HEAD INJURY – ACUTE MANAGEMENT

PRACTICE GUIDELINE©

DOCUMENT SUMMARY/KEY POINTS

- This policy is based on the guideline developed by the Paediatric Research in Emergency Departments International Collaborative (PREDICT) ANZ https://www.predict.org.au/head-injury-guideline/
- This applies to mild to moderate head injuries in children. For severe head injury please refer to relevant related links
- It should be used as a guide, rather than as a complete authoritative statement of procedures to be followed in respect of each individual presentation. **It does not replace the need for the application of clinical judgement to each individual presentation.**
- The Paediatric Improvement Collaborative Head Injury guideline has also been endorsed by the NSW ACI.

Related SCHN Policies

- Trauma Attend: Code Brain – CHW
- Severe Traumatic Brain Injury - PICU – CHW
- Traumatic Brain Injury Management - CICU – SCH

CHANGE SUMMARY

- Links updated and changes made throughout. Guideline reviewed and aligned to latest PREDICT ANZ Guideline.

READ ACKNOWLEDGEMENT

- Medical and Nursing staff caring for patients presenting with potential or actual acute head injury should read and acknowledge this document.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st January 2024	**Review Period**: 3 years
Team Leader:	Staff Specialist	**Area/Dept**: Emergency Depts [SCH & CHW]

This Policy/Procedure may be varied, withdrawn or replaced at any time. Compliance with this Policy/Procedure is mandatory.

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Overview: Management of head injury in children

Initial management

The aims of initial evaluation and management are to rapidly assess the extent and severity of the injury; to institute early management; and to minimise secondary injury.

Primary survey

- Airway with cervical spine immobilisation
- Breathing pattern and adequacy
- Circulation and haemorrhage control
- Disability: rapid neurological examination
- Exposure: complete examination with protection against hypothermia
- Blood Glucose

Risk Factors and Risk Stratification of Children with mild- moderate head injury

The PREDICT Guidelines should be used to risk stratify children with head injuries and to guide decision making for observation, imaging, and discharge in children with mild to moderate head injuries.

https://www.predict.org.au/download/predict-head-injury-guidelines/PREDICT-Head-Injury-Guideline-Summary-V1-17.1.23.pdf

Consider the possibility of cervical spine injury in all children presenting with head injury.

Children with delayed initial presentation (24-72 hrs post head injury) and GCS 15 should be risk stratified the same way as children presenting within 24 hours.

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Risk factors and Stratification

Table 1: Risk Factors in children with GCS 14-15
(Adapted from Paediatric Research in Emergency Departments International Collaborative (PREDICT). Australian and New Zealand Guideline for Mild to Moderate Head injuries in Children – Algorithm (2021).

All Children	< 2 years	≥ 2 years
GCS 14 or other signs of altered mental status (agitation, drowsiness, repetitive questioning, slow response to verbal communication) Abnormal neurological examination Severe mechanism of injury- MVA with patient ejection or rollover, death of another passenger, pedestrian or cyclist without helmet struck by motor vehicle, falls of >1m (< 2 years) and >1.5m (≥2 years), head struck by high impact object Post traumatic seizures	Palpable skull fracture Non frontal scalp haematoma (occipital, parietal or temporal) History of LOC ≥ 5 seconds Acting abnormally per parent	Signs of basal skull fracture History of loss of consciousness History of vomiting Severe headache

High Risk	Intermediate Risk	Low Risk	Very Low Risk
Palpable skull fracture Signs of basal skull fracture [haemotympanum, 'Racoon' eyes, CSF otorrhoea or rhinorrhoea, Battle's sign (bruising over the mastoid area)] Worsening signs or symptoms Persistent GCS 14 Persistent signs of altered mental status	≥ 2 risk factors or Post traumatic seizures or persistent severe headache or persistent vomiting >4 hrs post injury	GCS 15 Acting normally No current signs of altered mental status (agitation, drowsiness, repetitive questioning, slow response to verbal communication) Vomiting has ceased Severe headache has resolved	No risk factors

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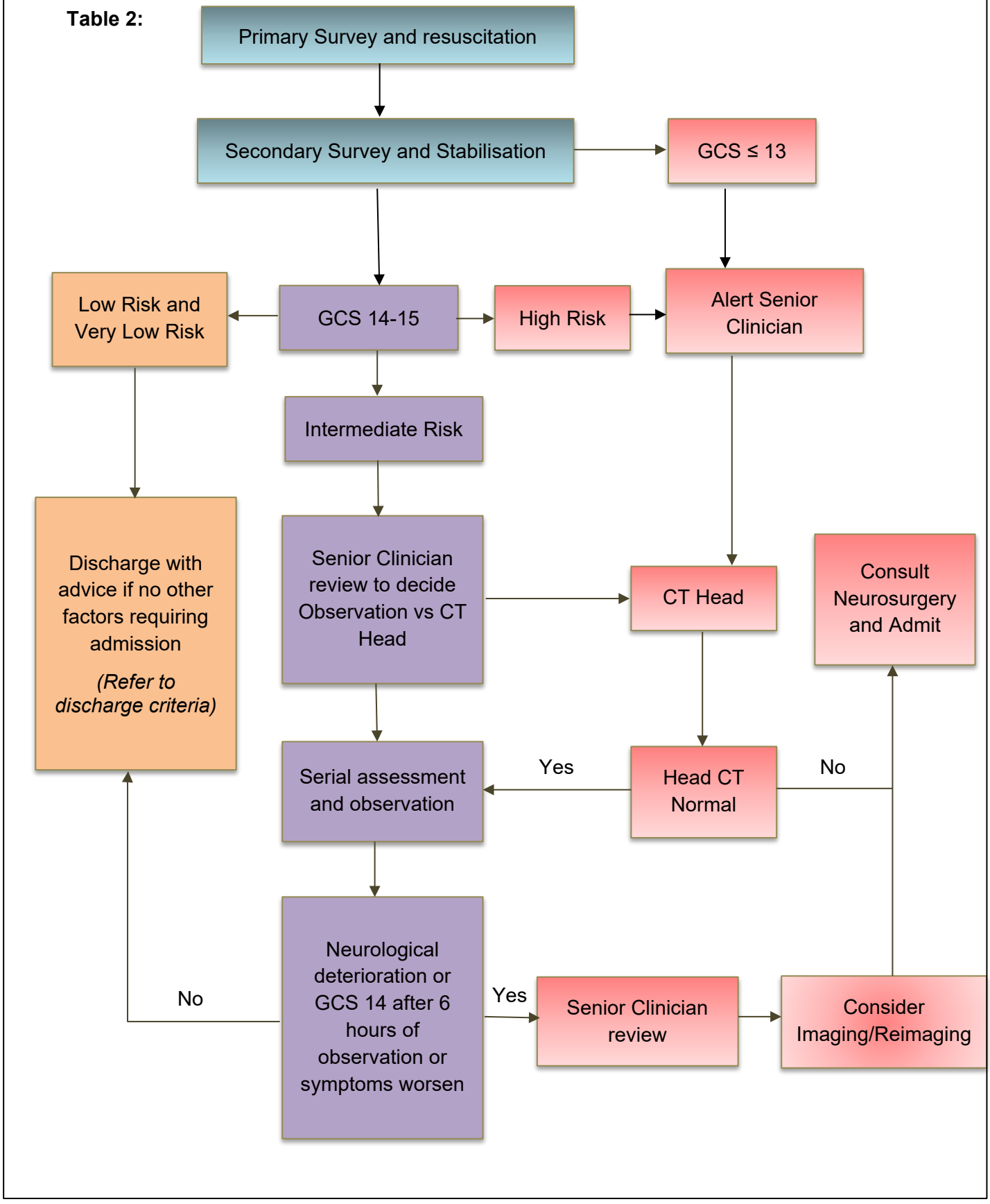
Table 2:



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Imaging

CT scanning is the imaging modality of choice because of its increased sensitivity and specificity for intracranial injury. **Skull X-rays** are not routinely ordered.

- Discuss the child with ED consultant or fellow before ordering head CT scan. Consider if sedation may be required.
    - **At CHW:** Discuss options for sedation with ED Staff Specialist or Fellow in charge and refer to the Paediatric Sedation in the Emergency Department – CHW Practice Guideline.
    - **At SCH:** Discuss options for sedation with ED Staff Specialist or Fellow in charge and refer to the Procedural Sedation in the Emergency Department – SCH Practice Guideline. Options for assistance may need to be discussed with the Paediatric Duty Anaesthetist.

- Contact radiology consultant/ fellow/registrar on call to arrange head CT.
    - **At CHW**, during afterhours, a non-contrast Head CT can be ordered and organised with the radiographer on-call when clinically indicated.

- Head CT scans:
    - **At CHW** are generally read by the radiology registrar/fellow/consultant on call during hours and by Everlite Radiology afterhours.
    - **At SCH** will be reported at all times by the radiology registrar or radiologist on call.

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Observation

Recommended observation period for children with head injury is 4 - 6 hours post injury including 1 hour return to normal in all but very low or low risk groups. Observation duration may be modified based on patient and family variables. These include time elapsed since injury/symptoms and ability of child/parent to follow advice on when to return to hospital.

Frequency of head injury observation should be ½ hourly for the first 2 hours, then 1-hourly until 4 hours post injury. After 4 hours, continue 2-hourly as long as the patient is in hospital.

It is recommended that children with mild to moderate head injuries who present to the Emergency complete an **Abbreviated Westmead Post Traumatic Amnesia Scale (A-WPTAS)** – Refer to the Post Traumatic Amnesia - Protocol for use of the Abbreviated Westmead Post Traumatic Amnesia Scale protocol (A-WPTAS) Practice Guideline..

The assessment of amnesia will not be possible in preverbal children and is unlikely to be possible in any child aged under 5 years. A drop in GCS/A-WPTAS by 2 or more points should prompt senior medical review immediately.

Children who do not require CT head and children who have had a normal CT head may be discharged after appropriate neurological observation if they meet discharge criteria outlined below.

- **At CHW** may be admitted to the Emergency Short Stay Unit (EDSSU) after discussion with the Emergency Consultant/ Fellow.
- **At SCH** there is no EDSSU and children are observed in the Emergency Department.

Neurosurgical consultation is required:

- For any moderate or severe head injury (GCS<14)
- For any head injury where the CT scan is abnormal
- For any child with persistent neurological symptoms and signs irrespective of head CT result

- In **CHW** refer to the Trauma Attend: Code Brain – CHW Practice Guideline.

Vomiting

Antiemetics should **not** be prescribed to patients with head injury and vomiting / nausea where these factors are still being used to guide investigations.

Isolated vomiting, without any other risk factors, is an uncommon presentation of clinically important traumatic brain injury (ciTBI). Vomiting, regardless of the number or persistence of vomiting, in association with other risk factors, increases concern for ciTBI. [9-12]

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Special Conditions

1. **Possible NAI:**

Alert Senior Clinician. Admit under General Paediatric Team and consult Child Protection Unit. CT should be used as initial diagnostic tool to evaluate possible intracranial injury and other injuries relevant for the evaluation of NAI e.g., skull fractures.

2. **Drug or alcohol intoxicated:**

Treat as if the neurological findings are due to the head injury. Decision to CT scan or observe should be informed by risk factors for intracranial injury rather than the child being intoxicated.

3. **< 6 months of age:**

Consider at higher risk of intracranial injury with a lower threshold for observation or imaging. Discuss with a senior clinician.

4. **Ventricular Shunt:**

If there are local signs of shunt disconnection/shunt fracture (such as palpable disruption or swelling) or signs of shunt malfunction, consider obtaining a shunt series and consultation with neurosurgery Team.

5. **Neurodevelopmental disorders:**

It is unclear whether these children have a different background risk for intracranial injury. As these children may be difficult to assess, consider structured observation or head CT scan and include the paediatric team that knows the child (parents, caregivers, and clinicians) in shared decision-making.

6. **Bleeding Risk:**

Urgently seek advice from the treating haematology team around risk of bleeding and management of coagulopathy.

Consider structured observation over immediate CT scan if there are no risk factors for intracranial injury. If there is a risk factor for intracranial injury a head CT should be performed. If there is a deterioration in neurological status, perform urgent head CT scan.

Coagulation factor deficiency: CT scan or decision to observe must not delay the urgent administration of replacement factor.

ITP: Check a platelet count in all patients and blood group in all symptomatic patients if not already available. For ITP with platelet counts < 20 x 10^9/L, consider empirical treatment after discussion with the treating haematology team.

On warfarin therapy or other newer anticoagulants or anti-platelet therapy: Consider CT regardless of the presence or absence of risk factors for intracranial injury. Seek senior clinician review to inform timing of the CT and discuss the patient with the team managing the anticoagulation regarding early consideration of reversal agents. For children on anticoagulation therapy, if available, check the appropriate anticoagulant measure (e.g. International normalised ratio, Factor Xai).

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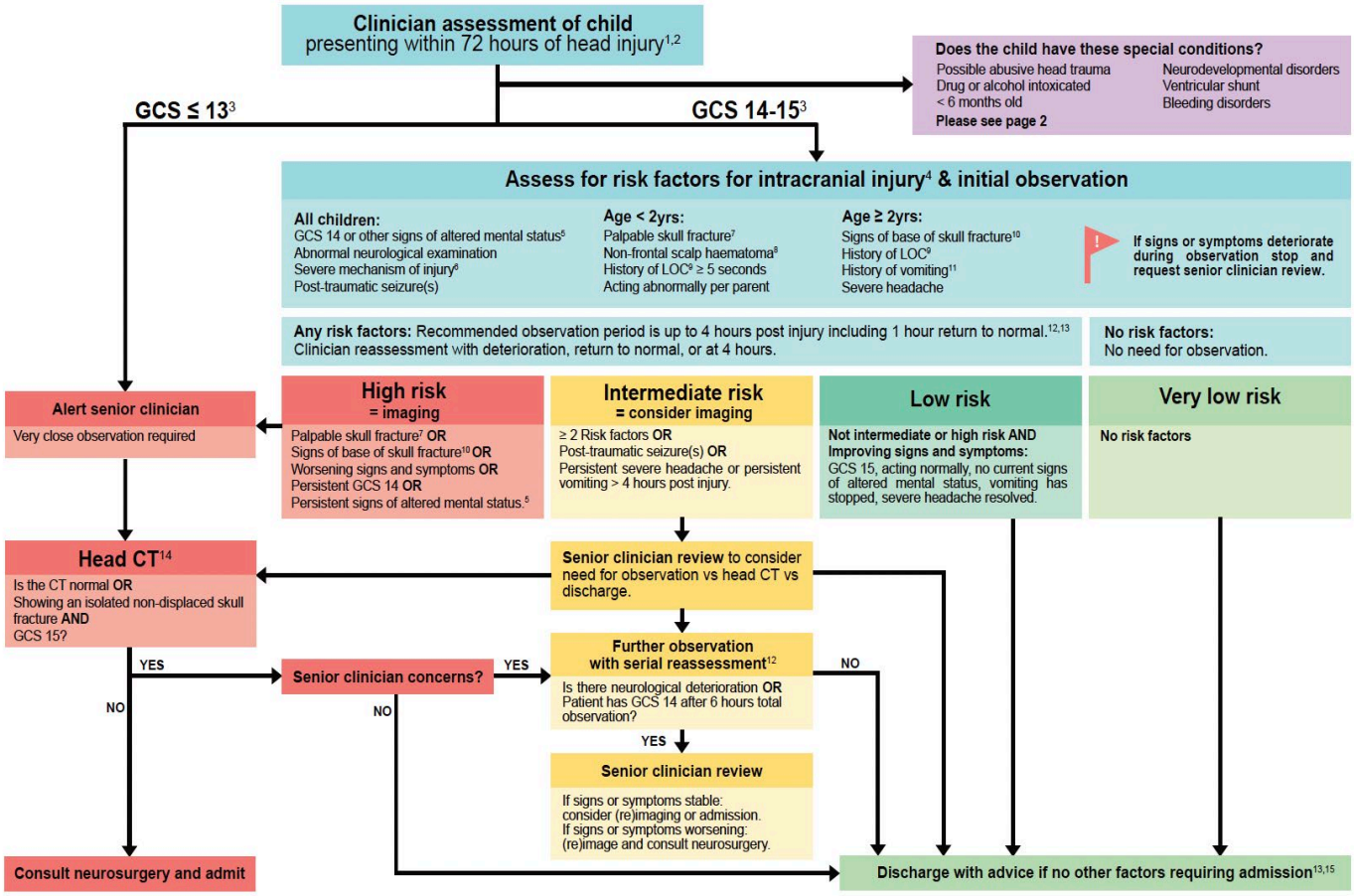
PREDICT Algorithm

From: PREDICT GUIDELINE FOR CHILDREN WITH MILD TO MODERATE HEAD INJURIES (see www.predict.org.au) Version 1.0 [150121]

Algorithm: Imaging & Observation Decision-Making for Children with Head Injuries

Further details and footnotes are important to interpretation of the algorithm. Please see page 2.



From: PREDICT GUIDELINE FOR CHILDREN WITH MILD TO MODERATE HEAD INJURIES (see www.predict.org.au) Version 1.0 [150121]

Further details to aid algorithm interpretation

[1] Always consider possible cervical spine injuries and abusive head trauma in children presenting with head injuries.
[2] Children with delayed initial presentation (24-72 hrs post head injury) and GCS 15 should be risk stratified the same way as children presenting within 24 hours. They do not need to be assessed with a further 4 hrs of observation.
[3] Remember to use an age-appropriate Glasgow Coma Scale (GCS).
[4] Risk factors adapted from Kuppermann N et al. *Lancet* 2009;374(9696):1160-70.
[5] Other signs of altered mental status: agitation, drowsiness, repetitive questioning, slow response to verbal communication.
[6] Severe mechanism of injury: motor vehicle accident with patient ejection or rollover, death of another passenger, pedestrian or cyclist without helmet struck by motor vehicle, falls of ≥ 1m (< 2 yrs), fall > 1.5m (≥ 2yrs), head struck by high impact object.
[7] Palpable skull fracture: on palpation or possible on the basis of swelling or distortion of the scalp.
[8] Non-frontal scalp haematoma: occipital, parietal, or temporal.
[9] Loss of consciousness.
[10] Signs of base of skull fracture: haemotympanum, 'raccoon' eyes, cerebrospinal fluid (CSF) otorrhoea or CSF rhinorrhoea, Battle's signs.
[11] Isolated vomiting, without any other risk factors, is an uncommon presentation of clinically important traumatic brain injury (ciTBI). Vomiting, regardless of the number or persistence of vomiting, in association with other risk factors, increases concern for ciTBI.
[12] Observation to occur in an optimal environment based on local resources. Frequency of observation to be ½ hourly for the first 2 hours, then 1-hourly until 4 hours post injury. After 4 hours, continue 2-hourly as long as the patient is in hospital. Observation duration may be modified based on patient and family variables. These include time elapsed since injury/symptoms and ability of child/parent to follow advice on when to return to hospital.
[13] Shared decision-making between families and clinicians should be considered.
[14] Do not use plain X-rays, or ultrasound of the skull, prior to or in lieu of CT scan, to diagnose or risk stratify a head injury for possible intracranial injuries.
[15] Other factors warranting hospital admission may include other injuries or clinician concerns e.g. persistent vomiting, drug or alcohol intoxication, social factors, underlying medical conditions, possible abusive head trauma.

Special Conditions

Possible abusive head trauma

Follow local screening tools for abusive head trauma (AHT). CT should be used as initial diagnostic tool to evaluate possible intracranial injury and other injuries relevant for the evaluation of AHT e.g. skull fractures. The extent of the assessment of a child with possible AHT should be co-ordinated with the involvement of an expert in the evaluation of non-accidental injury.

Drug or alcohol intoxicated

Treat as if the neurological findings are due to the head injury. Decision to CT scan or observe should be informed by risk factors for intracranial injury rather than the child being intoxicated.

< 6 months of age

Consider at higher risk of intracranial injury with a lower threshold for observation or imaging. Discuss with a senior clinician.

Neurodevelopmental disorders

It is unclear whether these children have a different background risk for intracranial injury. As these children may be difficult to assess, consider structured observation or head CT scan and include the paediatric team that knows the child (parents, caregivers, and clinicians) in shared decision-making.

Ventricular shunt (e.g. ventriculo-peritoneal shunt)

Consider structured observation over immediate CT scan if there are no risk factors of intracranial injury. If there are local signs of shunt disconnection/shunt fracture (such as palpable disruption or swelling) or signs of shunt malfunction, consider obtaining a shunt series based on consultation with a neurosurgical service.

Bleeding disorders or anti-coagulant or anti-platelet therapy

Urgently seek advice from the treating haematology team around risk of bleeding and management of coagulopathy. Consider structured observation over immediate CT scan if there are no risk factors for intracranial injury. If there is a risk factor for intracranial injury a head CT should be performed. If there is a deterioration in neurological status, perform urgent head CT scan.

Coagulation factor deficiency

CT scan or decision to observe must not delay the urgent administration of replacement factor.

Immune thrombocytopaenias (ITP)

Check a platelet count in all patients and blood group in all symptomatic patients if not already available. For ITP with platelet counts < 20 x 10^9/L, consider empirical treatment after discussion with the treating haematology team.

On warfarin therapy or other newer anticoagulants (e.g. direct oral-anticoagulant) or anti-platelet therapy

Consider CT regardless of the presence or absence of risk factors for intracranial injury. Seek senior clinician review to inform timing of the CT and discuss the patient with the team managing the anticoagulation regarding early consideration of reversal agents. For children on anticoagulation therapy, if available, check the appropriate anticoagulant measure (e.g. International normalised ratio).

Citation: Babl FE, Tavender E, Dalziel S. On behalf of the Guideline Working Group for the Paediatric Research in Emergency Departments International Collaborative (PREDICT), Australian and New Zealand Guideline for Mild to Moderate Head Injuries in Children – Algorithm (2021). PREDICT, Melbourne, Australia.

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Discharge Criteria

1. The child has no significant extracranial injuries or other indications (e.g., persistent vomiting) for admission.
2. The child is alert and has a normal neurological examination.
3. There is no suspicion of abuse or neglect.
4. The child lives in a relatively close proximity to hospital and has reliable caretakers who are able to return if necessary.

   All carers of discharged patients need to have specific discharge instructions explained to them. Provide a fact sheet "Concussion and mild head injury" found on the hospital's website under "factsheets". This fact sheet explains the possible late effects of head injury, advice on graded return to sport, and the need for referral to the Brain Injury Rehabilitation Unit at CHW or SCH for persistent symptoms of concussion.
5. Provide a Concussion Action Plan for children with concussion symptoms or significant injury. Refer to hospital webpage on Concussion for more resources (info sheet, Action Plan, Aftercare, return to activity)
6. Provide a GP letter/discharge letter.

   Advise patients to see GP if they do not recover in 2-3 days or to return to ED if there is a deterioration of symptoms
7. Consider referral to CHISM (e-referral or see the link) for children with sports related head injuries and recurrent head injuries.
8. Children with persistent post concussive symptoms at 3-4 weeks post injury should be discussed with the Brain injury Rehabilitation Program Coordinator at CHW/SCH.

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Severe Traumatic Brain Injury

Severe Traumatic Brain Injury:

- For severe head injury, (GCS< 8) or any intubated and ventilated patient with a head injury, early neurosurgical and ICU input is advised.
  - **At CHW**: See PICU guideline "Severe traumatic brain injury" for further details Please refer to other relevant policies as needed (page 1).
  - **At SCH**: See "Traumatic Brain Injury Management – CICU – SCH"

Goals of management of severe traumatic brain injury are (see box below for specifics):

- Maintenance of adequate cerebral perfusion with oxygenated blood.
- Control of increased intracranial pressure (ICP) by reducing the volume of cranial vault contents.
- Avoid secondary brain injury by prevention and/or early recognition of factors known to contribute to secondary brain injury. These include:
  - Hypotension,
  - hypoxaemia,
  - hypercarbia,
  - acidosis,
  - hyperthermia and
  - seizures.
- Recognition of events that may require neurosurgical intervention.
- If the patient is stable assess for other injuries (secondary survey):
  - spine, chest, abdomen etc

Management necessitates frequent neurological assessment. Therapies may include sedation, analgesia, neuromuscular blockade, hyperventilation, hypothermia, osmotic diuresis, anticonvulsants, and antimicrobials.

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References

1. Babl FE, Tavender E, Ballard DW, Borland ML, Oakley E, Cotterell E, Halkidis L, Goergen S, Davis GA, Perry D, Anderson V. Australian and New Zealand guideline for mild to moderate head injuries in children. Emergency Medicine Australasia. 2021 Apr;33(2):214-31.
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