ED Initiative
General Treatment Guidelines
For the Patient with Suspected Mild-Moderate Head Injury

Purpose: The purpose of this guideline is to provide the ED healthcare team with general stabilization and treatment guidelines for the patient with suspected or diagnosed traumatic brain injury.

Definitions:

Hypotension: Hypotension is defined in adults as a single observation of a SBP <90mmHg at any time post injury. Hypotension in the child is defined as a single observation of a SBP that is <5th percentile for the age group (see below).

Hypoxia: Hypoxia is defined as a PaO_2 <60 mm Hg or O_2 saturation <90% at any time post injury.

Guidelines:

I. Initial Presentation
   a. Neurological Examination prior to administration of sedation, analgesics or paralytics. Exam to include;
      i. GCS (Adult/Pediatric)
      ii. Pupillary Assess for:
         1. Asymmetry: 1mm or more difference in size of 1 pupil
         2. Fixed pupil: No response (<1mm) to bright light
         3. Left and Right distinction and duration of the following;
            a. Unilateral or Bilateral fixed pupil(s)
            b. Unilateral or Bilateral dilated pupil(s)
            c. Fixed and Dilated pupil(s)
      iii. Cranial Nerve Exam (If Appropriate)
         1. Corneals
         2. Cough
         3. Gag
   b. Blood Pressure and Oxygenation
      i. Hypotension:
         1. Adult: A single observation of an SBP <90mmHg
         2. Child: SBP <5th percentile for the age:
            a. <65 mmHg (0-1 years)
            b. <75 mmHg (2-5 years)
            c. <85 mmHg (6-12 years)
            d. <90 mmHg (13-16 years)

            3. Fluid resuscitation with Isotonic Crystalloid Solution unless otherwise instructed (No dextrose containing solutions). Avoid overly aggressive volume resuscitation as this can contribute to cerebral edema
            4. If unsuccessful with fluid resuscitation;
                a. Phenylepherine 5-400 mcg/min
                b. Dopamine 5-20 mcg/min
    ii. Hypoxia: PaO_2 <60 mm Hg or O_2 saturation <90%
            1. Oxygen saturation should be monitored continuously on all patients suspected of or with a traumatic brain injury on a continuous basis
            2. Hypoxemia should be corrected by administering supplemental oxygen
            3. Airway should be secured (intubation) in patients who have;
                a. GCS $\leq$8
                b. Inability to protect or maintain an airway secondary to altered mentation, waxing/waning mentation (GCS $\leq$8, toxic/metabolic) and/or facial trauma
                c. Hypoxemia not corrected by supplemental oxygen
            4. Ventilation
                a. Normal ventilation is defined as;
                    - 10 bpm (Adults)
                    - 20 bpm (Children)
                    - 30 bpm (infants)
                b. Hyperventilation is defined as;
                    - 20 bpm (Adults)
                    - 30 bpm (Children)
                    - 35-40 bpm (Infants)
                b. Prophylactic hyperventilation ($PaCO_2$ <25 mmHg) is not recommended
                c. Hyperventilation is recommended as a temporizing measure for the reduction of elevated ICP in patients with signs of impending or ongoing cerebral herniation (pupil asymmetry or motor posturing)
                    - Hyperventilation to a $PaCO_2$ <29 mmHg should be avoided during the firs 24 hours after injury

c. Criteria for Hyperosmolar Therapy
    i. Mannitol should be administered in patients with evidence of raised intracranial pressure or signs of brain herniation **do not administer in the hypotensive patient**

Dose: 100gm administered as a BOLUS.
Do not administer as a drip

- ii. Blood pressure should be monitored frequently to avoid hypotension
- iii. Assess for papillary changes after administration

d. Criteria for Antiseizure Prophylaxis (Dilantin or Valproate): indicated to decrease the incidence of early posttraumatic seizures and should be administered to the following;
- i. GCS ≤8
- ii. Patient’s with witnessed/reported seizure activity in the Emergency Department

e. CT Scanning Criteria
- i. Please see Guidelines for Computed Tomographic Imaging

II. Indications for Intracranial Pressure Monitoring

a. Intracranial Pressure (ICP) should be monitored in all patients with
- i. GCS 3-8 after resuscitation and an abnormal CT scan: defined as one that reveals hematomas, contusions, swelling, herniation, or compressed basal cisterns
- ii. A normal CT scan if two or more of the following features are noted at admission;
  1. Age >40 years
  2. Unilateral or Bilateral motor posturing,
  3. SBP <90 mmHg

III. Surgical Guidelines

a. **Acute Epidural Hematoma:**
- i. EDH >30cc should be surgically evacuated regardless of GCS
- ii. EDH <30cc and with <5mm midline shift with a GCS >8 without focal deficit can be managed non-operatively with serial CT scans and neurological observation
  1. The first follow-up CT should be performed within 6-8 hours after TBI

b. **Acute Subdural Hematoma:**
- i. SDH with a thickness >10mm or MLS >5mm should be surgically evacuated, regardless of GCS
- ii. **All** patients with a SDH and a GCS <9 should undergo ICP monitoring
- iii. GCS <9 with a SDH <10mm in thickness and MLS <5mm should undergo surgical evacuation of the lesion if the GCS decreased between the time of injury and admission by ≥2 points and/or the ICP is >20mmHg

c. **Traumatic Parenchymal Lesions:**
- i. Parenchymal mass lesion and signs of progressive neurologic deterioration referable to the lesion, medically refractory intracranial hypertension, or signs of mass effect on CT should be treated operatively

ii. GCS 6-8 with frontal or temporal contusions >20cc in volume with MLS ≥5mm and/or cisternal compression on CT scan, and patients with any lesion >50cc in volume should be treated operatively

iii. Parenchymal mass lesions without evidence of neurologic compromise, controlled ICP, and no significant mass effect on CT may be managed non-operatively with intensive monitoring and serial imaging

d. **Posterior Fossa Mass Lesion:**

i. Mass effect on CT or with neurological dysfunction or deterioration referable to the lesion should undergo operative intervention

ii. Lesions with no significant mass effect on CT and without signs of neurologic dysfunction may be managed with close observation and serial imaging

Notes:

- Mass effect on CT is defined as:
    - Distortion, dislocation, or obliteration of the fourth ventricle
    - Compression or loss of visualization of the basal cisterns
    - Presence of obstructive hydrocephalus

e. **Depressed Skull Fractures:**

i. Open (compound) fractures depressed greater than skull thickness should undergo operative intervention to prevent infection

ii. Open (compound) depressed skull fractures may be treated non-operatively if:

1. No clinical or radiographic evidence of dural penetration
2. No significant intracranial hematoma
3. No depression>1cm
4. No frontal sinus involvement
5. No gross cosmetic deformity
6. No wound infection
7. No pneumocephalus
8. No gross wound contamination

iii. Closed (simple) depressed skull fractures may be managed non-operatively or operatively depending on the degree of fracture displacement, extent of comminution, presence or absence of frontal sinus involvement and cosmetic considerations.