**Emergency Department, Inpatient – Severe Traumatic Brain Injury - Management of Increased Intracranial Pressure (ICP)**

**Phase I – Initial Treatment**

- **Admit To PICU**

  - **ReAssess GCS History**

  - **Repeat GCS Assessment**

  - **Icp Monitoring Indicated?**

    - **Yes**
      - **Monitor**

    - **No**
      - **CONTINUE TO MONITOR**

- **Icp Monitor**
  - **Surgery As Indicated**

- **Start Seizure Prophylaxis**
  - **Continuous Eeg Monitoring**

  - **Assess**

    - **Icp Sustained ≥ 20 For 5 Min?**

      - **Yes**
      - **Phase III**

      - **No**

  - **Sedation & Analgesia**
    - **Per PICU**
    - **Avoid PRN Pentobarbital**

  - **CT Scan**
    - **Consider Repeat CT Scan**

**Phase II – ICP Non-Responsive to Phase I Therapy**

- **NeuroMuscular Blockade**
  - **Assess**

  - **ICP Sustained ≥ 20 For 5 Min?**

    - **Yes**
      - **Consider CT Scan**

    - **No**

- **Hyperosmolar Therapy**
  - **Assess**

  - **ICP Sustained ≥ 20 For 5 Min?**

    - **Yes**
      - **Phase III**

    - **No**

**Phase III – Concern for Impending Herniation**

- **Panic Value**

  - **Indicators Present:**
    - Acute Rise in ICP (≥ 40)
    - Pupil Changes
    - Bradycardia & Hypertension

  - **Treatment**
    - Notify Intensivist and/or Neurosurgeon for Emergent:
      - Hyperosmolar Therapy
      - Hyperventilation
      - Sedation

**Hyperosmolar Therapy**

- **3% Saline Bolus**
  - 5ml/kg over 15 minutes
  - Monitor Serum Sodium or Osmo
  - 2 Hrs After Bolus Administration

- **3% Saline Continuous Infusion**
  - 0.1-1 ml/kg/hr titrated to keep ICP <20
  - Goal: Serum Sodium < 160
  - Serum Osmo < 360

**Barbiturate Therapy**

- If ICP Not Controlled with Burst Suppression
  - Go to Phase III

**Pentobarbital Loading Dose**

- 5 mg/kg over 30-60 minutes

**Maintenance Infusion**

- Initial: 1 mg/kg/hr

**Bolus Dose**

- 1 mg/kg and increase infusion rate by 0.5mg/kg/hr as needed to maintain burst suppression on EEG.

**Max Dose**

- 5mg/kg/hr

**Monitoring during Barbiturate Therapy**

- Burst suppression is monitored by EEG activity

- If EEG is overly suppressed, Hold Pentobarbital until EEG activity resumes and restart drip

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**KEY INFORMATION**

**INCLUSION**
- Traumatic Brain Injury with GCS of ≤8 scored in the field, transport, or ED.
- Traumatic Brain Injury Patient admitted with initial score >8 and deteriorates to GCS ≤8
- Score accepted is one scored prior to interventions requiring sedation.

**EXCLUSION**
- GCS > 8, or surgical intervention without insertion of ICP monitoring device.
- Patient is not salvageable (initiate call to Life Link)

**COAGULATION LABS**
- DIC Panel q 6 Hours times 48 Hours if patient not on Massive Transfusion Protocol (MTP)
- If patient is on the Massive Transfusion Protocol, follow MTP Lab schedule as indicated until Transfusion protocol is ended; then resume TBI Pathway Coagulation Labs

**STEPS FOR ICP ≥ 20**
1. Avoid stimulation including suctioning, noise, moving, treatments
2. Limit environmental stimulation: noise, stimulation, moving.
3. Verification that HOB is elevated 30°
4. Validate ICP reading is accurate (see below)
5. Ensure prior treatments, including sedation, are optimized before advancing to next phase of intervention.
6. At any step in the process, prior treatments may be repeated.
7. At any point along the Algorithm, if the ICP is sustained ≥ 20 min and not responsive to therapy, consider:
   - Repeat CT Scan
   - Surgery as indicated

**VALIDATION OF ICP VALUES**
- Check calibration with each ICP elevation and PRN
- If EVD is present:
  - Check stopcock position for drain or monitor
  - Check EVD drain for patency and flow
  - Check accurate level for EVD drain

**CONSIDER REVERSAL OF THERAPY**
- If the ICP is ≤20 for 24HRS, consider withdrawing treatment in reverse order
- If patient remains stable consider removing the monitoring device
- "If Moderate Hypothermia was used and re-warming is initiated, it should be done at a rate of 0.5 to 1°C every 12-24 hours

**ABBREVIATIONS:**
- CPP – Cerebral Perfusion Pressure (MAP – ICP)
- HOB – Head of Bed
- ICP – Intracranial Pressure
- MAP – Mean Arterial Pressure (Arterial line recommended)
- Osmo- Serum Osmolarity Level
- TBI – Traumatic Brain Injury

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**PANIC VALUE CONCERN FOR IMPENDING HERNIATION**
- Indicators present:
  - Acute rise in ICP (≥ 40)
  - Pupil changes
  - Bradycardia & Hypertension

**TREATMENT**
- Notify intensivist and/or neurosurgeon for emergent:
  - Hyperosmolar Therapy
  - Hyperventilation
  - Sedation

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**PHASE III – ICP NON-RESPONSIVE TO PHASE II THERAPY**

**MILD HYPERSONVENTILATION**
PaCO2 30 - 35 mmHg

**ICP SUSTAINED ≥20 FOR 5 MIN?**

**YES**

**REPEAT CT Scan**

**NO**

**CISTERN OPEN?**

**YES**

**CONSIDER LUMBAR DRAIN**

**NO**

**ICP SUSTAINED ≥ 20 FOR 5 MIN?**

**YES**

**CONSIDER ALTERNATIVE TREATMENTS**
- **Hyperventilation**
  - PaCO2 <30 mmHg
- **Moderate Hypothermia**
  - 32-33°C
- **Experimental Drugs**
- **Decompressive Craniectomy**

**IF SEVERE BRAIN STEM DYSFUNCTION &/OR ICP SUSTAINED ≥ 40?**

**CONSIDER DISCONTINUING GUIDELINE**