



Pediatric Head Trauma

High-Yield Revision Sheet

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1. Definition

Pediatric head trauma is any injury to the scalp, skull, or brain caused by blunt or penetrating force.

Clinical severity ranges from:

- Minor head injury (most common)
- Moderate traumatic brain injury (TBI)
- Severe TBI with increased intracranial pressure (ICP)

Main goal: Identify children with clinically important traumatic brain injury (ciTBI) while avoiding unnecessary CT scans.

2. Clinical Presentation

History

Always ask:

- Mechanism of injury
 - Fall
 - Motor vehicle collision
 - Sports injury
 - Assault/non-accidental trauma
- Height of fall
- Loss of consciousness (LOC)
- Vomiting
- Seizure
- Headache

- Amnesia
 - Behavioral changes
 - Anticoagulant use
 - Previous neurological disease
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Physical Examination (ABCDE first)

A. Airway

- Cervical spine protection
- Airway patency

B. Breathing

- Respiratory effort
- Oxygen saturation

C. Circulation

- BP
- HR
- Signs of shock

D. Disability

- **Glasgow Coma Scale (GCS)**
- Pupils
- Limb movement
- Focal neurological deficits

E. Exposure

Look for:

- Scalp hematoma
 - Skull depression
 - Basilar skull fracture signs
 - Other injuries
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Red Flags

- GCS <15
 - Persistent altered mental status
 - Repeated vomiting
 - Severe headache
 - Seizure
 - Unequal pupils
 - Focal neurological deficit
 - CSF leak
 - Signs of skull fracture
 - Bulging fontanelle (infants)
 - Progressive drowsiness
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3. Diagnostic Approach

Step 1

Assess:

- ABCDE
- GCS
- Mechanism
- Neurological examination

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Step 2

Classify injury

Mild

GCS 14–15

Moderate

GCS 9–13

Severe

GCS ≤ 8

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Step 3

Use **PECARN** (preferred in children) to decide CT need.

PECARN High-Risk Features

<2 years

- GCS <15
- Altered mental status
- Palpable skull fracture

Intermediate risk:

- Non-frontal scalp hematoma
 - LOC >5 sec
 - Severe mechanism
 - Not acting normally
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≥2 years

High risk

- GCS <15
- Altered mental status
- Basilar skull fracture signs

Intermediate risk

- Severe headache
 - Vomiting
 - LOC
 - Severe mechanism
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4. Differential Diagnosis

- Concussion
- Skull fracture

- Epidural hematoma
 - Subdural hematoma
 - Cerebral contusion
 - Diffuse axonal injury
 - Intracranial hemorrhage
 - Cervical spine injury
 - Syncope preceding fall
 - Seizure disorder
 - Non-accidental trauma
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5. Investigations

Imaging

CT Head (Non-contrast)

Gold standard emergency imaging

Indications:

- GCS ≤ 13
 - Focal neurological deficit
 - Skull fracture signs
 - Persistent altered consciousness
 - Recurrent vomiting with risk factors
 - Severe mechanism with concerning findings
 - Seizure after trauma
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Cervical Spine Imaging

If:

- Neck pain
 - Neurological deficit
 - High-energy trauma
 - Altered consciousness
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MRI

Useful for:

- Diffuse axonal injury
- Persistent neurological symptoms
- Normal CT but ongoing deficits

Not first-line in emergencies.

Laboratory Tests

Only when indicated

- CBC
 - Electrolytes
 - Blood glucose
 - Coagulation profile
 - Blood type & crossmatch
 - Toxicology (selected patients)
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6. Management Algorithm

Step 1

ABCDE stabilization

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Immobilize cervical spine

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Correct hypoxia

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Treat hypotension

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Assess GCS



Mild Injury

- Observe
 - PECARN assessment
 - CT only if indicated
 - Discharge with advice if low risk
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Moderate Injury

- CT head
 - Admit
 - Frequent neurological assessment
 - Neurosurgical consultation if abnormal imaging
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Severe Injury (GCS ≤ 8)

- Airway protection (intubation)
 - ICU admission
 - CT head
 - Neurosurgery
 - ICP management
 - Prevent secondary brain injury
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Management of Raised ICP

- Elevate head 30°
 - Neutral neck position
 - Oxygenation
 - Avoid hypotension
 - Hypertonic saline or mannitol
 - Neurosurgical intervention when indicated
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7. Drug Summary Table

Medication	Indication	Pediatric Dose	Notes
Acetaminophen (Paracetamol)	Mild headache	10–15 mg/kg/dose PO every 4–6 h	Avoid NSAIDs initially if intracranial bleeding is suspected
Hypertonic Saline 3%	Raised ICP	3–5 mL/kg IV bolus	Preferred osmotic therapy in many pediatric ICUs
Mannitol	Raised ICP	0.5–1 g/kg IV over 10–20 min	Avoid if hypotensive
Levetiracetam	Early post-traumatic seizure (selected patients)	20–40 mg/kg IV loading	Usually after neurosurgical consultation
Normal saline	Fluid resuscitation	20 mL/kg IV	Avoid hypotonic fluids

8. Admission Criteria

Admit if:

- GCS <15 after observation
- Abnormal CT
- Skull fracture
- Persistent vomiting
- Neurological deficits
- Seizure
- Suspected abuse
- Significant associated injuries
- Social concerns preventing safe discharge

9. Referral Criteria

Immediate neurosurgical referral

- Epidural hematoma
- Subdural hematoma
- Intracranial hemorrhage
- Depressed skull fracture
- Open skull fracture
- Raised ICP
- Progressive neurological deterioration

Neurology referral

- Persistent post-concussion symptoms
- Recurrent seizures

Child protection referral

- Suspected non-accidental trauma
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10. Follow-Up

Minor Head Injury

Review if:

- Persistent headache
- Vomiting
- Dizziness
- Poor concentration
- Behavioral change

Return to school:

- Gradually after symptom resolution

Sports:

- Return only after complete recovery using a stepwise return-to-play protocol.
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11. Clinical Pearls

- **Normal GCS does not completely exclude intracranial injury.**
 - Most children **do not require CT** if PECARN criteria indicate very low risk.
 - Avoid unnecessary radiation exposure.
 - Hypoxia and hypotension markedly worsen outcomes in severe TBI.
 - Always consider cervical spine injury with significant head trauma.
 - Infants may have serious injury with subtle clinical signs.
 - Consider abuse in infants or when the history is inconsistent with the injury.
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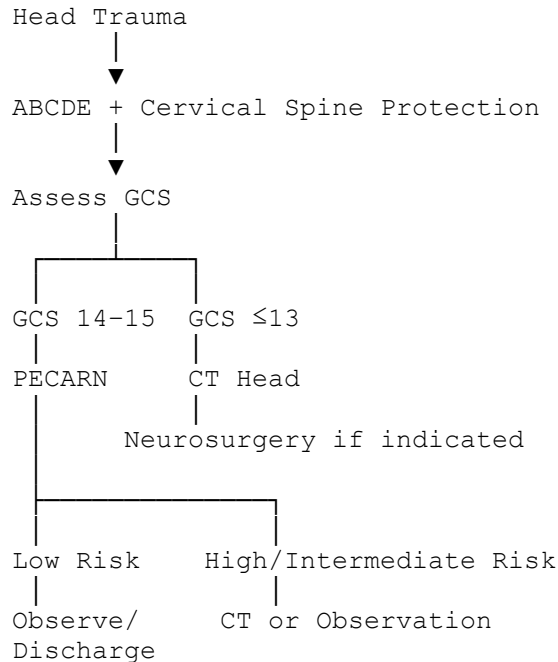
12. Common Mistakes in Exams and Practice

- ✗ Ordering CT for every minor head injury
 - ✗ Ignoring cervical spine stabilization
 - ✗ Missing signs of basilar skull fracture
 - ✗ Discharging a child with persistent altered mental status
 - ✗ Treating hypotension late
 - ✗ Using hypotonic IV fluids in severe TBI
 - ✗ Missing non-accidental trauma
 - ✗ Failing to provide discharge advice and return precautions
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13. Key Take-Home Messages

1. **ABCDE assessment and cervical spine protection come first.**
 2. **Use GCS to classify injury severity.**
 3. **Apply PECARN to identify children who need CT imaging.**
 4. **CT is indicated for high-risk features, not for every minor head injury.**
 5. **Prevent secondary brain injury by avoiding hypoxia and hypotension.**
 6. **Raised ICP requires urgent treatment and neurosurgical consultation.**
 7. **Most minor head injuries can be safely managed with observation and discharge instructions.**
 8. **Always evaluate for cervical spine injury and non-accidental trauma.**
 9. **Provide clear return precautions and arrange follow-up for persistent post-concussion symptoms.**
 10. **Early recognition and timely referral improve neurological outcomes.**
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Quick Emergency Algorithm



Recommended References

1. **NICE Guideline NG232.** *Head injury: assessment and early management.* Updated 2023.
2. **Kuppermann N, et al.** Identification of children at very low risk of clinically important brain injuries after head trauma: a prospective cohort study. *Lancet.* 2009;374:1160–1170. (PECARN)
3. **Brain Trauma Foundation.** *Guidelines for the Management of Pediatric Severe Traumatic Brain Injury*, 3rd Edition, 2019.
4. **American Academy of Pediatrics (AAP).** Clinical reports and policy statements on pediatric head injury and concussion.
5. **Centers for Disease Control and Prevention (CDC).** Pediatric Mild Traumatic Brain Injury Guideline, updated recommendations.