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Minor head injuries in children

An approach to management

Background
Traumatic head injury is a common occurrence in the paediatric population, with the majority of patients sustaining only mild head injury.

Objective
This article outlines the management of mild head injuries in children.

Discussion
A careful history including time of injury, the mechanism of injury, and any loss of consciousness or seizure activity; a thorough examination including a Glascow Coma Scale (GCS) score; and observation should be appropriate for most patients. Only a small number of injuries require further examination/imaging with computerised tomography. Indicators for transfer to hospital include GCS equal to or less than 12, focal neurological deficit, clinical evidence of skull fracture, loss of consciousness for more than 30 seconds, ataxia, amnesia, abnormal drowsiness, persistent headache, seizure following initial normal behaviour or recurrent vomiting. Postconcussive symptoms frequently occur after minor head injuries and parents and other family members should be aware of what symptoms to expect, and possible duration. Regular follow up until all symptoms have resolved is mandatory, with clear guidelines for stepwise resumption of physical activity.

Keywords: child health, emergencies, head injuries

CPD

Although head injury (HI) is common within the paediatric population, no accurate data exist for the true incidence of HIs within this population subset in Australia. For the management of HIs, all those aged 16 years or less are considered to be part of the paediatric population.

A recent review of presentations to a major paediatric trauma referral centre in Melbourne, Victoria, identified the incidence rate as 2008 per 100 000 children attending the emergency department, with minor HIs constituting the majority of injuries to the head.[1] The incidence of presentation to general practice is unknown.

Younger children are more prone to HIs, and even mild HI can result in ongoing cognitive and behavioural sequelae, although the majority of cases have good outcomes.[2,3]

Definition of head injury

Head injuries include a wide spectrum of symptoms and signs and are generally subdivided into mild and severe injuries. Mild HIs, as defined by the Mild Trauma Brain Injury Committee of the Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine, include any person who has had a traumatically induced physiologic disruption of brain function as manifested by at least one of the following:

- any period of loss of consciousness
- any loss of memory for events immediately before or after the incident
- any alteration in mental state at the time of the accident (eg. feeling dazed, disorientated, or confused)
- focal neurologic deficit(s) that may or may not be transient, but where the severity of the injury does not exceed the following:
  - loss of consciousness for approximately 30 seconds or less
  - after 30 minutes, an initial Glascow Coma Scale (GCS) score of 13–15
  - post-traumatic amnesia not greater than 24 hours.[3]

Mechanisms of injury

Younger children are more prone to head trauma. They have large head to body ratios, a thin skull, large subarachnoid space, and relatively weak musculature. Children less than 1 year of age have the highest

rate of HIs, and children under 3 years age constitute almost 50% of all paediatric traumatic HIs.[1,4]

According to age group, different mechanisms of injury exist. Most injuries in infants are due to falls from heights, eg. from a bed, couch, pram, change table, or down stairs. For school aged children, sporting activities are the major cause of HIs.[1]

Parents often present with a history of the child hitting his/her head, crying immediately afterward, and then being inconsolable for minutes to hours. Younger children often fall asleep.

Evaluation of the head injured patient

For the patient presenting to general practice within the first few hours following a HI, a careful history should include:

- time of injury
- the mechanism of injury, and
- any loss of consciousness or seizure activity.

As part of a thorough examination, an accurate GCS score needs to be determined. The GCS is based on the assessment of three clinical variables:

- best verbal response
- best motor response, and
- eye opening

with the maximum score being 15, and 3 being the lowest score. In children less than 4 years of age, responses are assessed using the Child's Glasgow Coma Scale (*Table 1*).

Any symptoms of confusion, disorientation, perseveration, or the presence of retrograde or anterograde amnesia should be noted. Also note any nausea, vomiting, headache, lethargy, visual changes, irritability, or other pain.

In children presenting with an altered mental state, the presence of possible hypoglycaemia should always be ruled out, and blood sugar level should always be documented.

During examination, care should be taken to look for signs of skull fracture. Look for any tenderness or deformity of the scalp, skull, fontanelles, facial bones, oropharynx, and ears. Also look for retro-auricular bruising (Battle sign), peri-orbital bruising ('raccoon eyes'), haemotympanum, and cerebrospinal fluid otorrhoea or rhinorrhoea.

Specific attention should be given to the pupils. Pupils should be examined for size, symmetry, direct and consensual light reflexes, and fixation or dilation. Abnormal reflexes can suggest herniation or brainstem injury. Direct trauma to the orbit, as well as pharmacological agents such as alcohol and opioids, may also affect pupillary reflexes.

Management

For the purpose of managing minor traumatic injuries to the head, injuries are divided into two groups:

- those injuries in which the child has not sustained any alteration in mental state during or after injury, is alert and interactive, and has not vomited more than once, and
- those with more significant mechanism of injury, which may include loss of consciousness for up to 30 seconds, but where the child is alert and responsive at the time of examination.

Management of the first group of patients generally involves observing the injured child at home under the care of a competent caregiver. Observation implies monitoring by an adult who would be able to recognise abnormalities, and seeking appropriate help or assistance, should they occur.

Table 1. Glasgow Coma Scale and Child's Glasgow Coma Scale

Glasgow Coma Scale (children >4 years of age)		Child's Glasgow Coma Scale (children <4 years of age)	
Eye opening		**Eye opening**	
Spontaneously	4	Spontaneously	4
To verbal stimuli	3	To verbal stimuli	3
To pain	2	To pain	2
No response to pain	1	No response to pain	1
Best motor response		**Best motor response**	
Obeys verbal command	6	Spontaneous/obeys verbal command	6
Localises to pain	5	Localises to pain/withdraws to touch	5
Withdraws from pain	4	Withdraws from pain	4
Abnormal flexion to pain (decorticate)	3	Abnormal flexion to pain (decorticate)	3
Abnormal extension to pain (decerebrate)	2	Abnormal extension to pain (decerebrate)	2
No response to pain	1	No response to pain	1
Best verbal response		**Best verbal response**	
Orientated and converses	5	Alert; babbles, coos words to usual ability	5
Disorientated and converses	4	Less than usual words, spontaneous irritable cry	4
Inappropriate words	3	Cries only to pain	3
Incomprehensible sounds	2	Moans to pain	2
No response to pain	1	No response to pain	1

Clear guidelines should be given as to when to return to seek medical attention (*Table 2*). If parents or caregivers have any concerns regarding their child's behaviour they should be advised to seek medical advice, and attention should be focused on these concerns.

In the group of children with more significant mechanism of injury and possible loss of consciousness for up to 30 seconds, signs and symptoms may be more apparent. The child might have a headache, might have vomited twice or more, may have had a seizure after injury, and generally displays signs of trauma to the skull (bruise, lump, or cut to the head).

These children should be observed in an appropriate setting, such as within a general practice clinic or hospital emergency department, until it is felt that they are safe to be managed at home; they should have normal mental state, be reasonably alert and interactive, and be able to tolerate fluids without vomiting. There is no evidence for observing a child for a specific period of time following HI (eg. 4 hours) (see *Resource*). All caregivers and parents should be provided with information regarding their child's HI upon discharge home (*Table 2*).

Within the scope of general practice, consideration should be given to whether further investigation is needed, which implies referral to a hospital emergency department. Skull radiographs have no role in the management of mild traumatic HI, and in cases where further investigation is deemed necessary, computerised tomography brain imaging (CTB) is preferred. Identifying those children who need CTB is difficult, and peforming CTB in the younger child may require sedation, which has associated risks. Computerised tomography also exposes the child to ionising radiation, and cumulative exposure for performing a CTB is equal to 115 chest X-rays.[5]

The essential indication for CTB is to identify an underlying abnormality that requires intervention. Examples include subdural haematoma and depressed skull fracture. There are no specific recommendations to guide imaging of children with mild traumatic HIs; however, certain findings may infer an underlying abnormality. These include: GCS equal to or less than 12, focal neurological deficit, loss of consciousness, ataxia, amnesia, drowsiness, headache, seizure or vomiting.[5,6]

In children less than 2 years of age, CTB should be considered in all patients presenting with:

- altered mental status
- focal neurological findings
- scalp swelling/haematoma, and
- unwitnessed trauma or unclear/inconsistent mechanism of injury.[2,6]

A lower threshold for imaging is also justified in children with haemophilia or those on anticoagulants.[7]

In cases where the mechanism of injury is deemed to be associated with suspicion of high risk for significant HI, referral to a hospital emergency department may be indicated. See *Table 3* for indications for referral and transfer to hospital.

A United Kingdom Emergency Medicine Research group has developed a clinical decision rule for the identification of children who should undergo CTB after HI.[8] Although the CHALICE (Children's Head injury Algorithm for the Prediction of Important Clinical Events) guidelines have not been adequately validated in different populations, they are helpful for the management of children less than 16 years of age with head trauma[7] (*Table 4*).

Table 2. Guidelines for return for medical assessment in mild head injuries[6]

- Unusual or confused behaviour
- Severe or persistent headache which is not relieved by paracetamol (irritability in a baby)
- Frequent vomiting
- Bleeding or discharge from the ear or nose
- A fit or convulsion, or spasm of the face or arms or legs
- Difficulty in waking up*
- Difficulty in staying awake
- Any signs or symptoms of concern to parents

* Parents do not need to wake their child during the night if the child has sustained a mild head injury

Table 3. Indications for referral and transfer to hospital

- GCS equal to or less than 12
- Focal neurological deficit
- Loss of consciousness for more than 30 seconds
- Ataxia
- Amnesia
- Drowsiness
- Persistent headache
- Seizure following initial normal behaviour
- Recurrent vomiting
- Children with haemophilia or those on anticoagulants
- Children less than 2 years of age with altered mental status, focal neurological findings, scalp swelling, and unwitnessed trauma or unclear/inconsistent mechanism of injury
- Any concern regarding the mechanism of injury, or clinical findings on examination

Table 4. CHALICE guidelines for computerised tomography in children[8]

1	Witnessed unconsciousness >5 minutes
2	Amnesia >5 minutes
3	Abnormal drowsiness
4	Three or more discrete episodes of vomiting
5	Clinical suspicion of nonaccidental injury
6	Post-traumatic seizure in the absence of history of epilepsy
7	GCS score <14 in a child, GCS score <15 in infants in the hospital emergency department setting
8	Suspicion of open/depressed skull fracture or tense fontanelle
9	Clinical evidence of base of skull fracture
10	Focal neurological deficit
11	Bruise, swelling or laceration >5 cm in infants
12	High impact head trauma

Follow up

Symptoms are common following mild HI, and follow up is recommended 1–2 weeks after initial injury. Postconcussion syndrome describes the acute symptoms following mild HI and includes physical complaints, behavioural changes and cognitive impairment[3] (*Table 5*). Headache is the most common complaint, and nearly a third of parents report personality changes in their children.[3] The majority of symptoms resolve within 3 months following the injury.[9] Symptoms may however cause significant psychosocial problems for both the patient and their family, and are often exacerbated by stress, depression, or anxiety. Interventions include proactive patient and family education, provision of support and counselling, and referral for neuropsychological testing if indicated.

The provision of information about expected symptoms, likely time course, and how best to cope with them, results in less symptoms being reported 3 months after injury.[9]

In children who sustained HI while participating in sporting activities, return to play guidelines vary. The concept of second impact syndrome refers to a rare, but potentially fatal consequence of repeat HI in an individual in whom signs and symptoms of the first HI have not resolved completely.[2] Early return to activity may also result in prolonged postconcussive symptoms.

Consensus recommendation is that no child should return to exertional activities until there are no symptoms at rest, the patient has a normal neurological assessment, and neuroimaging (if performed) is normal.[3] A stepwise set of guidelines for return to play is set out in *Table 6*.

Table 5. Common postconcussive signs and symptoms

Physical symptoms	Behavioural symptoms	Cognitive disturbances
Headaches	Excessive irritability	Slowed mentation
Dizziness	Depression	Attention difficulties
Insomnia	Anxiety	Concentration problems
Fatigue	Sleep disturbance	Memory problems (typically short term memory)
Ataxia	Eating disturbance	Orientation problems
Nausea	Emotional lability	
Blurred vision	Personality changes	
Tinnitus		
Seizures		

Table 6. Steps in managing head injury for return to play

1. No activity, complete rest; once asymptomatic, proceed to step 2
2. Light aerobic exercise such as walking or stationary cycling, no resistance training
3. Sport specific exercise (eg. running in football or soccer); progressive addition of resistance training at steps 3 or 4
4. Noncontact training drills
5. Full contact training after medical clearance
6. Game play

Conclusion

Traumatic HI is a common occurrence in the paediatric population, with the majority of patients sustaining mild HIs. A thorough neurological assessment and observation should be appropriate for most patients, and only a small number of injuries require further examination/imaging.

However, postconcussive symptoms are frequently found and parents and families should be aware of what symptoms to expect, and possible duration. Regular follow up with clear guidelines, until all symptoms have resolved, is mandatory.

Resource

The Royal Children's Hospital Clinical Practice Guidelines. Head injury guidelines. Available at www.rch.org.au/clinicalguide/cpg.cfm?doc_id=5177.

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