Table of Contents
1. Rationale
2. Background
3. Diagnosis
4. Clinical Management
5. Emergency Center Management
6. Admission
7. Closed Head Injury Clinical Pathway
8. Abnormal Head CT Clinical Pathway
9. Glasgow Coma Scale
10. Follow Up
11. References
12. Outcome Measures
13. Clinical Pathways Team Information

This pathway is intended as a guide for physicians, physician assistants, nurse practitioners and other healthcare providers. It should be adapted to the care of specific patients based on the patient’s individualized circumstances and the practitioner’s professional judgment.
Rationale:
This clinical pathway was developed by a consensus group of JHACH physicians, advanced practice providers, and nurses to standardize the management of children with a closed head injury.

Background
Head CT scan is the cornerstone of closed head injury diagnostic evaluation. Radiologic exposure is an equally important consideration. Following the PECARN guidelines will assist in determining risk of significant brain injury and need for head CT.

Diagnosis
*Lab tests:* Standard trauma labs
*Radiologic studies:* Head CT

Clinical Management
See [Closed Head Injury Clinical Pathway Algorithm](#).

Emergency Center Management
See [Closed Head Injury Clinical Pathway Algorithm](#) for imaging management. If CT head is normal, patient disposition and decisions for further imaging and consultation will be made by the trauma team leader. If CT head is abnormal, see [Abnormal Head CT Status Post Closed Head Injury Clinical Pathway](#) for further management and consultation.

Admission
Admission criteria include positive findings on CT scan (with the exception of isolated linear skull fracture), altered mental status or continued signs of post concussive syndrome, or concerns for caregiver competence in continuous assessment and decision making. Decisions regarding admission will be made by the trauma team leader in concert with the EC attending and neurosurgery attending (if applicable).

If patient is admitted, the admitting surgical service will place a routine consult for Neuropsychology as part of the admission orders. Patient will be discussed with the Neuropsychology team to determine optimal timing for their evaluation.
Johns Hopkins All Children's Hospital

Closed Head Injury Imaging Clinical Pathway

Closed Head Injury
(known or suspected blow to head, with or without loss of consciousness)
- ATLS primary/secondary survey
- Calculate Glasgow Coma Scale (GCS)

Age less than 2 years

- GCS ≤14
- Concern for skull fracture
- Agitation, somnolence, slow neurologic response

  Yes

  Head CT* without IV contrast

  Yes

  Observation versus Head CT*
  (consider CT if multiple findings, worsening symptoms, parental preference, age <3 mos)

  No

  Observation (no CT), disposition per trauma team leader

Age 2-17 years

- GCS ≤14
- Concern for skull fracture
- Agitation, somnolence, slow neurologic response, repetitive questioning

  Yes

  Head CT* without IV contrast

  Yes

  Observation versus Head CT*
  (consider CT if multiple findings, worsening symptoms, parental preference)

  No

  Observation (no CT), disposition per trauma team leader

  Yes

  Observation versus Head CT*
  (consider CT if multiple findings, worsening symptoms, parental preference, age <3 mos)

  No

  Observation (no CT), disposition per trauma team leader

- History of LOC ≥ 5 seconds
- Occipital, parietal, temporal cephalo-hematoma
- Not acting normally per caregiver
- Severe mechanism (MVC with ejection, death of another passenger, rollover, ped vs. auto, fall >3 ft, head struck by high impact object)

  Yes

  Observation versus Head CT*
  (consider CT if multiple findings, worsening symptoms, parental preference)

  No

  Observation (no CT), disposition per trauma team leader

- History of LOC
- History of vomiting
- Severe headache
- Severe mechanism (MVC with ejection, death of another passenger, rollover, ped vs. auto, fall >6 ft, head struck by high impact object)

  No

  Observation (no CT), disposition per trauma team leader

*If results are abnormal, go to Abnormal Head CT Status Post Closed Head Injury Clinical Pathway
Johns Hopkins All Children’s Hospital
Abnormal Head CT Status Post Closed Head Injury Clinical Pathway

Isolated Linear Skull Fracture?

Yes

No
- Intracranial bleed/abnormality
- Pneumocephalus
- Depression
- Basilar skull fracture or involvement of foramen magnum
- Other abnormal findings

Consult Neurosurgery

Does the patient meet discharge criteria?
- No suspicion for NAT, abuse, or neglect
- Not a high energy mechanism of injury
- Normal neurological exam/alerts easily
- No unremitting vomiting
- No significant extra-cranial injuries
- Lives close to health care facility/able to return to hospital if necessary, reliable caregivers
- More than 6 hours since time of injury*

Yes

No

Can be safely discharge home with follow-up and discharge instructions**

Admit to Neurosurgery or General Surgery/Trauma

*The six hours of observation from the time of injury can be done at home if legal guardian is deemed reliable by practitioner and patient is neurologically intact.

**Follow-up should be with the patient’s pediatrician; Neurosurgery does not follow-up with patients with an isolated linear non-depressed skull fracture. If patient has concussion like symptoms can follow-up with neuropsychology.
**Follow-up**
Please see the Concussion Management section of [Trauma Consults pathway](#).

**Glasgow Coma Scale**

![Glasgow Coma Scale Table]

*Figure 1. Pediatric modification of the Glasgow coma scale (pGCS).*

**References**


Eastern Association for the Surgery of Trauma - Management Guidelines  


Kupperman, N. PECARN Pediatric Head Injury/Trauma Algorithm  
Outcome Measures:

- Return to the EC/readmission with progressing TBI symptoms

---

Clinical Pathway Team

Closed Head Injury Imaging Clinical Pathway

Johns Hopkins All Children’s Hospital

Owner(s): JHACH Trauma Program, JHACH Neurosurgery

Also Reviewed by:

- Trauma program: Christopher Snyder, MD; Katie Deemer, RN Trauma PI Coordinator;
  Karen Macauley, RN Trauma Department Director
  Emergency Center: Lisa Odendal, MD; James O’Donnell, PA-C

Clinical Pathway Management Team: Joseph Perno, MD; Courtney Titus, PA-C

Date Approved by JHACH Clinical Practice Council:

Date Available on Webpage: February 2020

Last Revised: June 1st 2021 by Dr. Christopher Snyder

---

Disclaimer

Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

The information and guidelines are provided "AS IS" without warranty, express or implied, and Johns Hopkins All Children’s Hospital, Inc. hereby excludes all implied warranties of merchantability and fitness for a particular use or purpose with respect to the information. Johns Hopkins All Children’s Hospital, Inc. shall not be liable for direct, indirect, special, incidental or consequential damages related to the user's decision to use the information contained herein.