

Severe TBI Guideline at Cook Children's Hospital

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First edition (July 2012)

First Revision (September 2019)

This guideline provides the clinical guidance of care for any patient with a severe traumatic brain injury (TBI).

This is a guideline and physicians may choose to deviate from the guideline, based on clinical judgement.

Inclusion Criteria:

Abnormal CT scan with hematomas, swelling, herniation, compressed basal cistern, or diffuse axonal injury AND either #1 or #2 below

- Traumatic brain injury (TBI) with GCS \leq 8 (field, transport, or ED)
- TBI patient admitted with GCS $>$ 8, with deterioration to GCS \leq 8

Exclusion Criteria:

- Patients who are not expected to survive and would not benefit from TBI guideline after discussion / agreement by clinical care team

Relative Exclusion Criteria:

- Infants with open fontanelles (ICP monitor placement not feasible). May follow no ICP monitoring interventions

TBI Tier One

Initial Resuscitation Using ATLS Guidelines

- 1- **Airway**- Secure airway using neuroprotective strategies
- 2- **Breathing**- Avoid hypoxia and hypercarbia. Goals: PaO2 > 60 mmHg and PaCO2 35 to 40 mmHg.
- 3- **Circulation**- Maintain euolemia and normal MAP for age. Treat causes of hypotension. (Do not use Plasmalyte) Seizure prophylaxis with Keppra bolus 40 mg/Kg IV at ED. Maintenance (20 mg/Kg IV/PO BID) May Use 3% Saline for signs of elevated ICP

Indications for ICP Monitoring

Distracting Injuries requiring sedation/mechanical ventilation
Other indications at the discretion of treating clinicians (Neurosurgery, Critical Care)

ICP monitoring
(See indications)

First Tier Interventions

Elevate the head of the bed 30 degrees, head midline
Initiate Target Temperature Control Guideline. Target Temperature < 38.3
Maintain pain control and sedation (Avoid bolus of Fentanyl/Midazolam during ICP crises)
Maintain normal O2 Saturation and PaCO2 35 to 40 mmHg
Maintain Cerebral O2 Saturation > 60 %
Maintain normal blood pressure and CPP (40 -50 mmHg)
Maintain Blood sugar 80 to 200 mg/dL
Maintain Sodium level 140 to 155 mmol/dl (May use 3 % Saline)
Start Nutrition within 72 hrs

CT scan of Head

Surgical evacuation of mass lesion
If indicated

Post targets sign once agreed upon by neurosurgeon and intensivists team. Fill bedside check list.

Indications for Seizure Prophylaxis.

Non Accidental trauma
Age < 2 years
GCS < 8 (admission)
Subdural Hemorrhage
Impact Seizure

No ICP monitoring

First Tier Interventions

Elevate the head of the bed 30 degrees,
Initiate Target Temperature Control Guideline. Target Temperature < 38.3
Maintain pain control
Maintain normal O2 Saturation and PaCO2 35 to 40 mmHg
Maintain normal blood pressure
Maintain Blood sugar 80 to 200 mg/dL
Maintain Sodium level 138 to 145 mmol/dl (May use 3 % Saline)
Start nutrition within 72 hrs

If ICP is elevated and sustained above 20 mmHg for > 5 min

Reassess patient
Make sure the cervical collar is not compressive
Optimize First Tier Interventions
Exclude Seizure activity and treat if present (EEG monitoring)

TBI Tier Two

If ICP is elevated above 20 mmHg for > 5 min following Tier One, implement interventions in sequential order.

Neuromuscular blockade (Initiate Continuous EEG monitoring)

Vecuronium bolus 0.1 mg/Kg IV

If persistent ICP elevation start continuous infusion at 0.05 to 0.1 mg/Kg/h



Consider Head CT.
(Discuss with Neurosurgery)

If ICP is elevated and sustained above 20 mmHg for > 5 min



Hyperosmolar therapy (Maintain Euvoolemia)

- 3% saline boluses 5 ml/kg and/or infusion titrating to keep ICP < 20 mmHg keeping serum osmol < 360 mosm/L (follow protocol) (First line)
- Mannitol 0.25-1 g/kg keeping serum osmol < 320 mosm/L. (Second line)



Sustained ICP > 20 mmHg for > 5min



Consider 23.4% Saline bolus. 0.5 ml/Kg (Max. 30 mls)



Sustained ICP > 20 mmHg for > 5min



Consider CSF drainage (EVD)

Consider Head CT.
(Discuss with Neurosurgery)

TBI Tier Three

If ICP is elevated above 20 mmHg for > 5 min following Tier Two, implement interventions in sequential order.

Hypothermia for TBI
After clear by Neurosurgery
Target Temperature 33 °C (24-72h)

Sustained ICP > 20 mmHg

Repeat CT Scan/Surgery
If indicated

Consider Decompressive Craniectomy

No
↓

Pentobarbital

Bolus 0.5 to 1 mg/Kg q1h

If persistent ICP elevation start continuous infusion at 0.5 to 1 mg/Kg/h. Goal of burst suppression

Temporary Hyperventilation to PaCO2 25-30 mmHg
< 10 min

Only for patients with signs of herniation or for short period of time if ICP > 30 mmHg for > 5 min and waiting for other interventions to take effect.
Stop if Cerebral saturation drops by 10%

-Start withdrawal of therapy after 24 hrs of no therapy escalation and ICP stable below 20 mmHg
-Withdraw in reverse order of implementation. (exception will be patients that had decompressive craniectomy)

Addendum

Indications for ICP monitoring

Distracting Injuries requiring sedation/mechanical ventilation

Neurosurgeon will consider placing an ICP monitor if abnormal CT scan with hematomas, swelling, herniation, compressed basal cistern, or diffuse axonal injury AND either #1 or #2 below

- Traumatic brain injury (TBI) with GCS \leq 8 (field, transport, or ED)
- TBI patient admitted with GCS $>$ 8, with deterioration to GCS \leq 8

Other indications at the discretion of treating clinicians (Neurosurgery, Critical Care)

Bedside Nursing

Critical Care team will write neuro target parameters in EPIC. Parameters will be posted at the bedside by the bedside nurse. Bedside nurse will communicate with critical care team if patient is outside target parameters.

Bedside TBI checklist (Checklist with TBI Tiers) will be kept updated by the bedside nurse.

Indications for Seizure Prophylaxis

Non Accidental trauma

Age $<$ 2 years

GCS $<$ 8 (admission)

Subdural Hemorrhage

Impact Seizure

Seizure prophylaxis with Keppra bolus 40 mg/Kg IV at ED. Maintenance (20 mg/Kg IV/PO BID).

Patient with no traumatic seizure at presentation and no seizure during the first 24 hrs: Keppra could be stop before discharge from the hospital or at day 7 if patient did not have any seizures and remains in the hospital.

Patient with traumatic seizure at presentation or seizure at any time during the hospitalization: Neurology should be consulted for management of antiepileptics.

Hypothermia

Tier III intervention to be implemented after Tier II interventions failure.

Hypothermia should be cleared by neurosurgery.

Target temperature 33 °C for 24-72 hrs and rewarming over 48 hrs.

Follow Hypothermia for Status epilepticus order set.

If patient ICP is controlled and patient stable for 24 hrs, rewarming can be started earlier than 72 hrs.

If surgical interventions are planned, the patient will need to be warmed to 35 degrees.

REFERENCES

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