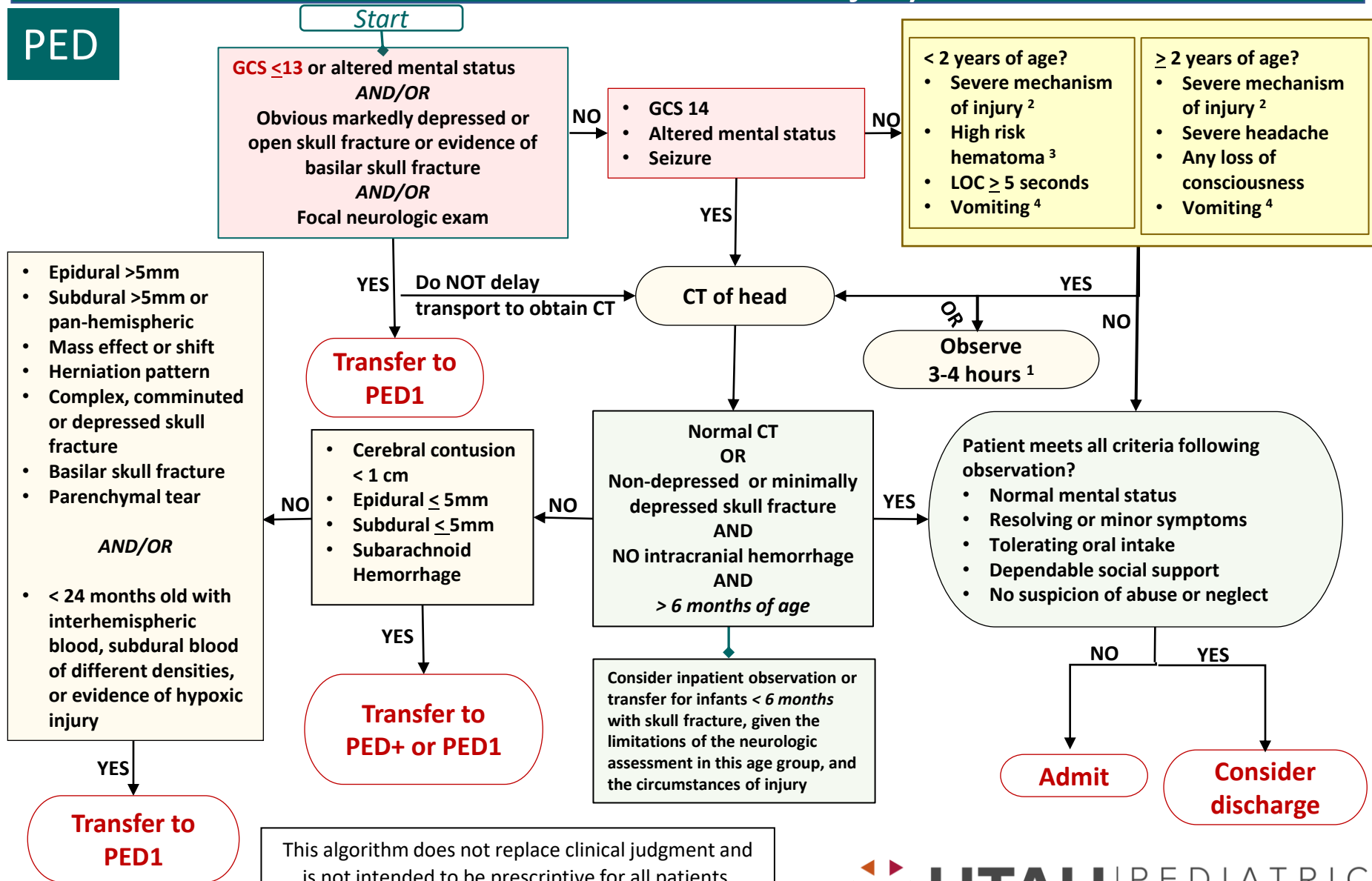


2022 Pediatric Traumatic Brain Injury (TBI) Clinical Guideline

Isolated Blunt Head Injury*

PED



This algorithm does not replace clinical judgment and is not intended to be prescriptive for all patients.

Pediatric Traumatic Brain Injury (TBI) Clinical Guideline

Isolated Blunt Head Injury*

*Isolated Blunt Head Injury

- No multi-system trauma
- No suspicion of abuse
- No structural brain disease
- No **VP** shunts
- No bleeding disorders
- No other conditions that may complicate assessment

1 Observation

Observation for 3-4 hours can be considered in lieu of CT scanning.

Depending on comfort level of clinician, distance to definitive care or presence of multiple factors, CT scanning may be favored.

2 Severe mechanism of injury

- Motor vehicle with ejection, death of another passenger or rollover
- Pedestrian/bicyclist struck by motor vehicle
- Fall > 3 feet (age < 2 years) or > 5 feet
- Head struck by high-impact object

Modified Glasgow Coma Scale for Infants and Children

	Child	Infant	Score
Eye opening	Spontaneous	Spontaneous	4
	To speech	To speech	3
	To pain only	To pain only	2
	No response	No response	1
Best verbal response	Oriented, appropriate	Coos and babbles	5
	Confused	Irritable cries	4
	Inappropriate words	Cries to pain	3
	Incomprehensible sounds	Moans to pain	2
	No response	No response	1
Best motor response*	Obeys commands	Moves spontaneously and purposefully	6
	Localizes painful stimulus	Withdraws to touch	5
	Withdraws in response to pain	Withdraws to response in pain	4
	Flexion in response to pain	Abnormal flexion posture to pain	3
	Extension in response to pain	Abnormal extension posture to pain	2
	No response	No response	1

3 High risk scalp hematoma

- Large, > 3cm
- Boggy
- Non-frontal
- Age < 6-12 months

4 Vomiting

Vomiting is so common in younger children that it is generally a poor discriminator of serious injury risk. This is especially true when vomiting occurs in isolation.

*If patient is intubated, unconscious, or preverbal, the most important part of this scale is motor response. Motor response should be carefully evaluated.

Pediatric Traumatic Brain Injury (TBI) Clinical Guideline

Isolated Blunt Head Injury*

Pediatric Head Trauma < 2 years

Derived from Intermountain CMP (2019, not published) and PECARN study 2009 (N = 42, 412) with subsequent substudies based on patients < 24 hours from head injury

Risk Stratification	Risk of ci TBI*
High Risk	4.4%
-Any of the following:	
GCS \leq 14 or altered mental status	
Palpable skull fracture	
Signs of basilar skull fracture	
Focal neurologic exam	
Seizure	
Medium Risk	0.9%
-Not high risk and any of the following:	
Severe mechanism of injury	
High risk hematoma	
LOC \geq 5 seconds	
Not acting normally per parents	
Comments regarding vomiting	
Low Risk	< 0.02%
-All others (NOT High Risk and NOT Medium Risk)	

*ciTBI: clinically important brain injury is defined as death, neurosurgery, intubation > 24 hours, admission \geq 2 nights

Pediatric Head Trauma \geq 2 years

Derived from Intermountain CMP (2019, not published) and PECARN study 2009 (N = 42, 412) with subsequent substudies based on patients < 24 hours from head injury

Risk Stratification	Risk of ci TBI*
High Risk	4.3%
-Any of the following:	
GCS \leq 14 or altered mental status	
Signs of basilar skull fracture	
Focal neurologic exam	
Seizure	
Medium Risk	0.9%
-Not high risk and any of the following:	
Severe mechanism of injury	
History of LOC	
Severe headache	
Vomiting	
Low Risk	< 0.05%
-All others (NOT High Risk and NOT Medium Risk)	

*ciTBI: clinically important brain injury is defined as death, neurosurgery, intubation > 24 hours, admission \geq 2 nights

Pediatric Traumatic Brain Injury (TBI) Clinical Guideline

Isolated Blunt Head Injury*

ADDITIONAL INFORMATION (< 2 years)

Focal neurologic exam: Focal findings are extremely uncommon after pediatric head trauma and are generally recognized as necessitating a CT scan.

Seizure: Seizure was not included in the original derivation of the PECARN study because many of these patients presented with other risk factors (e.g. altered mental status). Subsequent focused analysis indicates risk of Intracranial Injury (ICI) on CT scan significant enough to warrant scanning. Impact seizures have the lowest risk, 8.6% (95% ci 5.1%-13.5%) of ICI on CT while seizures occurring more than 30 minutes after trauma had the highest TBI risk of 20.0% (95% ci 10.4% – 33.0%). Clinicians should not scan for typical breath holding spells following minor head trauma.

Signs of basilar skull fracture: Uncommon in young children, includes CSF rhinorrhea / otorrhea, hemotympanum, racoon eyes, Battle's sign.

Severe mechanism of injury: MVC with ejection, death or rollover, pedestrian or bicyclist without helmet struck by a vehicle, fall > 3 feet if < 2 years and > 5 feet if > 2 years, head struck by high impact object. For isolated severe mechanism (no other signs / symptoms) in children < 2 years, a subsequent study noted a risk of ciTBI of 4/1330, 0.3% (95% ci 0.1%-0.8%) while for children ≥ 2 years, 12/2300, 0.5% (95% ci 0.3%-0.9%) had a ciTBI.

High risk hematoma: young age (especially < 6 months), size (especially > 3 cm), boggy and non-frontal location increases risk of ICI (intracranial injury) on CT. Frontal hematomas are NOT considered high risk. Re-evaluation for high risk hematoma during period of observation is recommended in infants.

Vomiting: Vomiting in the younger child was a poor discriminator because it is so common. In the original 2009 PECARN study vomiting was NOT an independent risk factor. In a follow-up sub study: for < 2 years olds with *isolated* vomiting there was an intracranial injury rate of 1% (95% ci 0.1%, 3.8%), while 0/567 had ciTBI.

Pediatric Traumatic Brain Injury (TBI) Clinical Guideline

Isolated Blunt Head Injury*

ADDITIONAL INFORMATION (≥ 2 years)

Focal neurologic exam: Focal findings are extremely uncommon after pediatric head trauma. And are generally recognized as necessitating a CT scan.

Seizure: Seizure was not included in the original derivation of the PECARN study because many of these patients presented with other risk factors (e.g. altered mental status). Subsequent focused analysis indicates risk of Intracranial Injury (ICI) on CT scan significant enough to warrant scanning. Impact seizures have the lowest risk, 8.6% (95% ci 5.1%-13.5%) of ICI on CT while seizures occurring more than 30 minutes after trauma had the highest TBI risk of 20.0% (95% ci 10.4% – 33.0%). Clinicians should not scan for typical breath holding spells following minor head trauma.

Signs of basilar skull fracture: Uncommon in young children, includes CSF rhinorrhea / otorrhea, hemotympanum, racoon eyes, Battle's sign.

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Vomiting: In the original 2009 PECARN study vomiting was NOT included as a moderate risk factor for younger children but it was included for older children. In a follow-up sub study: for **≥ 2 years olds** with isolated vomiting there was an intracranial injury rate of 3.2% (95% ci 2.1%-4.7%), while 10/1501 (0.7%) had ciTBI.