

Head Injuries (Head Trauma)

Definition / Supporting Information

Traumatic brain injury is the leading cause of death in children in the UK.

- Primary brain injury refers to the neural injury caused by the traumatic insult itself
- Secondary brain injury refers to the subsequent injury to neural tissue after trauma has occurred
- Concussion is any head injury associated with alteration in mental status (see Altered Conscious Level)

Essential History

Evaluation should progress only after the ABCs (airway, breathing, circulation and cervical spine stabilisation) of resuscitation have been addressed.

Ask about:

- Mechanism of force
 - High energy, for example:
 - High speed road traffic collision
 - Fall from height greater than 3 metres
 - High speed injury from projectile
 - Be assured severity of injury is proportional to history (eg, falling out of bed rarely causes serious injury)
 - See When to suspect child maltreatment [[NICE clinical guideline CG89](#)]
- Time since the injury
- Type of surface (eg, hard floor, cushioned, concrete)
- Any relevant medical conditions (eg, immune thrombocytopenic purpura)
- Any previous brain surgery
- Drug history especially anticoagulant therapy

Drug or [alcohol](#) intoxication (see Drug Overdose / Poisoning)

'Red Flag' Symptoms and Signs

Evaluation should progress only after the ABCs (airway, breathing, circulation and cervical spine stabilisation) of resuscitation have been addressed.

The possibility of cervical spine injury should be considered where there is reduced conscious level, focal neurology, or neck pain – early senior support and advice should be sought.

Ask about:

- Post-traumatic seizure (but no history of epilepsy)
- Loss of consciousness lasting > 5 minutes (witnessed)
- Abnormal drowsiness
- Any episodes of vomiting
- Amnesia (antegrade or retrograde) lasting > 5 minutes
- Persistent headache since the injury

Look for:

- Signs of increased intracranial pressure
- Irritability
- Poor feeding in an infant
- Altered behaviour in a child
- Reduced conscious level (Glasgow Coma Scale (GCS) score (see Tables 1-3) less than 15 at first assessment or at 2 hours after injury)
 - The GCS, or a modified GCS for children and infants, can be used to evaluate mental status, assess prognosis, and follow the patient's progress.
 - Severe head injury may be defined as that resulting in a GCS score < 9
 - Moderate head injury is associated with a score of 9–12
 - A score of 13–15 indicates a mild head injury
- Focal neurological deficits
- Boggy swelling, bruising, lacerations
- Haematoma or swelling and size
- Evidence of trauma with no or vague history of trauma
 - See When to suspect child maltreatment [[NICE clinical guideline CG89](#)]
- Signs of open, depressed or basal skull fracture:
 - Haemotympanum
 - 'Panda' eyes (blood around the eyes)
 - Cerebrospinal fluid leakage from the ear or nose
 - Battle's sign (blood behind the ears)

Table 1 GCS, Eye-Opening Response

Eye-Opening Response		
Score	> 1 Year	< 1 Year
4	Spontaneous	Spontaneous
3	To verbal command	To shout
2	To pain	To pain
1	None	None

Table 2 GCS, Motor Response

Motor Response		
Score	> 1 Year	< 1 Year
6	Obeys commands	Displays spontaneous response
5	Localises pain	Localises pain
4	Withdraws from pain	Withdraws from pain
3	Displays abnormal flexion to pain (decorticate rigidity)	Displays abnormal flexion to pain (decorticate rigidity)
2	Displays abnormal extension to pain (decerebrate rigidity)	Displays abnormal extension to pain (decerebrate rigidity)
1	None	None

Table 3 GCS, Verbal Response

Verbal Response			
Score	> 5 Years	2-5 Years	0-23 Months
5	Is oriented and converses	Uses appropriate words and phrases	Babbles, coos appropriately
4	Conversation is confused	Uses inappropriate words	Cries, but is consolable
3	Words are inappropriate	Cries or screams persistently to pain	Cries or screams persistently to pain
2	Sounds are incomprehensible	Grunts or moans to pain	Grunts or moans to pain
1	None	None	None

Glasgow Coma Scale score equals sum of best eye opening, motor, and verbal responses. Range is 3–15. Usual definitions of severity of head injury: severe, ≤ 9 ; moderate, 9–12; mild, 13–15. Modified from: Teasdale G, Jennett B. Assessment of coma and impaired consciousness: a practical scale. *Lancet*. 1974;304(7872):81–84. Copyright © Elsevier 1974.

Differential Diagnosis / Conditions

- Start by ascribing depressed conscious level to head / brain injury
- Consider other causes (eg, alcohol and / or drug intoxication (see Drug Overdose and Poisoning), meningitis, encephalitis) after significant brain injury has been excluded
 - See The management of children and young people with an acute decrease in conscious level (pdf) [RCPCH guideline]
- Parenchymal injuries
 - Clinical manifestations vary, but patients often exhibit:
 - Alteration in consciousness
 - Focal seizures
 - Focal neurological findings (eg, cortical blindness in cases of occipital lobe injury)
- Diffuse axonal injury
 - Often seen after an acceleration-deceleration mechanism (whiplash injury)
 - Most children will experience changes in sensorium
- Intracranial haematoma
 - Haematomas can occur anywhere in the intracranial space

Investigations

Evaluation should progress only after the ABCs (airway, breathing, circulation and cervical spine stabilisation) of resuscitation have been addressed.

To be undertaken by specialist practitioners (eg, Emergency Department / Paediatric Team(s)):

- Computerised tomography (CT) scan
 - See Head injury: Triage, assessment, investigation and early management of head injury in children, young people and adults [[NICE clinical guideline CG176](#)]
- CT head scan
 - For children who have sustained a head injury and have any of the following risk factors, perform a CT head scan within 1 hour of the risk factor being identified:
 - Suspicion of non-accidental injury
 - Post-traumatic seizure but no history of epilepsy
 - On initial Emergency Department assessment, GCS score < 14, or for children under 1 year GCS score (paediatric) < 15
 - At 2 hours after the injury, GCS score < 15
 - Suspected open or depressed skull fracture or tense fontanelle
 - Any sign of basal skull fracture:
 - Haemotympanum
 - ‘Panda’ eyes
 - Cerebrospinal fluid leakage from the ear or nose
 - Battle’s sign (blood behind the ears)
 - Focal neurological deficit
 - For children under 1 year, presence of bruise, swelling, or laceration of > 5 cm on the head
 - For children who have sustained a head injury and have more than one of the following risk factors (and none of those above), perform a CT head scan within 1 hour of the risk factors being identified:
 - Loss of consciousness lasting > 5 minutes (witnessed)
 - Abnormal drowsiness
 - Three or more discrete episodes of vomiting
 - Dangerous mechanism of injury:
 - High-speed road traffic accident as pedestrian, cyclist, or vehicle occupant
 - Fall from a height of > 3 metres
 - High-speed injury from a projectile or other object
 - Amnesia (antegrade or retrograde) lasting > 5 minutes
 - Children who have sustained a head injury and have only one of the risk factors in the second recommendation above (and none of those in the first recommendation) should be observed for a minimum of 4 hours after the head injury.

- If during observation any of the risk factors below are identified, perform a CT head scan within 1 hour.
 - GCS score < 15
 - Further vomiting
 - A further episode of abnormal drowsiness
- If none of these risk factors occurs during observation, use clinical judgement to determine whether a longer period of observation is needed.
- CT cervical spine scan
 - There is generally a lower risk of significant spinal injury in a child with head injury but advice from a senior colleague should be sought early.
 - For children who have sustained a head injury, perform a CT cervical spine scan (within 1 hour of the risk factor being identified), only if any of the following apply:
 - GCS score < 13 on initial assessment
 - The patient has been intubated
 - Focal peripheral neurological signs
 - Paraesthesia in the upper or lower limbs
 - A definitive diagnosis of cervical spine injury is needed urgently (eg, before surgery)
 - The patient is having other body areas scanned for head injury or multi-region trauma
 - There is strong clinical suspicion of injury despite normal X-rays
 - Plain X-rays are technically difficult or inadequate
 - Plain X-rays identify a significant bony injury
 - For children who have sustained a head injury and have neck pain or tenderness but no indications for a CT cervical spine scan, perform three-view cervical spine X-rays if any of the following is identified:
 - Dangerous mechanism of injury
 - Fall from a height of > 1 metre or five stairs
 - Axial load to the head (eg, diving)
 - High-speed motor vehicle collision
 - Rollover motor accident
 - Ejection from a motor vehicle
 - Accident involving motorised recreational vehicles
 - Bicycle collision
 - Safe assessment of range of movement in the neck is not possible
 - The X-rays should be:
 - Performed before assessing range of movement in the neck
 - Carried out within 1 hour of the risk factor being identified

- Reviewed by a clinician trained in their interpretation within 1 hour of being performed
- Magnetic resonance imaging (MRI)
 - May add important information about soft tissue injuries associated with bony injuries demonstrated by X-ray and / or CT
 - Usually undertaken in discussion with senior experienced staff

Treatment Approach

Evaluation should progress only after the ABCs (airway, breathing, circulation and cervical spine stabilisation) of resuscitation have been addressed.

To be undertaken by non-specialist practitioners (eg, General Practitioner (GP) Team):

- Children with mild concussion and GCS score of 15 can be managed at home with advice.

To be undertaken by specialist practitioners (eg, Emergency Department / Paediatric Team(s)):

- Emergency care of moderate (GCS score 9–12) or severe (GCS score < 9) head injury:
 - Be aware of the principles of management of the head injured patient as per Advanced Paediatric Life Support (APLS) / European Paediatric Life Support (EPLS) courses
 - Stabilise airway, breathing and circulation (ABC) before attention to other injuries
 - Maintain normal oxygenation
 - In the severely injured patient, the airway requires intubation to ensure adequate ventilation to reduce the chance of developing increased intracranial pressure.
 - Assume coexisting cervical spine injury until proved otherwise
- Minor head injury (concussion; children with a GCS score of 13–15 and no focal neurological findings)
 - Most concussion patients can be discharged home after a period of evaluation and observation.
 - Thorough evaluation is important, and the physician should advise parents regarding the child's return to sports (see references below).

When to Refer

See Head injury: Triage, assessment, investigation and early management of head injury in children, young people and adults [[NICE clinical guideline CG176](#)].

Refer urgently (arrange emergency transport if appropriate) to Emergency Department if:

- GCS score of less than 15 on initial assessment
- Any loss of consciousness as a result of the injury (see Altered Conscious Level)
- Any focal neurological deficit since the injury
- Any suspicion of a skull fracture or penetrating head injury since the injury
- Amnesia for events before or after the injury
- Persistent headache since the injury
- Any vomiting episodes since the injury
 - Clinical judgement should be used regarding the cause of vomiting in those aged 12 years or younger and the need for referral
- Any seizure since the injury
- Any previous brain surgery
- A high-energy head injury
- Any history of bleeding or clotting disorders
- Current anticoagulant therapy such as warfarin
- Current drug or alcohol intoxication (see Drug Overdose and Poisoning)
- There are any safeguarding concerns
 - Possible non-accidental injury
 - Vulnerable person is affected
- Continuing concern by the professional about the diagnosis
- Irritability or altered behaviour, particularly in infants and children aged under 5 years
- Visible trauma to the head of concern to the professional
- Continuing concern by the injured person or their family or carer about the diagnosis

Escalate care to / discuss with Neurosurgical Team if:

- New, significant abnormalities on imaging
 - 'Significant' to be agreed between local teams and neurosurgical centres
- Any skull fracture including depressed skull fracture or basilar skull fracture
- Persisting coma (GCS score 8 or less) after initial resuscitation
- Unexplained confusion which persists for more than 4 hours
- Deterioration in GCS score after admission (greater attention should be paid to motor response deterioration)
- Progressive focal neurological signs
- A seizure without full recovery
- Definite or suspected penetrating injury
- A cerebrospinal fluid leak

‘Safety Netting’ Advice

- Discharge home if mild head injury, provided:
 - Reliable caregivers
 - No suspicion of child maltreatment
 - Prompt recovery of neurological function
- After discharge, provide written information for parents or carers about:
 - Nature and severity of the injury and likely recovery process
 - Risk of later difficulties or complications despite initial quick recovery
 - Need for parents or carers to:
 - Observe the child carefully for at least 24 hours
 - Return immediately to the emergency department if their child:
 - Cannot be awakened
 - Shows decreasing mental status while awake (see Altered Conscious Level)
 - Develops seizures, focal weakness, increasing headache, progressive instability, or repeated episodes of vomiting
 - Return to everyday activities, including school, work, sports and driving
 - See Sport Concussion Assessment Tool (pdf) [\[SCAT3\]](#) and Sport Concussion Assessment Tool for children ages 5 to 12 years (pdf) [\[Child-SCAT3\]](#) for providing advice about return to sport.
- After hospital or emergency department discharge, follow-up is suggested at 2 weeks for moderate head injuries
 - Recovery can be reviewed and further anticipatory guidance provided to the family regarding relevant neurological sequelae
 - In children < 2 years with diastatic fractures (fractures that involve normal suture lines):
 - Evaluate again in 6–8 weeks to check for a growing fracture
 - Follow local protocols for follow up

Patient / Carer Information

****Please note: whilst these resources have been developed to a high standard they may not be specific to children.***

- [Minor head injury](#) (Web page), NHS Choices
- [Severe head injury](#) (Web page), NHS Choices
- [Concussion](#) (Web page), NHS Choices
- [Head injury](#) (Web page), Patient.co.uk

Resources

National Clinical Guidance

[Head injury: Triage, assessment, investigation and early management of head injury in children, young people and adults](#) (Web page), NICE clinical guideline CG176, National Institute for Health and Care Excellence.

[When to suspect child maltreatment](#) (Web page), NICE clinical guideline CG89, National Institute for Health and Care Excellence.

[Head injury overview](#) (Web page), NICE pathway, National Institute for Health and Care Excellence.

[Early management of patients with a head Injury](#) (Web page), SIGN clinical guideline 110, Scottish Intercollegiate Guidelines Network.

[The management of children and young people with an acute decrease in conscious level](#) (Web page), Royal College of Paediatrics and Child Health.

Medical Decision Support

[Recognition of Physical Abuse](#) (Web page), RCPCH Child Protection Companion 2013 (2nd Edition).

Suggested Resources

****Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.***

National Center for Injury Prevention and Control, Division of Injury Response. [Guidelines for field triage of injured patients](#). Pediatrics 2012;129(4):e1110. [PubMed] AAP Endorsed.

[CORE INFO: Cardiff Child Protection Systematic Reviews](#) (Website), Cardiff University.

Concussion in Sport Group. [Sport Concussion Assessment Tool - 3rd edition \(SCAT3\)](#). Br J Sports Med. 2013 47:259.

Concussion in Sport Group. [Sport Concussion Assessment Tool for children ages 5 to 12 years \(Child-SCAT3\)](#). Br J Sports Med. 2013 47:263.

[World Rugby Concussion Management](#) (Web page), World Rugby.

[Head Injuries in Professional Football](#) (Web page), The Football Association.

[Paediatric trauma protocols](#) (Web page), Royal College of Radiologists.

[Head Injury](#) (Web page), Spotting the Sick Child

Acknowledgements

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Update information

Created: 2017

Date last updated: -

Next review due: 2020