Head injuries are common in children of all ages. Causes include falls, play/sporting accidents, road traffic accidents and non-accidental injury.

The SIGN Guideline 110 on head injury uses a broad definition to include “patients with a history of a blow to the head or the presence of a scalp wound or those with evidence of altered consciousness after a relevant injury.”

The level of consciousness as assessed by the Glasgow Coma Scale (GCS) is used to determine the severity of a head injury.

History

It is important to gain as much information as possible regarding the nature of the incident which should include:

- Details on the exact mechanism and time of head injury
- Any loss of consciousness and duration
- Vomiting
- Headache
- Altered behaviour
- Clinical course prior to consultation – improving/stable/deterioration
- Other injuries

<table>
<thead>
<tr>
<th>Examples of High Energy Head Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>High speed/rollover motor vehicle collision</td>
</tr>
<tr>
<td>Child struck by motor vehicle</td>
</tr>
<tr>
<td>Child ejected from motor vehicle</td>
</tr>
<tr>
<td>Accident involving motorised recreational vehicles</td>
</tr>
<tr>
<td>Bicycle collision</td>
</tr>
<tr>
<td>Fall from height greater than 1 metre or more than 5 stairs</td>
</tr>
<tr>
<td>Impact from golf club, cricket or baseball bat</td>
</tr>
</tbody>
</table>

Assessment of a patient with head injury

Perform a primary survey and ensure the child’s airway, cervical spine, breathing and circulation are secure.

The AVPU scale is used for the rapid assessment of neurological status during the primary survey.
AVPU Scale

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>Alert</td>
</tr>
<tr>
<td>V</td>
<td>Responds to Voice</td>
</tr>
<tr>
<td>P</td>
<td>Responds to Pain</td>
</tr>
<tr>
<td>U</td>
<td>Unresponsive</td>
</tr>
</tbody>
</table>

Also assess pupil size, equality and reactivity and look for other focal neurological signs.

A formal GCS forms part of the secondary survey, which should also specifically include:

- Head – scalp bruising, lacerations, swelling, tenderness,
- Signs of base of skull # – bruising around the eyes (panda eyes) or behind the ear (Battle’s sign), CSF leak from the ears (otorrhoea) or nose (rhinorrhoea)
- Ears – blood behind the ear drum
- Nose – deformity, swelling, bleeding, septal haematoma
- Mouth – dental trauma, soft tissue injuries
- Assessment for ? facial fractures
- Neck and cervical spine – midline tenderness
- Glasgow Coma Scale
- Eyes – pupil size, equality and reactivity, eye movements, fundoscopy
- Cranial nerve function
- Motor function – examine limbs for any lateralising weakness and presence of reflexes
- Other possible injuries

Level of Consciousness – Glasgow Coma Scale

<table>
<thead>
<tr>
<th>Feature</th>
<th>Scale Responses</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Opening</strong></td>
<td>Spontaneous</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>To voice</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td><strong>Verbal Response</strong></td>
<td>Orientated / Smiles, fixes, follows, words to usual ability</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Confused / Cries but consolable</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate words / Persistently irritable, moaning</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Incomprehensible words / Agitated and inconsolable</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>None / None</td>
<td>1</td>
</tr>
<tr>
<td>Motor Response</td>
<td>Obeys commands / Normal Movement</td>
<td>6</td>
</tr>
<tr>
<td>Localise to pain</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Withdraw to pain</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Flexion to pain</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Extension to pain</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3 - 15</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Management**

**Minor Head Injury**

- No concern regarding mechanism of injury
- No loss of consciousness
- Single or no episode of vomiting
- GCS 15 stable conscious state
- May have minor scalp bruising or small laceration
- Normal clinical examination otherwise

Always consider the need for appropriate analgesia.

In the absence of any comorbidity and with satisfactory home circumstances, these children may be discharged from the ED with their parent/responsible carer.

Written head injury advice should be given to and discussed with parents/carers before a child is discharged. This should include clear instructions regarding symptoms that, if observed in their child, should prompt an immediate return to the ED.

If there are any doubts about the mechanism of injury or possible loss of consciousness, treat as for mild head injury.

**Mild Head Injury**

- Brief loss of consciousness at time of injury
- Currently alert or responds to voice. May be drowsy. GCS 14-15
- No more than two discrete episodes of vomiting
- Persistent headache
- Anterograde or retrograde amnesia < 5 minutes
- Normal clinical examination otherwise

Always consider the need for appropriate analgesia.

These children should be observed in the ED for a period of time, with 30 minutely neurological observations (HR, RR, BP, GCS, pupils and limb power).

If there is an improvement back to normal conscious state with no further vomiting (they should be able to tolerate oral fluids in the department), no other comorbidity and satisfactory home circumstances, these children may be discharged from the ED with their parent/responsible carer.
Written head injury advice should be given to and discussed with parents/carers before a child is discharged. This should include clear instructions regarding symptoms that, if observed in their child, should prompt an immediate return to the ED.

Senior advice should **always** be sought (Emergency Medicine ST3 / ED Consultant) regarding the need for further investigation and/or admission for **any** child who remains drowsy / continues to vomit / has a persistent headache or where there has been any deterioration during their time in the ED.

**Moderate Head Injury**

- Significant fall or other mechanism of injury
- More than a brief loss of consciousness, but < 5 minutes, at time of injury
- Large (> 5 cm) scalp bruise/haematoma/laceration
- Single brief (< 2 minutes) post traumatic seizure immediately after impact
- GCS may be more significantly decreased but still 9 or above
- Three or more discrete episodes of vomiting
- Persistent headache
- Anterograde or retrograde amnesia > 5 minutes

Always consider the need for appropriate analgesia.

These children require 30 minutely neurological observations (HR, RR, BP, GCS, pupils and limb power) whilst in the ED.

Children with a GCS ≤ 13 should have an immediate CT scan.

Children with one or more of the other criteria should be considered for CT scanning within 8 hours.

**Any** request for a CT scan should **always** be discussed with an ED Consultant.

The above criteria are also all indications for admission to hospital and therefore senior advice should **always** be sought (Emergency Medicine ST3 / ED Consultant) regarding admission and further investigation.

**Severe Head Injury**

- Witnessed loss of consciousness > 5 minutes
- Significantly decreased GCS of 8 or less
- Suspicion of open or depressed skull # or tense fontanelle
- Any sign of base of skull #
- Penetrating head injury
- Post traumatic seizures (other than a single brief (<2 minutes) convulsion occurring immediately after the impact)
- Localising neurological signs (unequal pupils, lateralising motor weakness)
- Signs of increased intracranial pressure:
Uncal herniation: Ipsilateral dilated non-reactive pupil due to compression of the oculomotor nerve

Central herniation: Compression of the brainstem causing bradycardia and hypertension

Perform a primary survey and ensure the child’s airway, cervical spine, breathing and circulation are secure.

Prevent secondary brain injury by maintaining adequate ventilation and oxygenation.

Control any seizures

In conjunction with ED Consultant/PICU/Neurosurgery consider measures to decrease intracranial pressure:

- Nurse 30° head up after correction of any shock
- Aim to ventilate to a normal pCO₂
- Maintain adequate BP
- Consider IV 20% Mannitol 2.5mls/kg over 20 minutes or IV 3% NaCl 3mls/kg as a bolus

Arrange immediate CT scan

Hospital Admission

Unless requiring neurosurgical intervention, any child with a head injury requiring admission to hospital will be admitted under the care of the Paediatric Surgical team.

A surgical bed should be organised and the senior paediatric surgical trainee on call informed of the admission.

All medical/nursing paperwork should be completed including a drug kardex and an IV fluid prescription chart if indicated.

Neurological observations will be continued on the surgical ward as follows:

1 hourly neurological observations for the first 4 hours
2 hourly neurological observations for the next 8 hours
4 hourly observations thereafter

Imaging

Children should not have a skull X-ray unless there is a specific clinical indication, such as when part of a skeletal survey for investigation of non-accidental injury.

Imaging the Cervical Spine

In children < 10 years initial assessment of the cervical spine should be by lateral and AP plain X-rays.
Cervical spine CT scanning should be used for those patients with a severe head injury, or where there are symptoms or signs of spinal cord injury or where plain X-rays are abnormal or inadequate.

Indications for Head CT Scan

- **GCS ≤ 13**
  - **YES**: Immediate CT scan*
  - **NO**: GCS 14/15 – 15/15

- **GCS 14/15 – 15/15**
  - **YES**: Involved in high speed RTA
    - **YES**: Any bruise/swelling/laceration > 5 cm on head
      - Post traumatic seizure with no history epilepsy or history suggestive reflex anoxic seizure
    - **NO**: GCS 14/15 – 15/15
      - **YES**: Consider CT scan within 8 hours*
      - **NO**: Where NAI is suspected a head CT scan should be performed as soon as possible for children:
        - Who present with encephalopathic features/focal neurology/retinal

- **NO**: Witnessed LOC ≥ 5 mins
  - **YES**: Suspicion of open/depressed skull # or tense fontanelle
  - **YES**: Focal neurological deficit
  - **YES**: Signs of base of skull #
  - **NO**: Amnesia (antero/retrograde) lasting > 5 mins
  - **YES**: Clinical suspicion of NAI
  - **YES**: Significant fall
  - **YES**: 3 or more discrete episodes vomiting
  - **YES**: Abnormal drowsiness/slowness to respond
  - **NO**: Age < 1 year with GCS < 15 as assessed by senior doctor
*Any head CT scan request must be discussed with an ED Consultant*