

PRACTICE GUIDELINE

Effective Date: 9-1-2012

Manual Reference: Deaconess Trauma Services

TITLE: TRAUMATIC BRAIN INJURY GUIDELINE

PURPOSE: To provide practice management guidelines for traumatic brain injury patients based upon the National Brain Trauma Foundation Guidelines.

- Early diagnosis and management of severe traumatic brain injury.
- Prevent causes of secondary brain injury during resuscitation (hypoxia, hypovolemia, hypocarbia, anemia, hyperthermia, hypo/hyperglycemia.)
- To rapidly identify and treat mass lesions.
- Indications for ICP/ CPP monitoring and management of intracranial hypertension (ICH.)

DEFINITIONS

1. Mild head injury: Glasgow Coma Scale* (GCS) score 13-15
2. Moderate head injury: GCS 9-12
3. Severe head injury: GCS 3-8

* After adequate cardiopulmonary resuscitation.

GUIDELINES

A. Initial management

1. Primary and secondary survey as outlined in resuscitation section above.
2. Establish level of consciousness and any focal neurologic deficits.
3. Airway:
 - a. Intubate all unconscious patients (GCS < 8) to secure airway. Use sedation and short acting neuromuscular blockade if necessary.
 - b. Maintain cervical spine immobilization in all unconscious or symptomatic (neck pain or tenderness) patients.
4. Breathing: Oxygenation and ventilation.
 - a. Administer high flow oxygen to all patients with suspected head injury.
 - b. Monitor oxygen saturation.
 - i. Avoid hypoxia (SaO₂ < 90% or PaO₂ < 60 mmHg.)
 - c. Ventilation.
 - i. Avoid hyperventilation; unless signs of herniation are present
 - ii. Maintain PaCO₂ 35-40 mmHg.
5. Circulation:
 - a. Prehospital: avoid SBP < 85 mmHg.
 - b. Resuscitate to goal of mean arterial pressure (MAP) > 85 mmHg to maintain a presumptive cerebral perfusion pressure (CPP) > 60 mmHg.
 - c. Fluids: infuse 0.9% NaCl and/or blood.

6. Recognize and treat herniation syndromes.
 - a. Signs:
 - i. Pupils: Anisocoria (asymmetric,) irregular, or sluggish reaction, progressing to fixed, dilated, nonreactive.
 - ii. Motor: hemiparesis, decerebrate posturing, Babinski reflex.
 - iii. Progressive neurologic deterioration, not attributable to extracranial causes.
 - b. Emergency treatment of herniation:
 - i. Hyperventilation.
 - ii. Mannitol, if not hypotensive.
 - iii. Hypertonic saline
 - c. In the absence of a herniation syndrome, do not initiate treatment for intracranial hypertension, until CT scan is done or ICP monitor inserted.
7. Manage all wounds in a sterile manner.
8. Indications for head CT scan (without IV contrast):
 - a. Unconscious.
 - b. History of loss of consciousness.
 - c. Focal neurologic deficits.
 - d. Post-traumatic seizure.
 - e. Decreasing level of consciousness.
 - f. Penetrating injury.
 - g. Skull fracture.
9. Indications for neurosurgery consultation:
 - a. Moderate or severe head injury: GCS<13.
 - b. Post-traumatic seizure.
 - c. Unequal pupils.
 - d. Neurologic deficit.
 - e. Abnormal head CT scan:
 - i. Contusion.
 - ii. Subdural hemorrhage (SDH)
 - iii. Subarachnoid hemorrhage (SAH) in patient with GCS less than 15 and/or on any anticoagulant medication
 - iv. Edema.
 - v. Compressed basal cisterns.
 - vi. Skull Fracture.
10. Patients with only a tiny SAH, normal GCS (15), and who are not on any anticoagulant medications can be managed by the trauma surgeon with serial neuro examinations (neuro checks every 2 hours at least).
 - a. If the patient has a change in neuro status, trauma surgeon should repeat head CT and consult neurosurgeon.
 - b. Repeat Head CT and Neurosurgical consultation should be obtained if there is a change in Neuro Status. Neurosurgery consultation may also be obtained at the Trauma Surgeon's discretion, if there are any other concerns.

- c. Upon discharge, patient should follow up in trauma clinic 2 weeks post discharge to ensure normal functioning and no residual symptoms (i.e. headache, nausea, inability to perform ADL, etc.).
- B. Intracranial pressure (ICP) and cerebral perfusion pressure (CPP) monitoring.
 - 1. Need for ICP/CPP monitoring will be determined by the neurosurgery service.
 - General indications:
 - a. Severe head injury (GCS 3-8 after resuscitation and considering presence of paralytics and sedatives) + abnormal CT scan.
 - b. Inability to monitor neuro exam: prolonged sedation or anesthesia.
 - 2. Brain Trauma Foundation provides Level III evidence for placement of ICP monitoring device in the following patient type:
 - a. Severe head injury + normal CT scan and at least 2 of the following 3:
 - i. Age > 40.
 - ii. Unilateral or bilateral posturing.
 - iii. SBP < 90 mmHg.
 - 3. Technique:
 - a. ICP: Parenchymal ICP monitoring catheter (Camino) or ventricular catheter.
 - b. CPP: Arterial line needed for continuous monitoring
 - i. $CPP = \text{mean arterial pressure(MAP)} - ICP$
- C. ICP/CPP treatment (see flowchart.)
 - 1. Parameters:
 - a. Normal ICP = 0-10 mmHg.
 - b. Treatment threshold > 20-25 mmHg.
 - c. Goal CPP = 60-70 mmHg.
 - 2. Hyperosmolar Therapy
 - a. Mannitol.
 - i. For treatment of intracranial hypertension:
 - (a) Effective doses range from 0.25-1 gram/kg, given by intermittent bolus infusion Q 4-8 hrs. (See flowchart for starting dose).
 - (b) Euvolemia must be maintained. Foley mandatory. CVP monitor recommended.
 - (c) Monitor serum osmolality
 - (i) If serum osmolality exceeds 310 mOsm/kg, contact neurosurgeon before administering Mannitol.
 - (d) Monitor serum sodium.
 - b. Hypertonic Saline
 - 3. Barbiturates.
 - a. High dose barbiturates may be considered for hemodynamically stable, salvageable, severe head injury patients with intracranial hypertension refractory to maximal medical and surgical therapy.
 - 4. Drugs contraindicated or to use with caution in TBI patients:
 - a. Steroids should not be used in patients with severe traumatic brain injury.
 - b. Ketamine should not be used in patients that require frequent neuro checks

- c. Use Ketamine with caution in TBI patients with elevated ICP.
- D. Early post-traumatic seizure prophylaxis (7 days):
1. Anti-convulsants may be considered in the following patients:
 - a. Glasgow coma scale score < 10.
 - b. Cortical contusion.
 - c. Depressed skull fracture.
 - d. Subdural hematoma.
 - e. Epidural hematoma.
 - f. Temporal lobe contusions.
 - g. Penetrating head wound.
 - h. Seizure within 24 hrs. of injury.
 2. Therapy should be considered for 7 days.
- E. Nutritional support.
1. Enteral feeds should be instituted within 72 hours of injury unless contraindicated.
 2. Consult Dietician for feeding recommendations
- F. Normothermia Protocol (Nursing Policy in Mosbys)
1. This should be instituted moderate and severe TBI (i.e. GCS < 13) patient with fever greater than 100.4 °F
 2. Use Normothermia Order Set in Epic

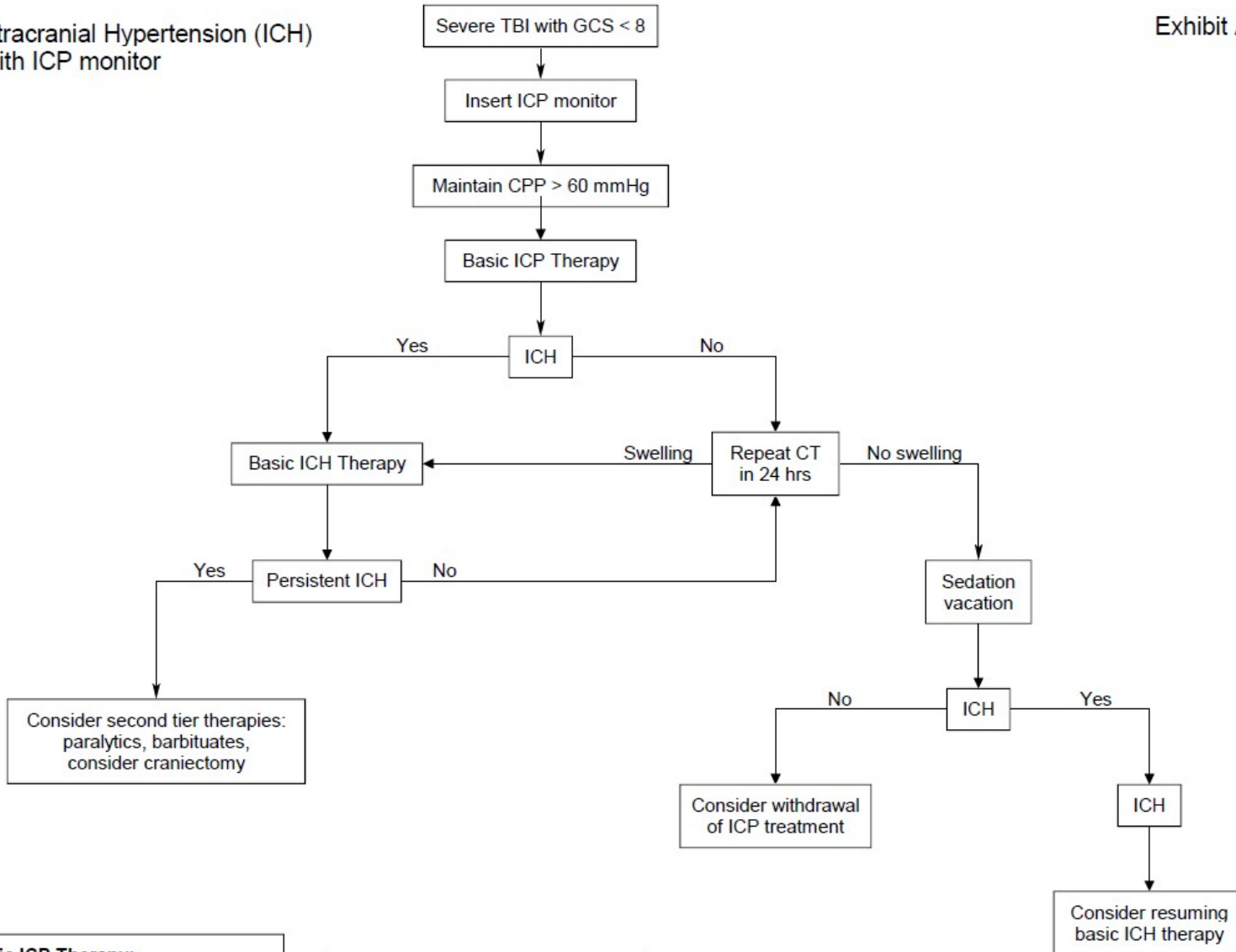
REFERENCES

- ❖ Brain Trauma Foundation, Inc. Guidelines for the Management of Severe Traumatic Brain Injury. 2016. <http://www.braintrauma.org> (accessed 12/16/2016)

REVIEWED DATE	REVISED DATE
9-1-2014	9-1-2012
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JAN 18	2-1-2017
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APRIL 20	
APRIL 21	

Treatment of Intracranial Hypertension (ICH) with ICP monitor

Exhibit A



Basic ICP Therapy:

- intubation, sedation, analgesia
- maintain normal PaCO₂ (35-40)
- hourly pupil checks
- no sedation vacation unless otherwise ordered
- no Precedex
- maintain MAP >85

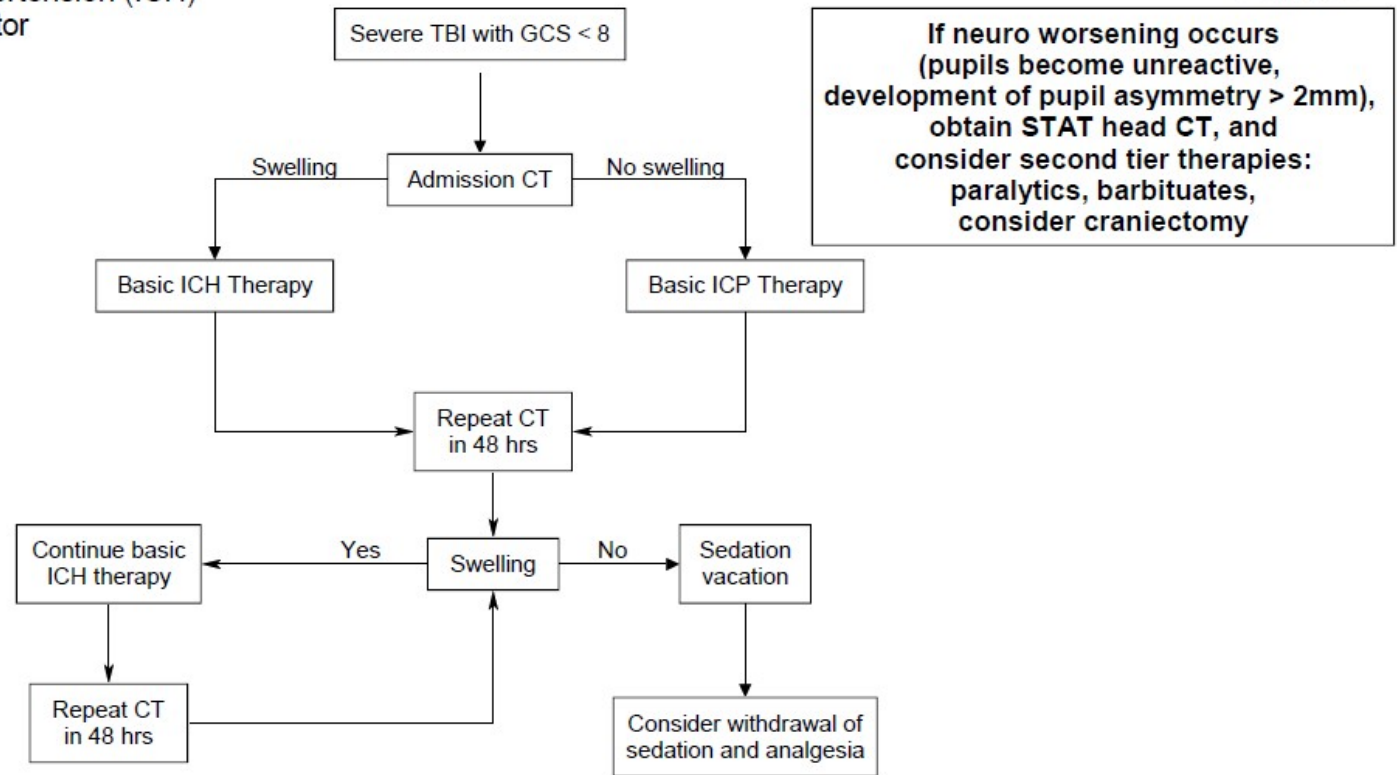
Basic ICH Therapy:

- Basic ICP Therapy
- Mannitol 0.5 g/kg IV q 8 hrs or hypertonic saline
- Ventricular drainage

If neuro worsening occurs (pupils become unreactive, development of pupil asymmetry >2 mm), obtain STAT head CT, and consider second tier therapies.

Treatment of Intracranial Hypertension (ICH) without ICP monitor

Exhibit B



- Basic ICP Therapy:**
- intubation, sedation, analgesia
 - maintain normal PaCO₂ (35-40)
 - hourly pupil checks
 - no sedation vacation unless otherwise ordered
 - no Precedex
 - maintain MAP >85

- Basic ICH Therapy:**
- Basic ICP Therapy
 - Mannitol 0.5 g/kg IV q 8 hrs or hypertonic saline