



Trauma Center Practice Management Guidelines

Mayo Clinic – Rochester

Imaging of Pediatric Patients with Traumatic Brain Injury

Pediatric Practice Management Guideline	Effective: 01/2011
Contact: Pediatric Trauma Center Medical Director/ Pediatric Trauma Coordinator	Last Reviewed: N/A

Purpose

To define appropriate utilization of ionizing radiation in diagnosis of a child with a known or suspected head injury.

Definitions

Pediatric Patient: Any person < 18 years of age.

Pediatric Trauma Patient: Any person ≤ 14 years of age admitted for an injury.

Traumatic Brain Injury: CT findings including any of the following: intracranial hemorrhage or contusion, cerebral edema, traumatic infarction, diffuse axonal or shearing injury, sigmoid sinus thrombosis, midline shift of intracranial contents or signs of brain herniation, diastasis of the skull, pneumocephalus, or a skull fracture depressed by at least the width of the table of the skull.

Clinically Significant Traumatic Brain Injury: A traumatic brain injury that results in any of the following: death, neurosurgical intervention, intubation of more than 24 hours, or hospital admission of ≥ 2 nights for persistent neurologic symptoms

Policy Statements

1. Traumatic brain injuries are the leading cause of death and disability in children.
2. More than 75% of all head injuries are categorized as mild and therefore may not require neuro-imaging.
3. There is growing recognition of potential untoward effects of ionizing radiation on the developing brain.
4. There is a risk/benefit ratio to injury identification versus radiation exposure risk and this ratio is dependent on both provider and patient/parental factors.
5. Data exists that defines individual risk for development of a clinically significant intracranial injury and should be utilized for decision making regarding need for neuro-imaging.
6. Children < 2 years of age are most sensitive to radiation, increasing the importance of sound clinical decision making in this population.

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Procedure Statements

1. If images from a referring facility are available, consultation with Peds/Adult Trauma consultant, Peds/Adult Emergency Medicine consultant, or Neurosurgery chief resident/Consultant is required prior to further imaging.
2. The age of the child (2 years or younger versus older than 2 years) will determine the decision making scheme related to need for a head CT.
3. Child is less than 2 years of age
 - a. If any of these signs or symptoms is present a head CT is recommended
 - i. $GCS \leq 13$
 - ii. Signs of an open/depressed skull fracture
 - iii. Concerns for non-accidental trauma
 - iv. Head circumference > 90% percentile
 - b. The remaining criteria while not as predictive of a clinically significant traumatic brain injury in isolation may be predictive in combination.
 - c. If none of the following criteria are met a CT is not recommended
 - d. If any of the following criteria are met, the clinical options include a period of observation or proceeding with imaging.
 - i. GCS 14
 - ii. Occipital, parietal, or temporal scalp hematoma
 - iii. Other signs of altered mental status (agitation, somnolence, or slow response to verbal communication)
 - iv. Concerning mechanism of injury (ejection, death of another passenger, rollover, pedestrian or bicyclist without helmet struck by motorized vehicle, fall > twice height, or head struck by high impact object)
 - e. The decision between a period of observation and imaging is based upon a number of clinical and social factors:
 - i. Physician experience and comfort level
 - ii. Presence of multiple versus isolated clinical findings
 - iii. Worsening exam since presentation
 - iv. Parental preference
 - v. Care giver reliability
 - f. Consultation with the Emergency Medicine physician is strongly encouraged.
4. Child is greater than 2 years of age
 - a. If any of these signs or symptoms is present a head CT is recommended
 - i. $GCS \leq 14$
 - ii. Signs of a basilar skull fracture
 - iii. Other signs of altered mental status (agitation, somnolence, or slow response to verbal communication)
 - b. The remaining criteria while not as predictive of a clinically significant traumatic brain injury in isolation may be predictive in combination.
 - c. If none of the following criteria are present a head CT is not recommended
 - d. If any of the following criteria are present the clinical options include a period of observation or proceeding with imaging.
 - i. History of loss of consciousness

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- ii. History of vomiting
- iii. Severe headache
- iv. Concerning mechanism of injury (ejection, death of another passenger, rollover, pedestrian or bicyclist without helmet struck by motorized vehicle, fall > twice height, or head struck by high impact object)
- e. The decision between a period of observation and imaging is based upon a number of clinical and social factors:
 - i. Physician experience and comfort level
 - ii. Presence of multiple versus isolated clinical findings
 - iii. Worsening exam since presentation
 - iv. Parental preference
 - v. Care giver reliability
- f. Consultation with the Emergency Medicine physician is strongly encouraged.

Related References:

1. Kuppermann, N et al. Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. *The Lancet Online* 2009; DOI: 10.1016.S0140-6736(09)61558-0.
2. Pediatric Glasgow Coma Scale

Clinical Parameter	Infants (0-12 months)	Children (1-5 years)	Points
Eye Opening	Spontaneous	Spontaneous	4
	Response to speech	Response to speech	3
	Response to pain	Response to pain	2
	No response	No response	1
Verbal Response	Coos/babbles	Appropriate words	5
	Irritable	Inappropriate words	4
	Cries to pain	Persistent cry	3
	Moans to pain	Grunts	2
	No response	No response	1
Best Motor Response	Normal	Spontaneous	6
	Withdraws to touch	Localized pain	5
	Withdraws from pain	Withdraws from pain	4
	Flexor response	Flexor response	3
	Extensor response	Extensor response	2
	No response	No response	1

Prepared by: Pediatric Trauma Operations Management Team

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