

# Diagnostic Imaging Pathways - Paediatric, Head Trauma

## Population Covered By The Guidance

This pathway provides guidance for imaging children with head trauma.

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## Quick User Guide

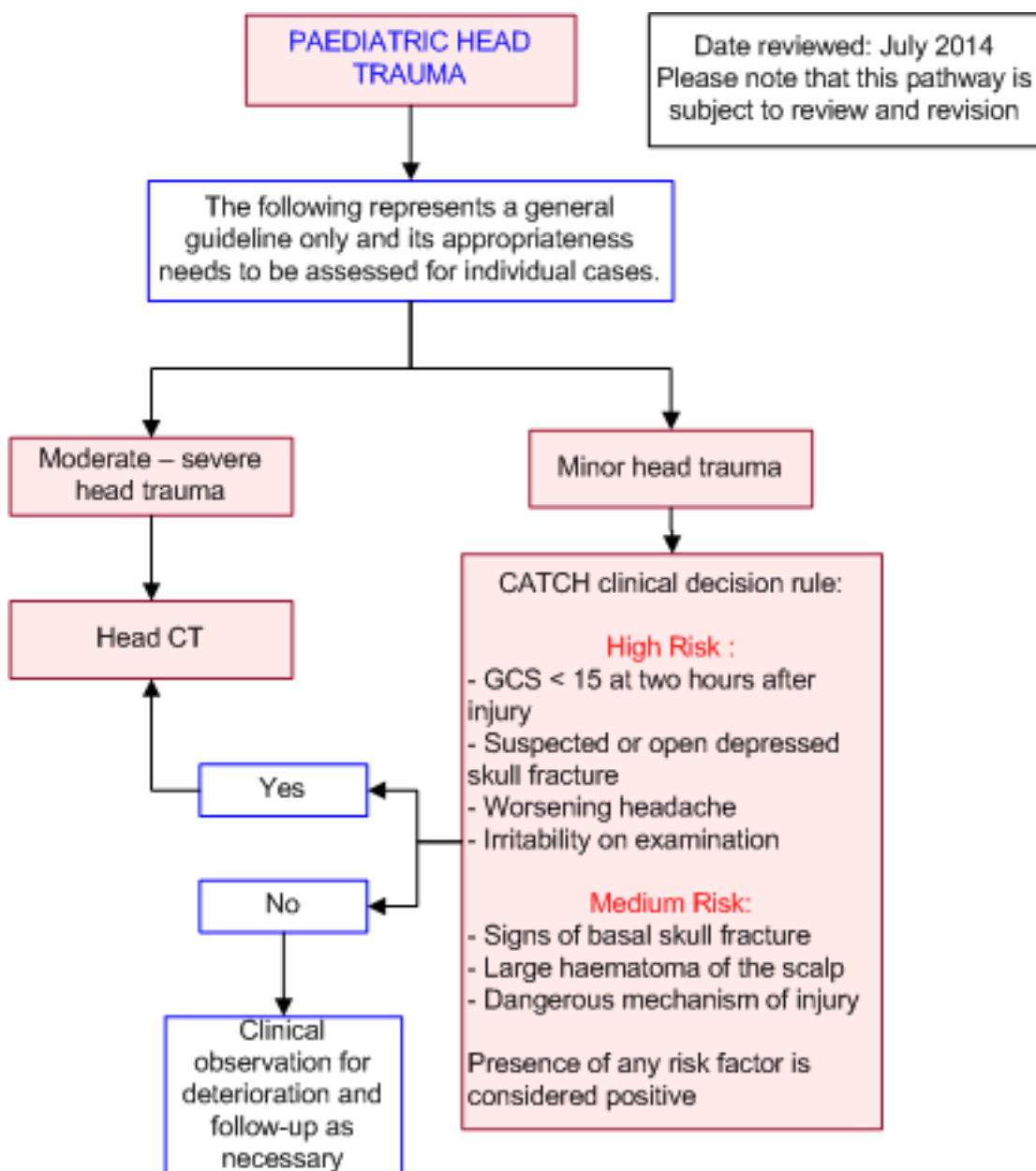
Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the PINK text box will bring up the full text.

The relative radiation level of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

## Pathway Diagram



## Image Gallery

*Note: Images coming soon*

## Teaching Points

- Traumatic brain injury is the leading cause of death and disability in accidental childhood trauma. A head CT is the modality of choice for assessing acute neurological presentations in this population
- Paediatric Glasgow Coma Scale (GCS) is used to stratify head injury severity in children [13](#)

Sign	PGCS	Score
Eye opening	Spontaneous	4
	To sound	3



	To pain	2
	None	1
Verbal response	Age-appropriate vocalisation, smile, or orientation to sound, interacts (coos, babbles), follows objects	5
	Cries, irritable	4
	Cries to pain	3
	Moans to pain	2
	None	1
Motor response	Spontaneous movements (obeys verbal command)	6
	Withdraws to touch (localizes pain)	5
	Withdraws to pain	4
	Abnormal flexion to pain (decorticate posture)	3
	Abnormal extension to pain (decerebrate posture)	2
	None	1
Best total score		15

- Moderate to severe head trauma is defined as a GCS of 9-12 (moderate) or 3-8 (severe) and should be investigated with a head CT
- Minor head trauma is defined as a GCS of 13 or greater. The prevalence of brain injury in this group is low (<5% with a GCS of 15) and the need for surgical intervention is even lower (1%). Missing a significant injury on CT, therefore, needs to be balanced against unnecessarily exposing children to the risks of ionising radiation and possible sedation for the exam
- Several clinical decision rules have been proposed to identify children who at risk of traumatic brain injury and who should therefore be investigated with a CT scan
- Common features to many of these clinical decision rules are that patients are unlikely to have a clinically significant intracranial injury if none of the following are present:
  - Child less than 2 years of age, altered mental status, clinical evidence of skull fracture, persistent vomiting, headache, dizziness, focal neurological deficit, seizure, amnesia, dangerous mechanism of injury (high speed motor vehicle accident, high speed projectile injury, fall from >3m)

## Clinical Decision Rule

- Several clinical decision rules have been proposed to identify children who are at risk of traumatic brain injury and who should therefore be investigated with a CT scan
- The sensitivity of these range from 95 to 99% with negative predictive values of around 99%. [6-10](#) Many of these decision rules, however, are derived from studies lacking either sufficient accuracy, prospective validation or an adequate sampling size. Therefore, their appropriateness needs to be assessed for patients individually [11](#)

## CATCH (Canadian Assessment of Tomography for Childhood Head injury)

- CATCH is a clinical decision rule developed for minor head injury (GCS 13-15) in children which classifies patients into high risk and medium risk groups in whom a CT scan of brain is helpful [12](#)
- **High risk (need for neurologic intervention)**
  - GCS score < 15 at two hours after injury
  - Suspected open or depressed skull fracture
  - History of worsening headache
  - Irritability on examination
- **Medium risk (brain injury on CT scan)**
  - Any sign of basal skull fracture (e.g. hemotympanum, 'raccoon' eyes, otorrhea or rhinorrhea of the cerebrospinal fluid, Battle's sign)
  - Large, boggy hematoma of the scalp
  - Dangerous mechanism of injury (e.g. motor vehicle crash, fall from elevation ? 3 ft [? 91 cm] or 5 stairs, fall from bicycle with no helmet)

It is estimated that application of these clinical decision rules may reduce the number of CT scans by 14 to 23% [8,9](#)

## Computed Tomography (CT)

- Modality of choice for assessing acute neurological presentations in children with trauma
- Useful for the rapid detection of acute or subacute haemorrhage and associated mass effects, skull fractures and scalp injury
- Advantages
  - Can accommodate life support equipment, monitoring devices and traction devices
- Disadvantages
  - May require sedation in paediatric populations
  - Exposure to ionising radiation

## Paediatric Head Trauma

- Traumatic brain injury is the leading cause of death and disability in accidental childhood trauma [1](#)
- The incidence of paediatric head trauma in Australia is estimated to be 765 per 100,000 per year. More children present to the emergency department with head injuries than any other age group [2](#)

- Approximately 7 per 100,000 per year will sustain significant head injuries of which 40% will require neurosurgical intervention [2](#)

## Minor Head Trauma

- Defined as a Glasgow Coma Scale (GCS) of 14 or greater [1](#)
- Although found in approximately 90% of children with head trauma, subtle or no neurological signs do not exclude the possibility of an acute brain injury. Half of all those with a traumatic brain injury seen on CT will have a GCS of 14 or more
- Nevertheless, the prevalence of brain injury in this group is low (<5% with a GCS of 15) and the need for surgical intervention, even lower (1%). [3-5](#) Therefore, missing a significant injury on CT needs to be balanced against unnecessarily exposing children to the risks of ionising radiation and possible sedation for the exam

## References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

- [1.](#) Swaminathan A, Levy P, Legome E. **Evaluation and management of moderate to severe pediatric head trauma.** J Emerg Med. 2009;37(1):63-8. (Review article). [View the reference](#)
- [2.](#) Mitra B, Cameron P, Butt W. **Population-based study of paediatric head injury.** J Paediatr Child Health. 2007;43(3):154-9. (Level III evidence)
- [3.](#) Dietrich AM, et al. **Pediatric head injuries: can clinical factors reliably predict an abnormality on computed tomography?** Ann Emerg Med. 1993;22(10):1535-40. (Level III evidence)
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- [5.](#) Schunk JE, Rodgerson JD, Woodward GA. **The utility of head computed tomographic scanning in pediatric patients with normal neurologic examination in the emergency department.** Pediatr Emerg Care. 1996;12(3):160-5. (Level III evidence)
- [6.](#) Palchak MJ, et al. **A decision rule for identifying children at low risk for brain injuries after blunt head trauma.** Ann Emerg Med. 2003;42(4):492-506. (Review article). [View the reference](#)
- [7.](#) Atabaki SM, et al. **A clinical decision rule for cranial computed tomography in minor pediatric head trauma.** Arch Pediatr Adolesc Med. 2008;162(5):439-45. (Level III evidence)
- [8.](#) Haydel MJ, Shembekar AD. **Prediction of intracranial injury in children aged five years and older with loss of consciousness after minor head injury due to nontrivial mechanisms.** Ann Emerg Med. 2003;42(4):507-14. (Level III evidence)
- [9.](#) Oman JA, et al. **Performance of a decision rule to predict need for computed tomography among children with blunt head trauma.** Pediatrics. 2006;117(2):e238-46. (Level III evidence)
- [10.](#) Dunning J et al. **Derivation of the children's head injury algorithm for the prediction of important clinical events decision rule for head injury in children.** Arch Dis Child. 2006;91(11):885-91. (Level III evidence)
- [11.](#) Kuppermann N. **Pediatric head trauma: the evidence regarding indications for emergent neuroimaging.** Pediatr Radiol. 2008;38 Suppl 4:S670-4. (Review article). [View the reference](#)
- [12.](#) Osmond MH, Klassen TP, Wells GA, Correll R, Jarvis A, Joubert G, Bailey B, Chauvin-Kimoff L, Pusic M, McConnell D, Nijssen-Jordan C, Silver N, Taylor B, Stiell IG. **CATCH: a clinical decision rule for the use of computed tomography in children with minor head injury.** CMAJ. 2010;182(4):341-8. (Level II evidence)

13. Michelson D, Thompson L, Williams E. **Evaluation of stupor and coma in children.** In: UpToDate, Basow, DS (Ed), UpToDate, Waltham, MA, 2012. [View the reference](#)

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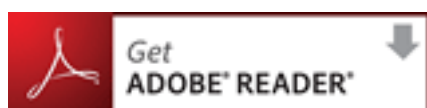
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