HEAD INJURY, MANAGEMENT OF PAEDIATRIC

Introduction

These Guidelines have been created in an attempt to create consistency in the management of head injuries in children with the following goals:

- Identification of at risk patients and utilisation of early CT scanning
- Avoidance of Skull x-ray as diagnostic tool in head injury assessment
- Minimise secondary injury.
- Use of “discharge after Normal CT scanning” if clinically appropriate and carer available with access to phone and transport.
- Identification of infants at risk from abuse or neglect. In some series, child abuse accounts for 25% or more of admissions for head injury in children under 2 years.

Any child who may have sustained a head injury (traumatic brain injury or skull fracture) should undergo initial assessment in the same structured manner as any other trauma patient (see Trauma Guideline).

Primary Survey

A Assess and secure airway whilst ensuring cervical spine immobilisation
B Assess breathing and give high flow oxygen by mask
C Assess circulation, obtain IV access, and commence fluid resuscitation if indicated (signs of hypovolaemia)
D Determine conscious level using GLASGOW COMA SCALE or AVPU scale (note any asymmetry in limb response), and examine pupil size, symmetry and reaction to light.
E Check blood glucose level, treat if low
Notes

- Good oxygenation and circulatory resuscitation are essential to avoid further brain injury (secondary brain injury). The presence of hypotension should be considered an emergency.
- If possible the neurological status should be reassessed following treatment of hypoxaemia and hypotension. The best GCS after resuscitation is used for classification of the severity of head injury.
- Intubation (after induction of anaesthesia) and mechanical ventilation may be required as part of steps A or B during the primary survey. However, for the patient who has been brought in by ambulance unintubated there is almost always sufficient time (30 – 60 seconds) to assess their neurological status (step D) prior to intubation.
- Establishing the mechanism of injury is important in assessing the risk of head and/or spinal injury.

Glasgow Coma Scale (GCS)
A more detailed version of the GCS for use in infants can be found in Appendix 1

<table>
<thead>
<tr>
<th>GLASGOW COMA SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EYE OPENING</td>
</tr>
<tr>
<td>4 spontaneous</td>
</tr>
<tr>
<td>3 to voice</td>
</tr>
<tr>
<td>2 to pain</td>
</tr>
<tr>
<td>1 no response</td>
</tr>
<tr>
<td>2 extension</td>
</tr>
<tr>
<td>1 no response</td>
</tr>
</tbody>
</table>

To obtain a GCS score add the points from each of the three categories together. (Minimum = 3, Maximum = 15). Points in each category should reflect the best response in a given time period.

AVPU
AVPU is a quick and simple assessment of neurological state. It is essentially the same as determining the motor response of the GCS. It may be useful in young (pre-verbal) children.

<table>
<thead>
<tr>
<th>AVPU (for children under 2 years old)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert</td>
</tr>
<tr>
<td>Responds to Voice</td>
</tr>
<tr>
<td>Responds to Pain</td>
</tr>
<tr>
<td>non-purposeful – withdrawal, abnormal flexion or extension</td>
</tr>
<tr>
<td>Unresponsive</td>
</tr>
</tbody>
</table>
HEAD INJURY, MANAGEMENT OF PAEDIATRIC

Categories of severity

The severity of head injury (as mild, moderate or severe) will determine further management (see flow chart below).

If at any stage there is doubt about the management of a patient, then discussion with senior colleagues is essential.

Be aware that deterioration can be rapid and reassessment may be required at any stage.

Severe Head Injuries

- **GCS** 3-8
- **AVPU** Unresponsive or non-purposeful response to pain

Moderate Head Injuries

- **GCS** 9-13
- **AVPU** Purposeful response to pain or better

Mild Head Injuries

- **GCS** 14-15
- **AVPU** Alert or responds to voice

Head Injury - Initial Management Flow Chart

1. **Primary Survey & Resuscitation**
2. **ASSESS SEVERITY OF HEAD INJURY**
   - using Glasgow Coma Score (or AVPU if < 2 years of age)
3. **MILD HEAD INJURY**
   - **GCS** = 14-15
   - **AVPU** = Alert or responds to voice
   - Complete Secondary Survey
   - See further detail in 'Mild HI Algorithms' below according to age
4. **MODERATE HEAD INJURY**
   - **GCS** = 9 - 13
   - **AVPU** = Purposeful response to pain or better
   - TRAUMA STAT Call
   - Arrange URGENT CT head +/- neck
   - Consult Neurosurgery
   - Complete Secondary Survey
   - See further detail below
5. **SEVERE HEAD INJURY**
   - **GCS** = 3-8
   - **AVPU** = Unresponsive or non-purposeful response to pain
   - TRAUMA STAT Call
   - Intubate with cervical spine immobilisation
   - Arrange URGENT CT head & Neck
   - Consult Neurosurgery & PICU
   - Complete Secondary Survey
   - See further detail below
HEAD INJURY, MANAGEMENT OF PAEDIATRIC

Secondary Survey

History:

- Detailed account of mechanism of injury including time of injury. Give children with appropriate verbal skills opportunity to tell you themselves as well as taking an eye-witness account including:
  - Fall. Height, surface, posture of fall, point of contact
  - Motor vehicle collision. Speed, place in car, restraint, point of impact
  - Other mechanisms. Asking a witness to draw a scene diagram may assist if the mechanism is complex or difficult to follow.
- Loss of consciousness (LOC) or altered level of consciousness at the scene or in transit
- Focal neurological signs at the scene or in transit
- Seizures – document timing in relation to accident
- Vomiting
- Headache, visual disturbance or focal neurological symptoms
- Amnesia - document duration of post traumatic amnesia (PTA) and retrograde amnesia (RGA)
- Details of pre-hospital care
- Features that may suggest non-accidental injury (e.g. delayed presentation or inconsistent history). If the history does not appear to fit with the injury, it is important to do your best to ensure you have taken a clear history of the mechanism proposed.
- Document developmental level of child
- Past history especially previous head injury, neurological disease, developmental problems and haematological disorders
- Medication
- Allergies
- Immunisation status
- Last food or drink

Examination

Always fully undress the child to look for occult injuries

Head

- Scalp haematomas are highly significant and should be carefully looked for. Take care in dark skinned children and those with a lot of hair, can be subtle.
- Fractures: depressed, base of skull (“raccoon eyes”, “Battles sign” (posterior auricular bruising), CSF leak, blood in the ear canal or behind the tympanic membrane)
- Check ears for pinna bruising (associated with inflicted injury)
- Head circumference should be measured in children under 1 year

Face – examine for facial fractures, intraoral injuries, frenulum tears (associated with inflicted injury)

Neck – immobilise if injury cannot be excluded clinically

Trunk and Limbs – look for bruises, swelling, deformity, bony crepitus, burns

Neurological – check cranial nerves and document neurology for all 4 limbs
HEAD INJURY, MANAGEMENT OF PAEDIATRIC

Moderate & Severe Head Injury (GCS ≤ 13)

- “Trauma Stat” call (must be assessed by the Neurosurgical Registrar (or Trauma Registrar in centres without Neurosurgery)
- Full resuscitation (“ABC”) and assessment (see Cardiopulmonary Resuscitation Guidelines)
- The priorities are maintenance of the airway, oxygenation and cerebral perfusion

AIRWAY AND BREATHING

- In the unintubated patient oxygen by mask should be continuously administered and SpO2 continuously monitored.
- Any child not protecting their airway or maintaining adequate ventilation should be intubated and ventilated. This includes any child with a GCS of 8 or less (severe head injury). Rarely the agitated or combative child with a higher GCS requires intubation to facilitate imaging (CT).
- In-line stabilisation or the cervical spine should be done to prevent potential secondary spinal injury.
- Induction of anaesthesia (with drugs) should be performed with care to avoid hypotension (usually due to excessive dosing or concurrent hypovolaemia) or a rise in intracranial pressure (under-dosing).
- The child should be intubated orally initially (until the skull base has been cleared by CT scan) and the ETT secured with tape.
- The cervical collar should also be fitted carefully to avoid interference with cerebral venous drainage.
- An orogastric tube should be inserted to decompress the stomach.
- SpO2 and ETCO2 should be continuously monitored.

CIRCULATION AND CEREBRAL PERFUSION

- Hypotension is the most important factor contributing to secondary brain insult.
- In the hypotensive patient fluid resuscitation should initially be with isotonic crystalloid solutions. Fluid should be given in aliquots of 20 ml/kg and the response monitored. If the patient remains hypotensive after correction of hypovolaemia, use vasopressors to maintain cerebral perfusion pressure.
- Aim for a systolic blood pressure > 100mmHg
  - For a child with an arterial line the target mean arterial pressure is:
    - ≤ 10 years  > 60 – 70 mmHg
    - > 10 years  > 70 – 80 mmHg
TREATMENT OF RAISED INTRACRANIAL PRESSURE

Signs of raised intracranial pressure include:
- Cushing’s reflex (hypertension with bradycardia) (NB – relative bradycardia alone can herald raised ICP before patient becomes hypertensive)
- Unilateral or bilateral pupillary dilatation
- Deteriorating GCS > 2 points
- Developing focal signs
- Extensor posturing

This is an emergency and the child requires urgent CT scan and neurosurgical review. While these are being organised, do the following:

- Arrange PICU admission
- Ventilate to low normal PaCO2 (4.5 – 5 kPa) or hyperventilate while waiting for other treatments to take effect
- Aggressively treat hypotension with IV fluid boluses and vasopressors
- Provide adequate analgesia (morphine) and sedation (midazolam)
- Paralyse with muscle relaxants
- Mannitol 0.5-1 g/kg (2.5-5 ml/kg of 20% mannitol) by intravenous infusion over 20 min
- Consider hypertonic saline (3-5mls/kg of 3% saline) intravenous bolus (if given rapidly may drop BP)
- Phenytoin 20 mg/kg should be given to prevent early post-traumatic seizures.
- Hyperthermia should be avoided (> 37.5°C).
- The head of the bed should be elevated (without hip flexion). The child’s head should be kept in the midline, neutral position (to avoid jugular venous compression and spinal cord injury).

NOTE: Neurosurgical consultation is required PRIOR to CT scan if patient deteriorating:
- Deteriorating GCS > 2 points
- Dilating pupil
- Developing focal signs
- Extensor posturing

Further management dependent on CT findings: Operating Theatre / PICU

See below for guidelines on Fluid Management & Drug Usage as well as detailed guidelines on CT scanning
Minor Head Injury (GCS 14-15)

This is the largest group. Goals of management are to identify the small subgroup at risk of late deterioration particularly from intracranial bleeding, and to identify infants at risk from child abuse. This is achieved by good clinical assessment (including a meticulous approach to taking the history), and early management, selective CT scanning and (in the case of possible child abuse) appropriate referral for further investigation.

A normal CT scan is the most accurate way of excluding intracranial injury and reducing the likelihood of late deterioration.

Minor head injury in children < 2 years of age:

Use this algorithm for an infant < 2 years with apparently minor head trauma who is alert or responds to voice or light touch.

Exclusion criteria: Birth trauma, bleeding diathesis, VP shunt, multiple trauma, pre-existing neurologic disorder or significant concern regarding abuse/negligence on initial evaluation.

*ICI = intracranial injury
** This decision will depend on several factors including: age, time of day, need for sedation or GA, when last fed etc. If unsure discuss with CED senior.
Minor head injury in children 2-15 years of age:

Use this algorithm for children and young people 2-15 years of age with apparently minor head trauma and GCS 14-15

Exclusion criteria: Bleeding diathesis, VP shunt, multiple trauma, pre-existing neurologic disorder or significant concern regarding abuse/negligence on initial evaluation.

Observation period in Emergency Department

Children with minor head injury may require a period of observation in CED (see algorithms above). This will usually be for a period of 4-6 hours with hourly neuro observations of GCS, pupil size and reactivity, power in limbs and vital signs (BP, pulse, respirations). At the end of the observation period perform a full clinical assessment and re-categorise into risk group (as described in the algorithm) to determine the next step in management.
Criteria for admission or discharge

Indicators for admission:

- GCS <15
- CT abnormality except simple uncomplicated fracture
- Delayed seizure
- Inadequate supervision / poor access to medical care
- Disabling symptoms
- Children may also be admitted at the discretion of the Starship ED Consultant
- **All children with suspicion of child abuse require admission for assessment**

All admissions should be discussed with the Neurosurgical Registrar.

Patients admitted during the day should be reviewed on the ward by the Paediatric Neurosurgical Registrar. After hours admissions will be reviewed by the Neurosurgical Registrar on call before he/she leaves the hospital at 10.00pm. Overnight admissions, after discussion, may be reviewed the following morning.

Requirements for discharge:

- Orientated in time and place (GCS 15)
- No focal neurological signs
- Mild / moderate headache only
- Normal CT scan with or without skull fracture [or no skull fracture if x-ray already performed at peripheral centre and CT not necessary]
- A responsible person, with access to phone and transport, available to continue observation of patient
- Medical officer is satisfied that the mechanism was accidental

Require provision of discharge check list on when to return to hospital:

- Increasing headache
- Persistent vomiting
- Becomes restless or drowsy
- Seizure
- Provision of information regarding post concussion syndrome and where to seek assistance for this

Inpatient Management of Mild Head Injury

- Hourly neurological observations
- Clear fluids orally for 6 hours, IV fluids if persistent vomiting (0.9% saline)
- Simple analgesia e.g. Paracetamol orally or PR
- Consider discharge after 12 hrs if asymptomatic
- Neurological symptoms, declining GCS or persistent vomiting >4hrs after admission require reassessment +/- head imaging
HEAD INJURY, MANAGEMENT OF PAEDIATRIC

Fluid Management in the Paediatric Head Injured Patient

Hyponatraemia

The most serious and frequently seen electrolyte abnormality is that of hyponatraemia (Na< 135mmol/L). Purported mechanisms include SIADH, cerebral salt wasting and overzealous fluid resuscitation.

The effects of hyponatraemia are those of cerebral oedema as fluid crosses the blood-brain-barrier into the cerebral parenchyma worsening cerebral swelling. Symptoms can include headache, anorexia, nausea, weakness, lethargy, confusion, disorientation, blurred vision, cramps, coma and seizure. Symptoms often mimic those of the head injury / concussion itself. The consequence of this can lead to extremely rapid neurological decline and has been associated with death or worsened neurological outcome.

Although the head injured child may have associated pulmonary and gastrointestinal injuries that may complicate electrolyte homeostasis, our experience suggests that:

| All paediatric head injured patients that require intravenous fluid for maintenance or resuscitation MUST receive 0.9% NaCl +/- 10mmol KCL/500mL. |

This has been shown on numerous occasions to be the most important prophylactic measure to prevent the development of hyponatraemia.

Avoid hypotonic solutions, e.g. 0.18% Sodium Chloride and 4% Dextrose or 5% Dextrose, which may impair cerebral compliance.

Infants require blood glucose checks 4 hourly as there is a significant risk of hypoglycaemia and subsequent seizure.

Serum sodium and potassium need assessment 12 hourly when in the Neurosurgical High Dependency Unit (HDU) ie Moderate – Severe Head Injuries. This can be changed to daily if parenteral fluids are still required when the patient is on the ward.

If the serum sodium remains low despite parenteral 0.9% NaCl then:
- a thorough review of fluid status is warranted
- reduce fluid intake
- check serum and urine sodium and osmolality
Guidelines on Drug Usage

1. Raised intracranial pressure

   Indications for medication:
   - Deteriorating GCS > 2
   - Dilating pupil
   - Developing focal signs
   - Extensor posturing
   - Cushing’s reflex (hypertension, bradycardia)
   - Prior to transfer with GCS < 9 (see below)

   Mannitol. Dose: 0.25 - 1g /Kg/dose (= 1.25 - 5ml/kg of 20%) repeated if necessary
   Given as 20% solution, run in over 20 minutes (=20g/100ml)
   e.g.: for 20 Kg child, 25-50 ml over 20 minutes

2. Seizures

   See also guidelines on status epilepticus

   Immediate post traumatic seizures (<1 hour) do not have the same pathological significance as
   those occurring after 1 hour.
   Treatment with anticonvulsants in the first 10 days can make management during the initial critical
   periods easier, but does not change incidence or severity of late post traumatic epilepsy.

   Diazepam. Give ongoing seizure > 3minutes, 0.25 mg/kg/dose IV

   Phenytoin. Give to stop and prevent further seizures
   20 mg / Kg, slow IV injection or infusion
   (see ADHB paediatric phenytoin IV guideline)
   Maintenance 5mg/kg/day (as single or divided doses)
   Monitor for side effects: rash, hepatitic picture, ataxia, nystagmus, slurred speech,
   nausea, vomiting, constipation

   Note: Some Neurosurgeons choose to administer Phenytoin to all patients with severe head injury
   for a period of 10 days.

3. Analgesia

   Paracetamol: 20mg/kg stat then 15mg/kg/dose 4hrly (max 90mg/kg/day). Use lower doses in
   infants less than 3 months of age.

   Morphine: May be cautiously used at the lowest dose noting that even slight respiratory
depression raises intracranial pressure
Detailed Guidelines for Head Imaging

CT is the investigation of choice. It is indicated in all head injuries except for trivial injury. A normal CT scan essentially rules out any subsequent complication developing from the head injury and management therefore will be entirely directed at symptoms. The patient may be discharged negating the necessity for admission for the purpose of observation. Furthermore, a significant proportion of minor head injuries have intracranial traumatic lesions on CT. Clinical examination is not sensitive for the detection of these lesions.

In the case of suspected child abuse in infants (particularly those under the age of 1 year), the CT scan may detect clinically unapparent or old intracranial bleeding. These findings may of themselves pose no clinical risk, but are a marker for a high risk of repeated injury.

Which patients need a CT scan?

A. Absolute indications:
   - GCS ≤13 (i.e. all moderate and severe head injuries)
   - Neurological deterioration - GCS decreases by more than 2 points, focal signs
   - Focal neurological signs
   - Penetrating injury
   - Depressed skull fracture

B. Relative indications (dependent on availability):
   - GCS 13 - 14 after 4 hours
   - Persistent severe headache, vomiting
   - Period of unconsciousness > 1 minute
   - Post-traumatic amnesia>5 minutes
   - Seizure
   - Signs basal skull fracture
   - Radiological skull fracture
   - Higher risk patient: age < 2yr, coagulation defects
   - Assessment difficult e.g. alcohol intoxication
   - Suspected child abuse

When should the CT scan be performed?

Urgent CT scan:

The following subgroup requires urgent CT scanning (within 2 hours)
   - Penetrating skull injury
   - Depressed skull fracture (open and closed)
   - Focal neurological deficit (CT within 30 minutes)
   - Post traumatic seizure (after 1st hour post injury)
   - Decreasing level of consciousness (> 2 GCS points) (CT within 30 minutes)

Note: Delayed traumatic intracranial haematomas are unlikely to occur when CT scan has been performed >4hours post injury
HEALTHY INJURY, MANAGEMENT OF PAEDIATRIC

Semi-Urgent CT Scan:

The following are at greater risk of intracranial pathology and require semi-urgent CT scan (<4hrs):
- GCS <15 after 4 hrs observation
- Progressive headache or persistent vomiting >4 hrs
- Intoxication with drugs / alcohol where conscious state does not improve over 2 hrs
- Children < 2 years with scalp haematoma
- Children < 2 years with any persisting symptoms
- Unconscious > 5 mins & persistent symptoms after 4 hrs observation
- Persistent confusion or post-traumatic amnesia (PTA) (i.e. inability to hold new memories) after 4 hrs observation
- Patients on anticoagulants & residual symptoms at 4 hrs

Non-urgent CT scan:

The following require CT scanning on a non-urgent basis (<12hrs) if clinically stable:
- Clinical evidence of a base of skull fracture
- Significant subgaleal haematoma (may signify an underlying skull fracture)
- Skull fracture on x-ray (when already performed at peripheral centre)
- Ongoing post concussional symptoms
- Low-risk clinical criteria but reasonable suspicion of child abuse (discuss with senior)

CT scanning in children <10 years may require general anaesthesia. The Anaesthetic Registrar on call must be contacted prior to scanning on all such children.
Transfer from a Peripheral Hospital

Consultation with consultant neurosurgeon will determine need for transfer. There are conditions for which transfer is not appropriate e.g. brain death

General recommendation for transfer:
- GCS < 9 after resuscitation
- GCS 9 - 13 persisting after 2 hours
- Neurological deterioration:
  - GCS > 2 points
  - Focal neurological signs
  - Penetrating injury
  - Depressed skull fracture (all compound, some closed)

All transferred patients should be seen and assessed in ED prior to admission to 26A except for those transferred to PICU

Rapid Neurological Deterioration

A rapid neurological deterioration in a patient may require immediate surgical decompression prior to transfer. This decision will be based on:
- Transfer time
- Clinical state
- Rate of deterioration
- CT scan availability

General recommendations:
- Transfer time < 2 hours:
  - Intubate + hyperventilate
  - Mannitol
  - Transfer
- Transfer time > 2 hours:
  - Intubate + ventilate
  - Mannitol + Frusemide
  - Possible burr hole exploration and craniectomy evacuation
  - Await retrieval team

Consult with Neurosurgery at all times. The burr holes are exploratory only. The aim is evacuation of the solid blood clot through a craniectomy. Burr holes alone are not adequate.
Base of Skull Fracture

Diagnosis.
- Clinical:
  - Periorbital haematoma ("raccoon eyes")
  - Mastoid bruising ("Battle’s sign")
  - Blood / CSF from external ear canal or haemotympanum
- CSF tests:
  - β2 Transferrin: most reliable
  - Glucose: nonspecific. If absent it is probably not CSF. If present, it might be CSF.
- Radiology:
  - Plain skull x-rays will usually not demonstrate a fracture and are not recommended
  - CT scan. Investigation of choice. Consult with radiologists to ensure that appropriate sequences are performed (i.e. not a standard CT Head)

Discuss findings with neurosurgeon

Assessment.
Specific assessment and documentation of function of cranial nerves VII and VIII

Management:
- As per guidelines above for head injury
- CSF rhinorrhoea / otorrhoea.
  - Conservative initially:
  - Rest
  - Avoid blowing nose / sniffing
  - No antibiotics
  - Referral if persistent > 2 weeks
- Persisting hearing impairment / haemotympanum.
  - Audiology referral within approximately 6 weeks
- Bony step in canal / profuse otorrhoea
  - ENT Outpatient appointment approximately 2 weeks
- Facial Palsy
  - ENT referral as inpatient
- Meningitis
  - Urgent neurosurgical referral
  - Diagnosis by LP
  - Antibiotics
Post Traumatic Seizure

Post traumatic seizure is a relatively frequent clinical manifestation of head injury. The temporal sequence of seizure, in combination with the degree of intra-cranial injury, is the most important prognostic indicator for determining ongoing treatment requirements. Seizures are classically separated into immediate, early and late.

Immediate Seizure
Usually occur within seconds of injury and are thought to represent traumatic depolarisation of neuronal elements. These patients do not require epilepsy work-up if they are normal on presentation to the Emergency Department. These seizures are not thought to increase the susceptibility to later, unprovoked, seizures and treatment with anti-epileptic medication is not indicated.

Early Seizure
Early Seizure is commonly defined as a seizure occurring within 1 week of head injury. Early seizures are more frequent in the paediatric population in comparison with late seizures, with the majority occurring within the first 24 hours. Younger children (< 7 yrs) are at increased risk of both early and late seizures, and are also at higher risk of status epilepticus.

The risk of early seizure increase with the severity of brain injury:
- Mild head injury - 1.0% risk
- Moderate head injury - 1.1% risk
- Severe head injury - 30.5% risk

Treatment for early seizures is recommended with either phenytoin or carbamazepine.

Late Seizure
Late seizures are defined as seizures occurring after 7 days from time of initial head injury. Younger children appear more at risk of developing late seizures.

The incidence increases with severity of head injury:
- Mild head injury - 0.2%
- Moderate head injury - 1.6%
- Severe head injury - 7.4%

The greatest risk factors for the development of late seizures are degree of brain contusion, subdural haematoma and age.
There is no evidence for the use of prophylactic treatment utilising anti-epileptic drugs with any severity of head injury, but the recommendation is for active treatment of epilepsy (2 or more seizures) as identified.
Post Concussion Syndrome

The number of people that sustain post concussion symptoms following mild head injury has been reported to be almost 50%. The most frequent symptoms are those of headache, nausea and lethargy. Other symptoms include dizziness, fatigue, poor memory, poor concentration, irritability, depression, sleep disturbance, blurred vision and photophobia.

Whilst most of these symptoms resolve within 1-2 weeks, 8% of people are reported to have persistent symptoms at 1 year.

There has been great debate as to whether the symptoms are of organic or psychological origin. Although MRI, cerebral blood flow anomalies and histopathological studies have clearly shown evidence suggesting organic abnormalities, it seems likely that both organic and psychological factors are involved in an interplay determining the symptoms.

In the acute hospital setting, the main concern is the appropriate management of the patient with ongoing concussive symptoms. The main factors to consider are:

1. Normal neurological examination
2. Normal electrolyte profile and fluid intake
3. Adequate analgesic and anti-emetic requirements.

If the child who has sustained a mild to moderate head injury, has ongoing symptoms, and a CT scan has not been performed, then this should be requested.

If a CT scan has been performed, and there is no deterioration in GCS, then a repeat CT scan is not indicated. The child should be managed with careful fluid intake (oral or parenteral), daily electrolyte analysis, correct analgesia (ensuring no allergies) and adequate anti-emetics.

If the symptoms persist and are relatively mild, the child may be discharged as per the discharge policy.

If parenteral fluids, or high levels of analgesic/anti-emetic are required, then the child should remain in hospital until these are readily controlled.
## Appendix 1: Glasgow Coma Score (detail)

See also Coma guideline

### Eyes

<table>
<thead>
<tr>
<th>&lt; 1 year</th>
<th>&gt; 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Opens eyes spontaneously</td>
<td>4 Opens eyes spontaneously</td>
</tr>
<tr>
<td>3 Opens to shout</td>
<td>3 Opens eyes to verbal command</td>
</tr>
<tr>
<td>2 Opens to pain</td>
<td>2 Opens eyes to pain</td>
</tr>
<tr>
<td>1 No eye opening</td>
<td>1 No eye opening</td>
</tr>
</tbody>
</table>

### Motor

<table>
<thead>
<tr>
<th>&lt; 1 year</th>
<th>&gt; 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Normal movements</td>
<td>6 Obeys verbal commands</td>
</tr>
<tr>
<td>5 Localizes to noxious stimuli</td>
<td>5 Localises to noxious stimuli</td>
</tr>
<tr>
<td>4 Flexion withdrawal</td>
<td>4 Flexion withdrawal</td>
</tr>
<tr>
<td>3 Flexion / Decorticate posturing</td>
<td>3 Flexion / Decorticate posturing</td>
</tr>
<tr>
<td>2 Extension / decerebrate posturing</td>
<td>2 Extension / decerebrate posturing</td>
</tr>
<tr>
<td>1 No response to noxious stimuli</td>
<td>1 No response to noxious stimuli</td>
</tr>
</tbody>
</table>

### Verbal

<table>
<thead>
<tr>
<th>0 – 23 months</th>
<th>2-5 years</th>
<th>&gt; 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Smiles / coos / cries appropriately</td>
<td>5 Appropriate words / phrases</td>
<td>5 Orientated</td>
</tr>
<tr>
<td>4 Cries / consolable crying / screams</td>
<td>4 Inappropriate words</td>
<td>4 Confused</td>
</tr>
<tr>
<td>3 Irritable / inconsolable</td>
<td>3 Cries / screams</td>
<td>3 Inappropriate</td>
</tr>
<tr>
<td>2 Grunts / agitated</td>
<td>2 Grunts</td>
<td>2 Incomprehensible</td>
</tr>
<tr>
<td>1 None</td>
<td>1 None</td>
<td>1 None</td>
</tr>
</tbody>
</table>

To obtain a GCS score add the points from each of the three categories together. (Minimum = 3, Maximum = 15). Points in each category should reflect the best response in a given time period. A motor score can be assigned to both Left and Right sides. Use the greater motor score in the total GCS score. A modified and expanded GCS includes best/worst, and left/right motor scores.

Please document as follows GCS = ?/15 (E?, V?, M?) If intubated V=T
HEAD INJURY

__________________________ has had a minor head injury and it is safe for you to take
him/her home.

This type of injury is very common in children and rarely causes any serious problems.

It is important to observe your child closely for the first 24 hours following injury as there is
a very small chance of complication occurring.

If your child shows any signs of the following symptoms you should return immediately to
the Children’s Emergency Department or call your Family Doctor.

The signs to watch for:

- Unusual sleepiness – your child is very drowsy or you can’t wake them up completely
- Jerking movements of arms, legs or face – “a fit”
- Severe headache, that Paracetamol (Pamol, Panadol) does not relieve
- Vomiting – more than once after you leave Starship
- Confusion or unusual behaviour
- Any change in the way your child walks or uses their arms/legs
- Blurred vision or slurred speech

IF YOU ARE VERY WORRIED ABOUT HOW YOUR CHILD
LOOKS OR CANNOT WAKE YOUR CHILD
DIAL AN AMBULANCE – DIAL 111
If you are taking your child home at night you can let them sleep but it is important to fully wake your child at these times:

• If your child normally has a daytime sleep, let them sleep but you should wake and check how they are if they sleep more than 2 hours.

• Your child should be able to attend school, crèche, kindergarten or Kohanga Reo as usual.

• They may be tired / irritable or have difficulty concentrating for 2-3 days. If these problems carry on for more than a week you should see your GP.

Any queries you may have, particularly throughout the night, over the next 24 hours, please phone us (09) 307 4902. Then continue to contact your GP for ongoing care of your child.
HEAD INJURY
Toddlers and Infants

Your child has had a minor head injury. The doctor has found no serious injury. It is safe for you to take baby home.

Though unlikely, in the next 24 hours baby could develop serious complications.

If your baby shows any of the following symptoms you should return immediately to the Children’s Emergency Department.

The signs to watch for:
- Crying baby won’t settle
- Repeated vomiting
- Fitting
- Taking < ½ normal feeds
- Sleepy baby, hard to waken or unable to wake

IF YOU CANNOT WAKE YOUR BABY UP OR ARE VERY WORRIED ABOUT HOW YOUR BABY LOOKS
DIAL 111 TO CALL AN AMBULANCE

It is important to wake baby every 4 hours during first nights sleep after leaving hospital to make sure he/she is not unconscious.

Wake during the day if sleeps for more than two hours:
- It is safe to give Paracetamol (Pamol, Panadol) every 4 hours for headache / crying for 1-2 days
- Toddlers may require extra rest periods for several days after head injury
- Toddlers may need extra supervision as they can be unsteady on their feet after a head injury
- Most babies / toddlers return to normal in 3-4 days

Any queries you may have, particularly throughout the night, over the next 24 hours, please phone us (09) 307 4902.

Then continue to contact your GP for continuing care of your child.
References


