

Pediatric traumatic brain injury (TBI) – Emergency Department

Created: January 2023 | Updated: September 2026
 Next review: 2029
 Updated by: Sara Holmstrom, MD; Allie Kenneally, PharmD
 Approved by: PEMCET

Maintain cerebral perfusion

H's of head injury

- Elevate **H**ead of bed 30°
- Avoid **H**ypotension
- Avoid **H**ypoxia
- Avoid **H**ypo/**H**yperglycemia
- Avoid **H**yper/**H**ypothermia
- Avoid **H**ypocarbida
(goal PaCO₂ 35 – 40)

Avoid herniation

Signs and symptoms

- Hypertension with bradycardia
- Pupillary dilation/asymmetry
- Extensor posturing
- Irregular respirations

Emergent management

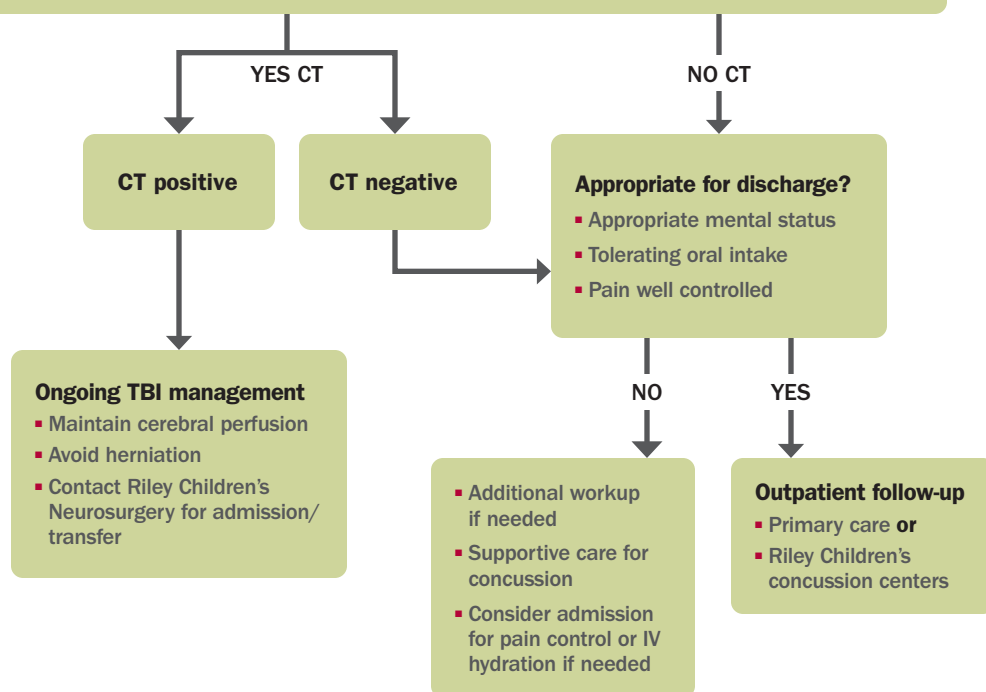
- Hyperventilation (PaCO₂ 30 – 35)
- Increase FIO₂ to 100%
- Hyperosmolar therapy with one of the following (see dosing table on page 2):
 - Sodium chloride 3% – 5mL/kg, infuse over 20 minutes
 - Mannitol 20% – 1g/kg, infuse over 20 minutes, requires in line filter
- Neurosurgery emergent evaluation
- Seizure prophylaxis
 - Levetiracetam 40 mg/kg IV (Max: 2,000 mg) – infuse over 15 minutes
- Appropriate pain control

Initial assessment and stabilization

- **Airway:** Include medical screening assessment and C-spine examination, adjuncts or definitive airway and c-spine stabilization as indicated
 - **Breathing:** Supplemental oxygenation, pulse oximetry, end-tidal capnography, goal PaO₂ 35 – 40 mmHg
 - **Circulation:** Assess and maintain normotension, IV fluids, blood products as indicated, assess for additional occult injuries
- Cerebral Perfusion Pressure (CPP) = Mean Arterial Pressure (MAP) – Intracranial Pressure (ICP)

Head CT needed?

Visit [mdcalc.com](https://www.mdcalc.com) for the PECARN Pediatric Head Injury/Trauma Algorithm
 Can consider CT brain at provider's discretion



References

- Kochanek PM, Tasker RC, Carney N, et al. Guidelines for the management of pediatric severe traumatic brain injury, third edition: update of the brain trauma foundation guidelines. *Pediatr Crit Care Med*. 2019; 20:S1-S82.
- Kuppermann N. PECARN Pediatric Head Injury/Trauma Algorithm. MD Calc site: <https://www.mdcalc.com/calc/589/pecarn-pediatric-head-injury-trauma-algorithm>.



Riley Children's Health
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CONTACT RILEY CHILDREN'S HEALTH

Calling from an ED or inpatient setting? **Call the IU Health Transfer Center for transfer or consult at 877.247.1177.**

Calling from an outpatient setting? **Call MyRiley at 1.844.697.4539.**

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Hyperosmolar dosing reference sheet

Drug/ Weight (kg)	≤ 2.5	2.6 – 3.5	3.6 – 4.5	4.6 – 5.5	5.6 – 7.0	7.1 – 9.0	9.1 – 12.5	12.6 – 17.5	17.6 – 22.5	22.6 – 27.5	27.6 – 32.5	32.6 – 37.5	37.6 – 42.5	42.6 – 47.5	≥ 47.6
Sodium Chloride 3% – 5 mL/kg = 2.5 mEq/kg															
Volume in mL	10 mL	15 mL	20 mL	25 mL	30 mL	40 mL	50 mL	75 mL	100 mL	125 mL	150 mL	175 mL	200 mL	225 mL	250 mL
Dose in mEq	5.13 mEq	7.7 mEq	10.26 mEq	12.83 mEq	15.39 mEq	20.52 mEq	25.65 mEq	38.48 mEq	51.3 mEq	64.13 mEq	76.95 mEq	89.78 mEq	102.6 mEq	115.4 mEq	128.3 mEq
Mannitol 20% – 1 GM/kg = 5 mL/kg															
Volume in mL	10 mL	15 mL	20 mL	25 mL	30 mL	40 mL	50 mL	75 mL	100 mL	125 mL	150 mL	175 mL	200 mL	225 mL	250 mL
Dose in GM	2 GM	3 GM	4 GM	5 GM	6 GM	8 GM	10 GM	15 GM	20 GM	25 GM	30 GM	35 GM	40 GM	45 GM	50 GM

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References

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