Increased Intracranial Pressure (ICP)
Severe Traumatic Brain Injury
Clinical Practice Guideline for Management of

**Phase I – Initial Treatment**

- Admit to PICU
- Reassess GCS history
- Repeat GCS assessment

GCS ≤ 8

No

**CONTINUE TO MONITOR**

No

**ICP monitoring indicated?**

Yes

ICP Monitor

Surgery

As indicated

Labs q 6hr x 48hrs

CBC & Chem 7

Coags* with DIC panel

Intubation

Maintain PaCO2 within 35-45 mmHg

**Orders**

- Start seizure prophylaxis
- Consider continuous EEG monitoring

**Recommend:**

≥1yr, Levetiracetam IV

<1yr, Phenobarb IV

**Assess**

ICP sustained ≥ 20 for 5 min?*

Yes

Sedation & analgesia

Per PICU

Avoid PRN

Pentobarbital

CT Scan

Consider repeat CT Scan

Assess

ICP sustained ≥ 20 for 5 min?

**Phase II**

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

- Assess ICP before initiating 2nd intervention
- Hyperosmolar therapy

3% saline

Per ICU, manage blood pressure to maintain CPP

Threshold of 40 mm Hg for infants and 50 mm Hg for > 1 year

**Consider CT Scan**

Assess

ICP sustained ≥ 20 for 5 min?

**Phase III**

**Neuromuscular blockade per PICU**

**Barbiturate therapy²**

Pentobarbital dosing for burst suppression²

Continuous EEG monitoring to achieve burst suppression

**Assess**

ICP sustained ≥ 20 for 5 min?

**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

**Hyperosmolar therapy**

3% saline bolus

5ml/kg over 15 min

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 therapy²**

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 0.5 mg/kg/hr as needed to maintain burst suppression on EEG.

**Max dose:** 5 mg/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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*see inclusion criteria on pg. 2

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Severe Traumatic Brain Injury
Clinical Practice Guideline for Management of Increased Intracranial Pressure (ICP)

Phase III – ICP Non-Responsive to Phase II Therapy

**Clinical Practice Guideline for Management of Increased Intracranial Pressure (ICP)**

**Mild Hyperventilation**
PaCO2 30 - 35 mmHg

**ICP Sustained ≥20 for 5 min?**

**YES**

**Repeat CT Scan**

**Cisterns Open?**

**YES**

**Consider Lumbar Drain**

**ICP Sustained ≥20 for 5 min?**

**YES**

**Consider Alternative Treatments**

- **Hyperventilation**
  PaCO2 <30 mmHg

- **Moderate Hypothermia**
  32-33°C

- **Experimental Drugs**

- **Decompressive Craniectomy**

**NO**

**Consider Discontinuing Guideline**

**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:**
   - a. Repeat CT scan
   - b. 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 Osmolality Level
TBI – Traumatic Brain Injury

Developed through the efforts of Children’s Healthcare of Atlanta and physicians on Children’s medical staff in the interest of advancing pediatric healthcare. This is a general guideline and does not represent a professional care standard governing providers’ obligation to patients. Ultimately the patient’s physician must determine the most appropriate care.

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