation rate to $EtCO_2$ between 35 - 45 mmHg.**
  - **Recommended ventilation rates with advanced airways:**
    - **Infant/ Toddler: 25 breaths / minute**
    - **Children: 20 Breaths / minute**
    - **Adolescents/ Adults: 10 – 12 Breaths / minute**
- **Hypotension:**
  - **Episodes of hypotension can worsen head injury and increase mortality:**
    - **In adults, minimal SBP is at least 90 - 100 mmHg.**
    - **In pediatrics, minimal SBP is at least > 70 + (2 x the age in years).**
  - **Usually indicates shock unrelated to the head injury and should be aggressively treated, otherwise limit fluid administration.**
- **GCS**
  - **Key performance measure used in the EMS Acute Trauma Care Toolkit.**
  - **Serial assessments of GCS with ongoing assessments should be performed.**
- **Do not place in Trendelenburg position as this may increase ICP and worsen blood pressure.**
- **Poorly fitted cervical collars may also increase ICP when applied too tightly.**
- **In areas with short transport times, Drug Assisted Airway protocol is not recommended for patients who are spontaneously breathing and who have oxygen saturations of ≥ 90% with supplemental oxygen including BIAD/ BVM.**
- **Increased intracranial pressure (ICP) may cause hypertension and bradycardia (Cushing's Response).**
- Consider Restraints if necessary for patient's and/ or personnel's protection per the Restraints: Physical Procedure USP 5.
- **Concussions:**
  - Traumatic brain injuries involving any of a number of symptoms including confusion, loss of consciousness, vomiting, or headache.
  - Any prolonged confusion or mental status abnormality which does not return to normal within 15 minutes or any documented loss of consciousness should be evaluated by a physician ASAP.
  - **EMS Providers should not make return-to-play decisions when evaluating an athlete with suspected concussion. This is outside the scope of practice.**