



erlanger

Origination 03/2023

Last 03/2026

Approved

Effective 03/2026

Last Revised 03/2026

Next Review 03/2029

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Applicability Erlanger Health -
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Traumatic Brain Injury Practice Management Guideline

A. Process/Procedure Description

SUMMARY: Traumatic brain injury (TBI) is a potentially lethal injury across all age groups with mortality rates as high as 30%. Injury severity and subsequent treatment can be delineated using the Brain Injury Guidelines (BIG) scale. Patient outcomes following severe TBI (defined as a post-resuscitation Glasgow Coma Score (GCS) ≤ 8) are significantly improved when such patients are managed according to a comprehensive TBI protocol. Primary endpoints in the management of severe TBI include minimizing cerebral edema and intracranial pressure (ICP) while simultaneously optimizing cerebral perfusion pressure (CPP) ($CPP = MAP - ICP$) and tissue oxygenation to reduce secondary ischemic injury. This protocol will use tiers of therapy as recommended by the Brain Trauma Foundation (BTF), Neurocritical Care Society and ACS TQIP Best Practices in the Management of Traumatic Brain injury guidelines.

B. TIER ZERO

The following interventions should be implemented in all patients with TBI admitted to the critical care and step-down areas:

- Maintain target MAP ≥ 80 mmHg if no ICP monitor is in place
- Administer supplemental oxygen to maintain SpO₂ $>90\%$
- Elevate head of bed to 30 degrees
- Maintain head in neutral position to avoid jugular vein compression – consider removing cervical collar and utilizing sandbags or towels
- Maintain serum sodium ≥ 140 mEq/L with isotonic intravenous fluids (no dextrose)
- Correct coagulopathy with the appropriate reversal agent in life-threatening bleeds
 - Four factor PCC (refer to Guideline for Reversal of Anticoagulation and Antiplatelet

- Therapy order set for dosing) for Coumadin and Anti-Xa agents (Xarelto (rivaroxaban), Eliquis (apixiban), Savaysa (edoxaban))
 - Platelets or DDAVP for Plavix (clopidogrel), Brilinta (ticagrelor), Effient (prasugrel), Aggrenox
 - Consider Vitamin K for long term reversal
- Maintain normothermia (temperature 36-37 Celsius)
 - Tylenol 650 mg PO/PR q4 hours scheduled if temperature > 37 Celsius
 - Consider Ibuprofen 800 mg PO/PR q6 hours (if unable to control with Tylenol)
 - Consider cooling device if unable to maintain normothermia
- Maintain serum glucose ≥ 70 mg/dl and ≤ 180 mg/dl
- Ensure early appropriate nutritional support with gastric tube feeds within 24 hours
- Consider post-pyloric tube feeds in patients that do not tolerate gastric feeds
- Ensure early deep venous thrombosis (DVT) treatment – initiate DVT prophylaxis within 48 hours of a stable CT brain
- Initiate gastrointestinal stress ulcer prophylaxis in mechanically ventilated patients
- Prevent skin breakdown/decubitus ulcer formation with early (<24 hours) Mepilex padding

C. TIER ONE

The following interventions should be added in all patients with a GCS ≤ 8 (with a motor score below 6)

- Ensure all physiologic goals from Tier Zero are met
- AIRWAY/BREATHING
 - Intubate patient if GCS ≤ 8 and as needed to protect airway
 - Maintain PaCO₂ 35-40 mmHg
 - Consider obtaining arterial blood gas to correlate with end-tidal CO₂
 - Maintain PaO₂ 80-120 mmHg
- SYSTEMIC PERFUSION
 - Insert an arterial line
 - Maintain MAP ≥ 80 mmHg
 - Ensure adequate volume resuscitation
 - Ensure hemoglobin > 9 g/dl during patient's acute resuscitation phase
 - Consider vasopressors to keep MAP ≥ 80 mmHg or CPP ≥ 60 mmHg
- CEREBRAL PERFUSION
 - Place intracranial pressure (ICP) monitor if GCS ≤ 8 after resuscitation AND concern for elevated ICP on imaging or exam (GCS motor score < 5)
 - The decision to use an ICP monitor with or without CSF diversion should be made in collaboration with neurosurgery.

- Maintain cerebral perfusion pressure (CPP) ≥ 60
- If CPP < 60
 - Ensure adequate volume resuscitation
 - Consider vasopressors (levophed 0.05mcg/kg/min – titrate to keep CPP >60)
- Management of sustained ICP>22 for 10 min
 - Verify accurate ICP with review of waveform and/or leveling and re-zeroing of an EVD.
 - Concerns about accuracy of an ICPm should be discussed with the critical care resident.
 - Concerns about CSF diversion should be discussed with neurosurgery on call.
 - Discuss plan with neurosurgery to increase CSF diversion
- PROTECT THE BRAIN
 - Provide judicious analgesia and sedation to control pain and agitation
 - Fentanyl 25-500mcg/hr IV infusion
 - Bolus with dose increased for elevated ICP
 - Bolus patient with 50% current rate before increasing infusion rate for acute increases in ICP
 - If paralyzed and BIS is <40, boluses should not be used for elevated ICP
 - Propofol 10-50 mcg/kg/min
 - Must fill out propofol order set
 - Monitor for signs of propofol infusion syndrome
 - Seizure prophylaxis is indicated in BIG 3 injuries with penetrating injury, depressed skull fracture or GCS <10.
 - Keppra 500mg IV/PO every 12 hours for 7 days (stop after 7 days if no seizure activity)
 - Consider EEG monitoring to rule out non-convulsive status epilepticus
 - Avoid
 - Hypotension (SBP <100mmHG) or CPP < 60 mmHg
 - Hypoxemia (SpO₂ <92%)
 - Hypercarbia (PaCO₂>45 mmHG)
 - Hyponatremia (serum sodium <140 mEq/L)
 - Hypoglycemia or hyperglycemia (serum glucose <70 mg/dl or >180 mg/dl)
 - Hypovolemia

- Fever
- Anemia

D. TIER TWO

The following interventions should be considered if ICP is persistently >22 mmHg for more than 60 minutes and after discussion with neurosurgery and surgery critical care:

- Ensure all applicable elements from Tier One are met
- CSF diversion in the form of external ventricular drainage or lumbar drain
- Continuous 3% sodium chloride drip as long as serum sodium <160 mEq/L
- Consider repeat head CT to rule out space-occupying lesion
- Consider continuous EEG monitoring to rule out non-convulsive status epilepticus
- Consider bolusing and then increasing sedative and analgesic therapy
- Paralysis
 - Ensure RASS -5 before initiation of paralytic
 - Start rocuronium and titrate to train 2/4
 - BIS monitors should be used with all paralyzed patients
 - Target BIS is 40-60 and should be obtained before starting paralytics
- Prophylactic hypothermia is currently NOT recommend for patient with diffuse injury
- Mild hyperventilation
 - Begin mild hyperventilation with goal PaCO₂ 30-34 mmHg

E. TIER THREE

The following interventions should be considered if ICP remains >22 mmHg despite all Tier two goals being met

- Ensure that medical therapy with hypertonic saline is maximized (serum sodium 155-160 mEq/L)
- Consider revised ICP threshold of 25 mmHg with strict adherence to CPP >60mmHG
- Initiate continuous EEG
- Surgical decompression
 - Consider decompressive craniotomy with or without craniectomy for surgical lesions
 - Decompressive craniectomy solely for management of malignant cerebral edema does not improve long-term neurologic outcome but may be considered as a rescue therapy
- Barbiturate Coma
 - If not a surgical candidate and refractory to all the above intervention consider pentobarbital coma

- Pentobarbital 10mg/kg IV over 10 minutes, then 5mg/kg/h x 3 hours, then 1mg/kg/hr IV infusion
- Titrate pentobarbital to the minimal dose required to achieve EEG burst suppression – 3-5 burst/minute
- Discontinue all other sedative agents and paralytics after pentobarbital loading doses complete (4 hours)
- Consider invasive hemodynamic monitoring (such as pulmonary artery catheter) due to the negative inotropic effects of pentobarbital
- Once ICP < 22mmHg for 48 hours, wean pentobarbital dose over the next 48-72 hours
- Discontinue or decrease tube feeds to trophic rate (10-20 ml/hr)

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Approval Signatures

Step Description	Approver	Date
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Trauma Services Committee Approval	Stephanie Spain: Trauma Prgm Mgr Adult	02/2026
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Applicability

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