

ADULT TRAUMA CLINICAL PRACTICE GUIDELINES

Initial Management of Closed Head Injury in Adults

Summary Document
2nd Edition



Health

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SHPN: (SSD) 110187

ISBN: 978-1-74187-581-2

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November 2011

A revision of this document is due in 2015



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Acknowledgements

The following individuals are acknowledged for their contribution to the development of this document.

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Introduction

Trauma is the leading cause of death and disability in children and young adults in New South Wales and closed head injuries cause a significant proportion of this burden.^{1, 2} Closed head injury may result in lifelong physical, cognitive, behavioural and social dysfunction for patients which in turn may place major social and financial burdens on their families and society.³ Recent Australian figures indicate there are approximately 150 patients per 100,000 population admitted to hospital each year with closed head injuries.³⁻⁵ Worldwide figures suggest an incidence range of 200-350 per 100,000 population per year for patients with closed head injury with mild head injury accounting for 80%.⁶ Despite the fact that closed head injuries are common, the classification and management of closed head injuries remains surprisingly controversial and subject to variation in clinical practice.⁶⁻¹⁰ Due to the large numbers of patients involved it has been estimated that even small improvements in closed head injury management could have significant impact.¹¹ Furthermore, it has been suggested that the greatest improvements can be made in the better management of those patients with mild to moderate head injury rather than those with severe head injury.¹²

Much of the controversy that exists about closed head injury management stems from the combination of a lack of uniformity in definitions with a paucity of large well designed studies in the area.^{11, 13, 14} 'Head injury' is typically used to describe the initial clinical presentation whilst 'traumatic brain injury' or "concussion" are used to describe the subsequent functional outcome. The terms "mild head injury", "mild traumatic brain injury" and "concussion" are largely interchangeable and which term is used depends on whether you are examining emergency medicine, trauma, rehabilitation or sports medicine literature. It is difficult to find two studies that define mild head injury in exactly the same way so comparison of data can be difficult.^{6, 8-10, 13}

Similarly, comparison of data in moderate to severe head injury studies is made difficult because controversy exists about how and when best to apply Glasgow Coma Scale (GCS) to sedated or intubated patients.¹⁵ Perhaps most

significantly there have been very few large prospective randomised controlled trials of sufficient power and quality to guide management.^{11, 13, 14} However, in the past few years there has been some progress in working toward uniform definitions and some better quality trials and meta-analyses have been published.^{6, 8-10, 15-35}

The variety of clinical practice observed worldwide cannot be explained solely by the lack of uniformity of definitions and good quality studies. Much of the variation in management strategies between the USA, Canada, Europe and Australasia is driven by local issues such as the availability of resources, the medico-legal environment and in recent years the concerns about the potential harm from CT radiation.^{6, 36, 37} Thus the USA has higher rates of CT scanning for mild head injuries compared to Canada, Europe and the UK. Even within countries and within institutions, considerable variation in practice has been shown to exist.^{7, 12, 35, 38} Whilst some variation in clinical practice is to be expected, the introduction of clinical practice guidelines can potentially improve care and ensure adequate access to resources for more isolated areas.^{6, 35} Furthermore, clinical guidelines can potentially reduce unnecessary tests and hospital admissions for mild head injury patients by identifying those patients at low risk of neurosurgically significant lesions.^{6, 13, 33-35}

Scope of the guideline

The guideline is intended for use by clinicians managing patients with closed head injury in major and regional trauma services, and urban and rural hospitals. The guideline is concerned with the initial care of the mild, moderate and severely head injured patient. The guideline will make evidence based recommendations on the diagnosis, resuscitation, and disposal of patients with closed head injuries.

The initial management plan for adults is based upon recommendations to be followed subject to the clinician's judgement in each case.

The recommendations however, are not prescriptive nor are they rigid procedural paths. It is recognised that the recommendations may not suit all patients in all clinical situations. They are intended to provide a clinically practical approach to the initial management of closed head injuries based on the current best available evidence. However, as with all guidelines, it should be remembered that they are a clinical tool and should not replace clinical judgement. The guideline relies on individual clinicians to decipher the needs of individual patients.

All recommendations regarding pre-hospital care should be read and considered in conjunction with the Ambulance Service of NSW.

Guidelines for the initial management of head injury in children can be found at http://www.health.nsw.gov.au/policies/pd/2011/pdf/PD2011_024.pdf

Aims and objectives

The guideline is intended to assist clinicians throughout NSW in delivering optimal care to patients with closed head injury. It aims to provide information to support clinical decision making, rather than dictate what decisions should be made.

The broad objectives of the guideline are to reduce morbidity and mortality in adult patients with closed head injury by providing clinicians with practical evidence based recommendations to assist them in managing such patients. It is also hoped that the guidelines may prevent unnecessary diagnostic tests and hospital admissions especially in the mild head injury group.

The process of constructing the guideline began with the clinicians on the Trauma Clinical Guidelines Committee posing a series of questions about the initial management of closed head injuries. The final questions were derived from the guideline priority areas identified by the committee; that is, the management of mild head injuries and the timing of transfer of patients with closed head injury from centres with limited resources. The initial management of patients with moderate to severe head injury was felt to be less controversial. This edition also includes recommendations in relation to the use of analgesia and anti-convulsants.

An extensive description of the methodology used for this guideline can be found in the full guideline document at Appendix 8, together with the search terms used at Appendix 9.

The clinical questions addressed:

- 1 What is the definition of a mild head injury?
- 2 What are the clinically important complications of mild head injury?
- 3 How should patients with mild head injury be assessed?
- 4 Which patients with mild head injury require a CT scan?
- 5 What should be done with high risk mild head injury patients when CT scan is unavailable?
- 6 What should be done when patients with mild head injury deteriorate?
- 7 When can patients with mild head injury be safely discharged?
- 8 What discharge advice should be provided?
- 9 What are the proven treatments for patients with moderate head injury?
- 10 What are the proven treatments for patients with severe head injury?
- 11 When should patients with closed head injury be transferred to hospitals with neurosurgical facilities?
- 12 What analgesia should patients with closed head injury receive?
- 13 Which patients with closed head injury should receive anti-convulsants?

Defining closed head injury

This guideline uses the terms ‘closed head injury’ and ‘mild, moderate or severe head injury’ to identify and classify patients on arrival to hospital. The outcome following presentation with a ‘closed head injury’ will vary from rapid complete recovery to a mixture of structural lesions and functional deficits ranging from trivial to life threatening. The terms “concussion” and “traumatic brain injury” refer to the patient outcome following their initial presentation with a “closed head injury” and are retrospective diagnoses. Important functional deficits following ‘closed head injury’ range from post concussion symptoms and post traumatic amnesia to a variety of disabling persistent physical-cognitive-behavioural-social sequelae.

Many patients who suffer a “mild head injury” will have “mild concussion symptoms” or “mild traumatic brain injury symptoms”. If these acute “concussion” symptoms persist beyond the first few hours they are usually referred to as “post concussion symptoms”. The term “post concussion symptoms” is used to describe the clinical symptoms of mild brain injury that mild head injury patients may suffer for a few days to weeks following their injury. In the

situation where multiple post concussion symptoms persist for several months they are called a “post concussion syndrome”

As this guideline concentrates on the initial management of the patients presenting to hospital, it was felt that the term ‘head injury’ was more relevant to the initial clinical presentation than the term ‘traumatic brain injury’ that essentially refers to the subsequent functional outcome. It was also felt that the clinicians at whom this guideline is aimed would be far more familiar and comfortable with using the term ‘head injury.’ The definition of closed head injury is further discussed in Question 1.

Classification of closed head injury

This guideline has classified patients with **initial GCS 14-15** on admission as **mild head injury**. This system classifies patients with initial GCS score of 13 in the moderate head injury group due to the patients having similarly patterns of intracranial injury and cognitive behavioural sequelae. The following table gives a rough guide to classification and outcome.^{15, 39-43}

Table 1. Summary of closed head injury classification and outcome

	Mild Head Injury	Moderate Head Injury	Severe Head Injury
Initial GCS	14-15	9-13	3-8
% of Total	80	10	10
Abnormal CT Scan (%) ^{1,2}	5-15	30 - 50	60 - 90
Neurosurgical Intervention (%) ^{1,2} (excluding ICP monitoring)	1-3	5-30	30-50
Mortality (%) ¹	<1	10-15	30-50
Good Functional Outcome (%) ^{1,2,3}	>90	20-90	<20

Notes:

1. Generally the lower the GCS the worse the prognosis or the higher the rate of complications
2. Outcome deteriorates with increasing age - “children do better and elderly do worse”
3. Good functional outcome being return to independent ADL and to work or school at 6 months

Changes from 2007 edition

Background

The first edition of this guideline was written in 2005 using evidence available until December 2004. The aim of this new edition is to review the evidence published since December 2004 and to provide some additional information on specific topics including the role of anticonvulsants and analgesics in the management of closed head injury.

The aim of the original guideline was to provide a clinically practical evidence based guideline that summarised the initial management of adult closed head injury. It was piloted by the NSW Institute of Trauma and Injury Management (ITIM) and then formally adopted and published by NSW Health in January 2007. There was a conscious effort by the initial guideline team to provide a clinically practical document with clinically useful resources such as algorithms, summaries and discharge advice sheets backed up by a detailed evidence review. The guideline team has continued the same principles for this update, incorporating feedback from clinicians to improve the guideline. The algorithms and mild head injury discharge sheets have been revised to reflect the changes in the body of the guideline and the feedback received.

The guideline team would emphasise that this guideline is a clinical tool designed to assist clinicians and should be used to assist rather than replace the clinical judgement of an experienced clinician caring for an individual patient.

The information provided is based on the best available information at the time of writing, which is May 2010. These guidelines will be updated every five years and consider new evidence as it becomes available.

New evidence

Since 2004 there have been many new studies and guidelines published about the management of closed head injury. There have been some advances in our understanding of the assessment and treatment of closed head injury but these have been incremental and

evolutionary rather than revolutionary. The basic principles of management of closed head injury remain the same in 2010 as they were five years ago.

The following section briefly outlines the most significant advances in knowledge from the recent literature incorporated in this update.

Definition of mild head injury

- Recent literature emphasises that significant intracranial injury may occur without loss of consciousness or amnesia
- Patients with initial GCS 13 have a significantly higher rate of intracranial injury and should not be considered as having mild head injury

Clinically important complications of mild head injury

- Recent literature emphasises that mild post concussion symptoms are common and that patients should receive appropriate discharge advice to assist recovery
- Acute neurosurgical complications are uncommon but important to identify

Assessment of patients with mild head injury

- Recent literature emphasises that if structured clinical assessment indicates the risk of intracranial injury is low, the routine use of CT scanning is not warranted and is potentially harmful.
- Structured clinical assessment should include initial clinical history and examination, serial clinical observations and clinical risk factor assessment to determine the need for CT scanning
- A variety of clinical decision rules have been developed to determine which patients are at higher risk of intracranial injury and require CT scanning. However, they all require that the clinician is familiar with their inclusion / exclusion criteria and should be used as tools to support clinical decision making, rather than dictate management
- Post traumatic amnesia testing in the emergency

department, eg Abbreviated Westmead PTA Scale (A-WPTAS) can be useful in identifying patients with cognitive impairment at increased risk of structural lesions and post concussion symptoms.

Indications for CT scan for mild head injury

- Recent literature emphasises that patients can be risk stratified according to clinical risk factors and clinical decision rules. Patients who are classified as high risk should have CT scans to exclude clinically important intracranial lesions
- Significant head injuries can occur without loss of consciousness or amnesia and that the absence of these features should not be used to determine the need for CT scanning.
- Persistent abnormal mental status manifested by either abnormal GCS or abnormal alertness, behaviour or cognition is a strong indication for CT scanning
- Known coagulopathy and particularly supra-therapeutic anticoagulation are significant risk factors for intracranial injury and that these patients should have early CT scans and be considered for reversal of anticoagulation
- There have been several very large studies addressing this issue in the paediatric literature that have come up with very similar risk factors to the adult literature and have also confirmed that it is safe to discharge low risk patients without CT scanning.

Acute neurological deterioration

- Recommendations essentially unchanged
- Previously covered within guideline but now given separate question

Discharge of patients with mild head injury

- Recent literature emphasises that patients can be safely discharged for home observation if structured clinical assessment reveals no clinical risk factors indicating the need for CT scanning or following a normal CT scan if indicated.
- Deterioration of mild head injury patients following a normal CT scan is rare. Caution is advised for patients with known coagulopathy and elderly patients where the risk of a delayed subdural haemorrhage is increased.

Discharge advice for patients with mild head injury

- New section to emphasise importance of discharge advice
- Recent literature emphasises that all patients with mild head injury should be given both verbal and written discharge advice covering symptoms and signs of acute deterioration, when to seek urgent medical attention, lifestyle advice to assist recovery, information about typical post concussion symptoms and reasons for seeking further medical follow up. As with all discharge advice this should be time specific and action specific.
- An improved version of the original mild head injury advice sheet associated with this guideline has been developed and is now available in several languages.

Initial management of moderate head injury (GCS 9-13)

- Recommendations essentially unchanged

Initial management of severe head injury (GCS 3-8)

- Recommendations essentially unchanged

Transfer of patients with closed head injury to hospitals with neurosurgical facilities

- Recommendations essentially unchanged

Analgesia for closed head injury

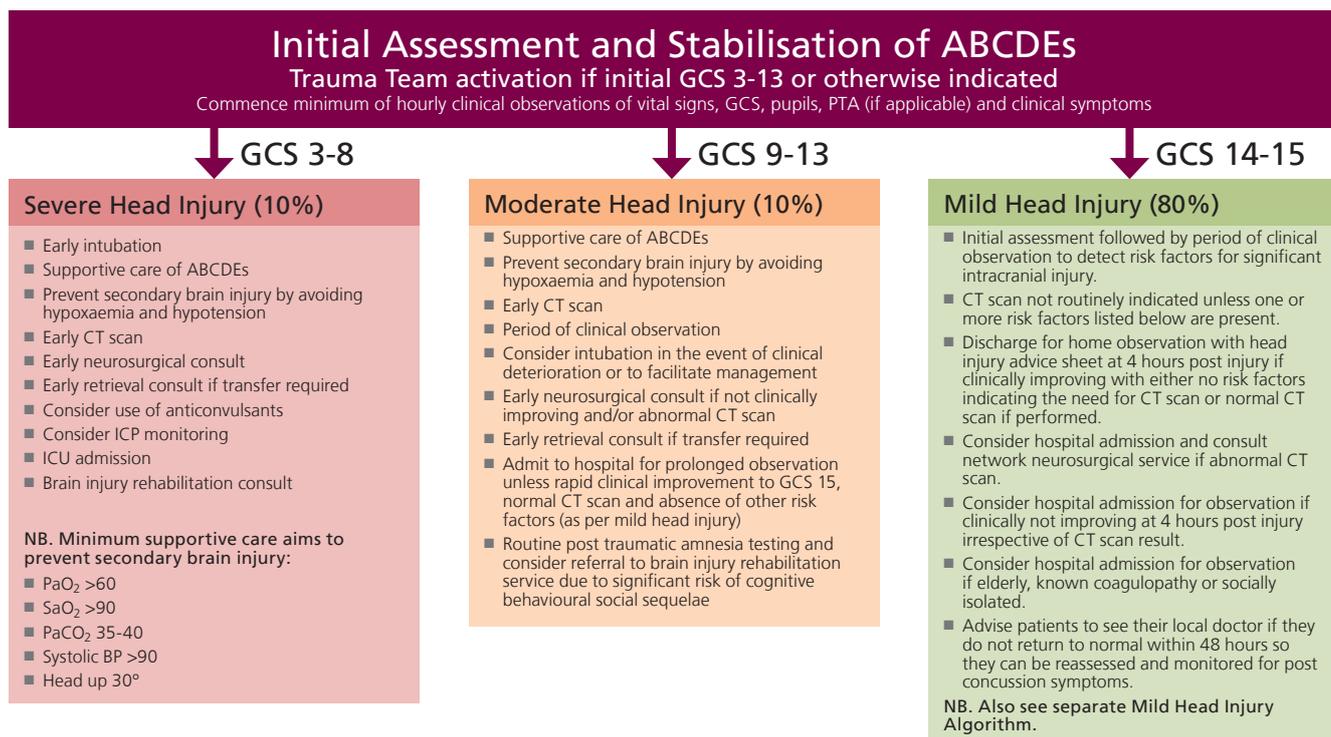
- New section

Anticonvulsants for closed head injury

- New section

Algorithm 1:

Initial Management of Adult Closed Head Injury



Risk factors indicating potentially significant mild head injury		
<ul style="list-style-type: none"> ■ GCS <15 at 2 hours post injury ■ Deterioration in GCS ■ Focal neurological deficit ■ Clinical suspicion of skull fracture ■ Vomiting (especially if recurrent) ■ Known coagulopathy / bleeding disorder 	<ul style="list-style-type: none"> ■ Age >65 years ■ Post traumatic seizure ■ Prolonged loss of consciousness (>5 min). ■ Persistent post traumatic amnesia (AWPTAS <18/18)* ■ Persistent abnormal alertness / behaviour / cognition* ■ Persistent severe headache* 	<ul style="list-style-type: none"> ■ Large scalp haematoma or laceration.** ■ Multi-system trauma** ■ Dangerous mechanism** ■ Known neurosurgery / neurological deficit.** ■ Delayed presentation or representation**
* particularly if persists at 4 hours post time of injury **clinical judgement required		

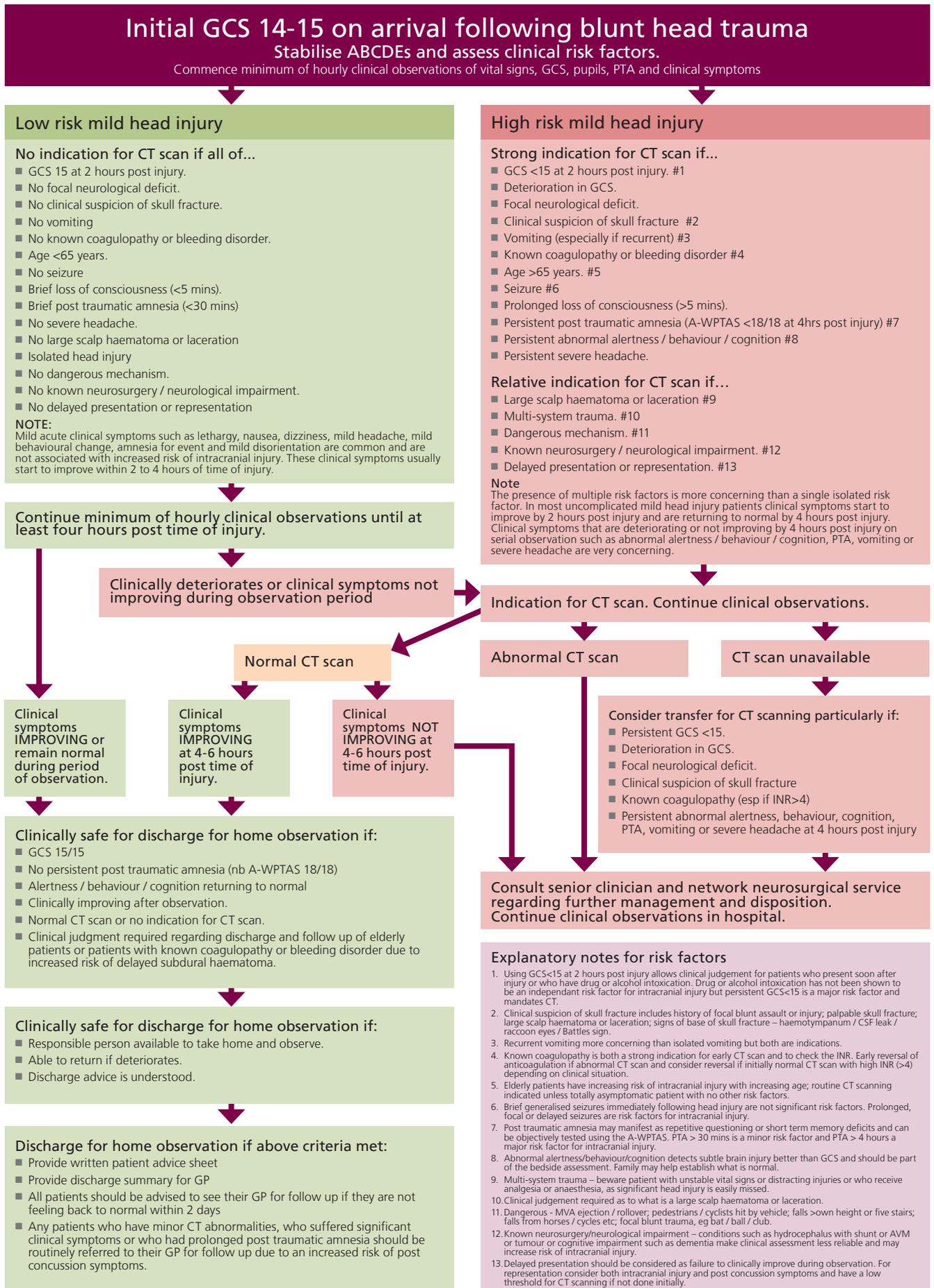
What should be done when patients with closed head injury acutely deteriorate?	
<p>Early signs of deterioration</p> <ul style="list-style-type: none"> ■ Confusion ■ Agitation ■ Drowsiness ■ Vomiting ■ Severe headache <p>Late signs of deterioration</p> <ul style="list-style-type: none"> ■ Decrease in GCS by two or more points ■ Dilated pupil(s) ■ Focal neurological deficit ■ Seizure ■ Cushing's response – bradycardia and hypertension 	<p>Clinical approach</p> <ul style="list-style-type: none"> ■ Resuscitate ABCDEs and exclude non head injury cause ■ Supportive care of ABCDEs ■ Early intubation if indicated ■ Immediate CT scan ■ If clinical or CT evidence of raised ICP/mass effect consult with network neurosurgical and retrieval services re; <ul style="list-style-type: none"> - short term hyperventilation to PaCO₂ 30-35 - bolus of mannitol (1g/kg) - local burr holes/craniectomy when more than 2 hours from neurosurgical care - prophylactic anti-convulsants

When should patients with closed head injury be transferred to hospitals with neurosurgical facilities?	
<p>Potential indications</p> <p>Patient with severe head injury</p> <p>Patient with moderate head injury if:</p> <ul style="list-style-type: none"> ■ clinical deterioration ■ abnormal CT scan ■ normal CT scan but not clinically improving ■ CT scan unavailable. <p>Patient with mild head injury if:</p> <ul style="list-style-type: none"> ■ clinical deterioration ■ abnormal CT scan ■ normal CT scan but not clinically improving within 4-6 hours post injury ■ mild head injury with CT scan unavailable, particularly if: <ul style="list-style-type: none"> - Persistent GCS<15 - Deterioration in GCS - Focal neurological deficit - Clinical suspicion of skull fracture - Persistent abnormal mental status - Persistent vomiting - Persistent severe headache - Known coagulopathy (particularly if age >65 or INR >4) 	<p>Clinical approach</p> <ul style="list-style-type: none"> ■ When in doubt consult you network neurosurgical service. ■ Patients with closed head injuries should be observed in facilities that can manage any complications that are likely to arise. Clinical judgment regarding risk of deterioration is required and neurosurgical consultation may be appropriate. ■ Patients with closed head injuries should be transferred to the nearest appropriate hospital with neurosurgical facilities if there is significant risk of intracranial injury. The transfer of patients to hospitals with CT scan facilities but without neurosurgical services should be avoided.

AMRS (adult)	1800 650 004
formerly the MRU	
NETS (children)	1300 362 500
Network neurosurgical service	<input style="width: 100px; height: 20px;" type="text"/>

Algorithm 2:

Initial Management of Adult Mild Closed Head Injury



Understanding the grades of recommendation

Strength of recommendations

This guideline uses the National Health and Medical Research Council's (NHMRC) overall grades of recommendation to indicate the strength of the body of evidence underpinning each recommendation. The body of evidence reflects the evidence components of all the studies relevant to each recommendation. The evidence

components are assessed according to the NHMRC body of evidence matrix (Table 2). The overall grade of the recommendation is determined based on a summation of the rating for each individual component of the body of evidence. Please note that a recommendation cannot be graded A or B unless the evidence base and consistency of the evidence are both rated A or B.⁴⁴

Table 2: Body of evidence matrix⁴⁴

Components	A	B	C	D
	Excellent	Good	Satisfactory	Poor
Evidence base	one or more level I studies with a low risk of bias or several level II studies with a low risk of bias	one or two level II studies with a low risk of bias or a SR/several level III studies with a low risk of bias	one or two level III studies with a low risk of bias, or level I or II studies with a moderate risk of bias	level IV studies, or level I to III studies/SRs with a high risk of bias
Consistency	all studies consistent	most studies consistent and inconsistency may be explained	some inconsistency reflecting genuine uncertainty around clinical question	evidence is inconsistent
Clinical Impact	very large	substantial	moderate	slight or restricted
Generalisability	population/s studied in body of evidence are the same as the target population for the guideline	population/s studied in the body of evidence are similar to the target population for the guideline	population/s studied in body of evidence differ to target population for guideline but it is clinically sensible to apply this evidence to target population	population/s studied in body of evidence differ to target population and hard to judge whether it is sensible to generalise to target population
Applicability	directly applicable to Australian healthcare context	applicable to Australian healthcare context with few caveats	probably applicable to Australian healthcare context with some caveats	not applicable to Australian healthcare context

Overall grade A or B recommendations are generally based on a body of evidence that can be trusted to guide clinical practice, whereas Grades C or D recommendations must be applied carefully to individual clinical and organisational circumstances and should be interpreted with care (see table below).⁴⁴ This guideline also utilises an additional grade of “Consensus” where appropriate.

The recommendation boxes of each clinical question addressed in this guideline contain clear recommendations with an associated strength of recommendation grade as detailed below. Where appropriate, the author has also added relevant clinical points which support the given recommendation.

Grade of recommendation	Description
A	Body of evidence can be trusted to guide practice
B	Body of evidence can be trusted to guide practice in most situations
C	Body of evidence provides some support for recommendation(s) but care should be taken in its application
D	Body of evidence is weak and recommendation must be applied with caution
Consensus	When limited literature was available, the author and editorial group utilised the best available clinical expertise, practices and accepted teachings to reach a consensus on the recommendation

Level of evidence

‘Level of Evidence’, applied to individual articles, refers to the study design used to minimise bias. Each article is classified according to their general purpose and study type

in accordance with the NHMRC publication: A guide to the development, evaluation and implementation of clinical practice guidelines.⁴⁵ From this, each article was allocated a level of evidence as follows:

Level I	Evidence obtained from a systematic review of all relevant randomised control trials
Level II	Evidence obtained from at least one properly-designed randomised control trial
Level III-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method)
Level III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case-control studies, or interrupted time series with a control group
Level III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies or interrupted time series without a parallel control group
Level IV	Evidence obtained from a case-series, either post-test or pre-test/post-test

For more information on the methodology please see Appendix 8 in the full guideline document.

Recommendations

The following is a summary of the evidence based recommendations for the management of head injury. For a more detailed explanation of the recommendations, please

see the associated discussion in the *Adult Trauma Clinical Practice Guidelines: Initial Management of Closed Head Injury in Adults, 2nd Edition*.

1. What is the definition of a mild head injury?

Mild Head Injury Definition	Strength of recommendation
<p>A patient with an initial GCS score of 14-15 on arrival at hospital following acute blunt head trauma with or without a definite history of loss of consciousness or post traumatic amnesia.</p> <p>Typical characteristics</p> <ul style="list-style-type: none"> ■ Direct blow to the head or acceleration / deceleration injury. ■ Transient loss of consciousness or brief post traumatic amnesia. ■ Transient abnormal alertness, behaviour or cognition. ■ Rapid clinical improvement ■ Neurosurgical intervention rare (1-3%) ■ Abnormality on CT scan relatively uncommon (5-15%) ■ Post concussion symptoms common. ■ Long term functional outcome good. <p>Specific exclusions:</p> <ul style="list-style-type: none"> ■ Clinically obvious penetrating head injury. ■ Non-traumatic brain injury. <p>Risk Stratification</p> <p>Patients may be classified into “high” and “low” risk groups based on the risk of suffering complications of their mild head injury. This risk stratification can be used to assist clinical judgement in determining the need for further assessment (eg CT scan), management and follow up. Stratification into “high” and “low” risk groups is based on the presence or absence of specified clinical risk factors identified by:</p> <ul style="list-style-type: none"> ■ initial clinical history ■ initial clinical examination ■ serial clinical observation <p>“Complicated” Mild Head Injury</p> <p>A “complicated” mild head injury is a mild head injury resulting in one of the following:</p> <ul style="list-style-type: none"> ■ significant structural lesion on CT scan ■ significant acute clinical symptoms ■ significant post concussion symptoms 	<p>CONSENSUS</p>

2. What are the clinically important complications of mild head injury?

RECOMMENDATION	Strength of recommendation
<p>The clinically important complications of mild head injury are:</p> <ul style="list-style-type: none"> ■ structural lesions on CT scan requiring acute neurosurgical intervention ■ structural lesions on CT scan requiring hospital admission and/or neurosurgical consultation ■ acute clinical symptoms requiring acute hospital admission ■ post concussion symptoms causing disabling cognitive behavioural social sequelae 	<p>CONSENSUS</p>
<p>Structural lesions on CT scan requiring acute neurosurgical intervention are rare (1-3%).</p> <p>Typical lesions include:</p> <ul style="list-style-type: none"> ■ acute extradural haematoma ■ acute subdural haematoma ■ depressed skull fractures <p>Structural lesions on CT scan requiring hospital admission and/or neurosurgical consultation are relatively uncommon (5-15%). Not all of these lesions will require hospital admission.</p> <p>Typical lesions include:</p> <ul style="list-style-type: none"> ■ small intracranial haematomas/haemorrhages ■ minor skull fractures 	<p>A</p>
<p>Clinicians and patients should be aware that the absence of a structural lesion on CT scan following mild head injury does not exclude the possibility of significant acute clinical symptoms or significant post concussion symptoms.</p> <p>Acute clinical symptoms are common immediately following mild head injury but should be starting to improve in most patients within two to four hours of time of injury.</p> <p>Common acute clinical symptoms include:</p> <ul style="list-style-type: none"> ■ post traumatic amnesia ■ disorientation ■ confusion ■ drowsiness ■ dizziness ■ nausea ■ vomiting ■ headache <p>Patients with persistent acute clinical symptoms at four hours post time of injury require prolonged clinical observation and a CT scan should be performed (if not already done) to exclude a structural lesion.</p>	<p>A</p>
<p>Patients with persistent post traumatic amnesia and/or other persistent significant acute clinical symptoms that are not improving require prolonged clinical observation and should be admitted to hospital even if their initial CT scan is normal.</p>	<p>CONSENSUS</p>

RECOMMENDATION**Strength of recommendation**

Post concussion symptoms are relatively common following mild head injury and may have significant cognitive-behavioural-social impact on patients and their families.

Many patients will have minor post concussion symptoms that will resolve within a few days while some patients will have more significant **post concussion symptoms** that will take a **few weeks to resolve**. A small number of patients with mild head injury will have persistent disabling post concussion symptoms after 3 months and will require referral for brain injury rehabilitation assessment. Most of these patients will improve by 12 months.

Mild head injury patients with structural lesions on CT scan, a history of significant acute clinical symptoms or documented persistent post traumatic amnesia are at increased risk of post concussion symptoms but post concussion symptoms can occur in the absence of these features.

The only interventions that have been shown to be beneficial for post concussion symptoms are education, reassurance and time. Therefore, it is important to provide education about post concussion symptoms to all mild head injury patients. All patients should be given written advice and advised to see a doctor if they are not feeling better within a few days of injury.

Typical post concussion symptoms include:

- headaches
- dizziness
- fatigue
- memory impairment
- poor concentration
- mood swings
- behavioural changes
- sleep disturbance
- social dysfunction

B

3. How should patients with mild head injury be assessed?

RECOMMENDATION	Strength of recommendation
<p>Mild head injury patients should be assessed by a process of structured clinical assessment involving a combination of:</p> <ul style="list-style-type: none"> ■ initial clinical history and examination ■ serial clinical observations ■ CT scanning if clinically indicated by risk factors identified on initial or serial assessment 	A
<p>Serial clinical observation should include minimum hourly observations of :</p> <ul style="list-style-type: none"> ■ vital signs. ■ pupillary reactions ■ GCS ■ alertness / behaviour / cognition ■ post traumatic amnesia (PTA) (eg A-WPTAS) <p>If patients have no significant risk factors for complications of mild head injury and are clinically judged to be "low risk" then they should be observed until at least four hours post time of injury.</p> <p>If patients have any significant risk factors for complications of mild head injury then they should continue to be clinically observed while further assessment is performed.</p> <p>Serial clinical observations should be continued on any mild head injury patients who fail to clinically improve at four hours post injury or who are found to have structural lesions on CT scan.</p>	B
<p>Assessment for PTA should be performed on all mild head injury patients in the emergency department. Mild head injury patients who are admitted to hospital because they have structural lesions, persistent PTA or clinical symptoms should have daily PTA testing until they are shown to be out of PTA.</p>	C
<p>Clinical assessment using clinical risk factors or clinical decision rules can identify those patients at increased risk of intracranial injury requiring further investigation.</p>	A
<p>CT scanning is indicated for those mild head injured patients identified by structured clinical assessment as being at increased risk of intracranial injury.</p>	A
<p>CT scanning is the most appropriate investigation for the exclusion of neurosurgically significant lesions in mild head injured patients</p>	A
<p>If structured clinical assessment indicates the risk of intracranial injury is low, the routine use of CT scanning is neither clinically beneficial nor cost effective.</p>	B
<p>Skull x-rays are not sufficiently sensitive to be used as a routine screening investigation to identify significant intracranial lesions.</p>	A

4. Which patients with mild head injury require a CT scan?

RECOMMENDATION	Strength of recommendation
<p>'High risk' mild head injury requiring CT scan</p> <p>The following risk factors identify patients with mild head injury (initial GCS 14-15) at increased risk of clinically significant lesions requiring acute neurosurgical intervention or prolonged observation in hospital. These patients should have early CT scanning if available, if they have any of the following features:</p> <p>On initial assessment</p> <ul style="list-style-type: none"> ■ GCS<15 at two hours post injury** ■ Focal neurological deficit ■ Clinical suspicion of skull fracture ■ Vomiting ■ Known coagulopathy or bleeding disorder ■ Age >65 ■ Witnessed seizure ■ Prolonged loss of consciousness (>5min) <p>On serial assessment</p> <ul style="list-style-type: none"> ■ Decrease in GCS ■ Persistent GCS<15 at two hours post injury ■ Persistent abnormal alertness/behaviour/cognition ■ Persistent post traumatic amnesia (A-WPTAS<18/18 at 4hrs post injury) ■ Persistent vomiting (≥ 2 occasions) ■ Persistent severe headache ■ Post traumatic seizure <p>Clinical judgement required if</p> <ul style="list-style-type: none"> ■ Initial GCS 14 within two hours of injury** ■ Large scalp haematoma or laceration ■ Associated multi-system injuries ■ Dangerous mechanism ■ Known neurosurgery/neurological impairment ■ Delayed presentation or representation <p>** NOTE: Includes patients with abnormal GCS due to drug or alcohol ingestion.</p>	A
<p>If CT scanning is unavailable</p> <p>"High risk" mild head injury patients should be closely observed and be considered for transfer to a hospital with neurosurgical and CT scan facilities when CT scan is unavailable.</p> <p>A clear decision about the need for transfer for CT scanning for "high risk" patients should be made at the time of initial assessment or after a brief period of observation. A local senior clinician should be consulted and the patient discussed with the network neurosurgical service.</p> <p>The clinical symptoms of patients with mild head injury typically improve within two to four hours post time of injury. Patients with persistently abnormal or worsening clinical symptoms are at "high risk" of intracranial injury. A clear decision about the need for transfer for CT scanning should be made no later than 4 hours post time of injury.</p>	CONSENSUS

RECOMMENDATION	Strength of recommendation
<p>Patients at “highest risk” of intracranial injury who should be discussed with the network neurosurgical service regarding urgent transfer for CT scanning include those with:</p> <ul style="list-style-type: none"> ■ Persistent GCS<15 at two hours post injury ■ Focal neurological deficit ■ Clinical suspicion of skull fracture ■ Any deterioration in GCS ■ Post traumatic seizure in ED ■ Known coagulopathy (particularly if age >65 or INR >4) ■ Persistent vomiting or severe headache ■ Persistent abnormal alertness, behaviour, cognition or PTA at 4 hours post injury. 	A
<p>If it is decided, after consultation with a network neurosurgical service, that a “high risk” patient does not require urgent transfer for CT scanning, then that patient should have close clinical observation in hospital for at least 24 hours and until clinically improving. If there are any signs of deterioration or no improvement, the network neurosurgical service should again be consulted. Rapid transfer to a neurosurgical centre in the event of deterioration must be available if this strategy is to be used.</p>	CONSENSUS
<p>If patients are transferred for CT scanning they should ideally be transferred to a hospital with neurosurgical facilities to avoid secondary transfer.</p>	CONSENSUS
<p>A skull x-ray may be useful to confirm the presence of a skull fracture that mandates an early CT scan due to the increased risk of deterioration.</p>	B
<p>‘Low risk’ mild head injury not requiring CT scan</p> <p>The following features indicate patients with mild head injury (initial GCS 14-15) at low risk of having clinically significant lesions requiring acute neurosurgical intervention or prolonged observation in hospital. These patients should not routinely have CT scanning if they have all of the following features:</p> <p>On initial assessment</p> <ul style="list-style-type: none"> ■ GCS 15 at two hours post injury. ■ No focal neurological deficit. ■ No clinical suspicion of skull fracture. ■ No vomiting. ■ No known coagulopathy or bleeding disorder. ■ Age <65 years. ■ No post traumatic seizure ■ Nil or brief loss of consciousness (<5min). ■ Nil or brief post traumatic amnesia (<30min) ■ No severe headache. ■ No large scalp haematoma ■ Isolated head injury ■ No dangerous mechanism ■ No known neurosurgery / neurological impairment ■ No delayed presentation or representation. <p>After a period of observation (until at least four hours post time of injury)</p> <ul style="list-style-type: none"> ■ GCS 15/15 ■ No post traumatic amnesia (A-WPTAS 18/18) ■ Normal mental status including alertness, behaviour and cognition. ■ No clinical deterioration during observation. ■ Clinically returning to normal 	A

5. What can be done when patients with mild head injury deteriorate?

RECOMMENDATION	Strength of recommendation
<p>Early signs of deterioration:</p> <ul style="list-style-type: none"> ■ Confusion ■ Agitation ■ Drowsiness ■ Vomiting ■ Severe headache 	B
<p>Late signs of deterioration:</p> <ul style="list-style-type: none"> ■ Decrease in GCS by two or more points ■ Dilated pupil ■ Focal neurological deficit ■ Seizure ■ Cushing's response – bradycardia and hypertension 	A
<p>Clinical approach to neurological deterioration:</p> <ul style="list-style-type: none"> ■ Resuscitation and stabilisation of ABCDEs to exclude non head injury cause ■ Supportive care of ABCDEs ■ Early intubation if indicated ■ Immediate CT scan if available ■ Early neurosurgical consult ■ Early retrieval consult ■ If clinical or CT evidence of raised ICP/mass effect consider in consultation with network neurosurgical service: <ul style="list-style-type: none"> - short term hyperventilation to PaCO₂ 30-35 - bolus of mannitol (1g/kg) - surgical decompression if more than 2 hours from neurosurgical care - prophylactic anti-convulsants 	B

6. When can patients with mild head injury be safely discharged and what discharge advice should be provided?

RECOMMENDATION	Strength of recommendation
Mild head injury patients can be safely discharged for home observation after an initial period of in-hospital observation if they meet the following clinical, social and discharge advice criteria:	CONSENSUS
<p>1. Clinical criteria:</p> <ul style="list-style-type: none"> ■ Normal mental status (alertness / behaviour / cognition) with clinically improving minor post concussion symptoms after observation until at least four hours post injury. ■ No clinical risk factors indicating the need for CT scanning or normal CT scan if performed due to risk factors being present. ■ No clinical indicators for prolonged hospital observation (irrespective of CT scan result) such as: <ul style="list-style-type: none"> - clinical deterioration - persistent abnormal GCS or focal neurological deficit - persistent abnormal mental status - persistent severe clinical symptoms (vomiting / severe headache) - presence of known coagulopathy (clinical judgement required) - persistent drug or alcohol intoxication (clinical judgement required) - presence of multi-system injuries (clinical judgement required) - presence of concurrent medical problems (clinical judgement required) - age >65 (clinical judgement required) 	A
<p>2. Social criteria:</p> <ul style="list-style-type: none"> ■ Responsible person available to take patient home. ■ Responsible person available for home observation. ■ Patient able to return easily in case of deterioration. ■ Written and verbal discharge advice able to be understood. 	CONSENSUS
<p>3. Discharge advice criteria:</p> <ul style="list-style-type: none"> ■ Discharge summary for local doctor. ■ Written and verbal head injury advice given to patient and nominated responsible person covering: <ul style="list-style-type: none"> - symptoms and signs of acute deterioration - reasons for seeking urgent medical attention - typical post concussion symptoms - reasons for seeking routine follow up. 	CONSENSUS
<p>Written and verbal head injury discharge advice should be given to the patient and a nominated responsible person covering:</p> <ul style="list-style-type: none"> ■ symptoms and signs of acute deterioration ■ reasons for seeking urgent medical attention ■ lifestyle advice to assist recovery ■ typical post concussion symptoms ■ reasons for seeking further medical follow up. 	A

7. What are the proven treatments for patients with moderate head injury?

RECOMMENDATION	Strength of recommendation
<p>Moderate head injury</p> <p>Standard care:</p> <ul style="list-style-type: none"> ■ Initial systematic assessment and resuscitation of ABCDEs ■ Supportive care of ABCDEs with appropriate attention to positioning (30° head up), basic nursing care and avoidance of hyperventilation or hypoventilation. ■ Prevention of secondary brain injury by avoiding hypoxaemia (O2 saturation <90%) and hypotension (systolic BP <90) ■ Early CT scan to identify acute neurosurgical lesions ■ Period of clinical observation ■ Consider intubation in the event of clinical deterioration to facilitate resuscitation of ABCDEs or to facilitate management of agitated patients ■ Early neurosurgical consult if not clinically improving and/or abnormal CT scan ■ Early retrieval consult if transfer required ■ Admit to hospital unless rapid clinical improvement to GCS 15, normal CT scan and absence of other risk factors (as per mild head injury) ■ Repeat CT scan at 24 hours if not clinically improving or abnormal initial CT scan ■ Routine post traumatic amnesia testing and consider referral to brain injury rehabilitation service. ■ If clinical or CT evidence of raised ICP/mass effect consider in consultation with network neurosurgical service: <ul style="list-style-type: none"> - short term hyperventilation to PaCO₂ 30-35 - bolus of mannitol (1g/kg) - surgical decompression if more than 2 hours from neurosurgical care - prophylactic anti-convulsants <p>Outcome:</p> <ul style="list-style-type: none"> ■ Approximately 80-90% of moderate head injury patients improve and should be managed as complicated mild head injury while 10-20% deteriorate and require management as per severe head injury.. ■ The majority of patients who suffer moderate head injuries will have some degree of cognitive behavioural social sequelae and should be considered for routine follow up with a brain injury rehabilitation service or a neurologist (see Appendix 7 in the full guideline document). 	<p>B</p>

8. What are the proven treatments for patients with severe head injury?

RECOMMENDATION	Strength of recommendation
<p>Severe head injury</p> <p>Standard care:</p> <ul style="list-style-type: none"> ■ Initial systematic assessment and resuscitation of ABCDEs ■ Early intubation ■ Supportive care of ABCDEs with appropriate attention to positioning (30° head up), basic nursing care and avoidance of hyperventilation or hypoventilation. ■ Prevention of secondary brain injury by avoiding hypoxaemia (O₂ saturation <90%) and hypotension (systolic BP<90) ■ Early CT scan to identify acute neurosurgical lesions ■ Early neurosurgical consult ■ Early retrieval consult if transfer required ■ Consider use of anticonvulsants to prevent early post traumatic seizures ■ Consider ICP monitoring to guide management of cerebral perfusion pressure. ■ Low threshold to repeat CT scan if patient condition changes ■ ICU admission ■ Routine repeat CT scan at 24 hours ■ Brain injury rehabilitation consult ■ If clinical or CT evidence of raised ICP/mass effect consider in consultation with network neurosurgical service: <ul style="list-style-type: none"> - short term hyperventilation to PaCO₂ 30-35 - bolus of mannitol (1g/kg) - surgical decompression if more than 2 hours from neurosurgical care - prophylactic anti-convulsants <p>Minimum supportive care aims:</p> <ul style="list-style-type: none"> ■ PaO₂ > 60 ■ SaO₂ > 90 ■ PaCO₂ 35-40 ■ Systolic BP > 90 ■ Head up 30° <p>Poor prognostic indicators:</p> <ul style="list-style-type: none"> ■ Low GCS (especially motor component). ■ Age >60 years (prognosis deteriorates with increasing age). ■ Absent pupillary reflexes (after systemic resuscitation). ■ Hypotension (systolic BP <90). ■ Hypoxaemia (oxygen saturation <90%). 	<p>A</p>

9. When should patients with closed head injury be transferred to hospitals with neurosurgical facilities?

RECOMMENDATION	Strength of recommendation
<p>A clear decision about the potential need for transfer should be made at the time of initial assessment or after a brief period of observation. A senior clinician should be consulted.</p> <p>The network neurosurgical and retrieval services should be consulted as soon as possible to facilitate early transfer. The following patients should be considered for transfer and discussed with the network neurosurgical service.</p>	CONSENSUS
<p>All patients with severe head injury (GCS 3-8)</p>	A
<p>Patients with moderate head injury (GCS 9-13) if:</p> <ul style="list-style-type: none"> ■ clinical deterioration ■ abnormal CT scan ■ normal CT scan but not clinically improving ■ CT scan unavailable. 	CONSENSUS
<p>Patients with mild head injury (GCS 14-15) if:</p> <ul style="list-style-type: none"> ■ clinical deterioration ■ abnormal CT scan ■ normal CT scan but not clinically improving at 4-6 hours post injury ■ high risk mild head injury with CT scan unavailable if: <ul style="list-style-type: none"> - Persistent GCS<15 at two hours post injury - Focal neurological deficit - Clinical suspicion of skull fracture - Persistent abnormal mental status - Persistent vomiting - Persistent severe headache - Any deterioration in GCS - Post traumatic seizure in ED - Known coagulopathy (particularly if age >65 or INR >4) 	CONSENSUS
<p>Note – the Ambulance Service of NSW Pre Hospital Major Trauma Triage Protocol (T1), attempts to ensure that, wherever possible, trauma patients with moderate to severe head injury are transferred directly from the pre-hospital setting to a Tertiary Trauma Centre.</p>	

10. What analgesia should patients with closed head injury receive?

RECOMMENDATION	Strength of recommendation
<p>Analgesia in isolated mild head injury</p> <ul style="list-style-type: none"> ■ Persistent severe headache or worsening severe headache is an indication for a CT scan to exclude a significant intracranial lesion ■ Most headaches associated with isolated mild head injury will respond to simple analgesia such as paracetamol. ■ Isolated mild head injury patients who require more than paracetamol for headache should be considered for a CT scan to exclude a significant intracranial injury 	CONSENSUS
<p>Analgesia guide for isolated mild head injury:</p> <ul style="list-style-type: none"> ■ Paracetamol, 1g, q 4-6 hours, maximum 4g/24 hours* <p>If paracetamol is ineffective as a sole agent then stronger analgesia such as oral opioids or parenteral opioids should not be prescribed to patients with isolated mild head injury unless the need for an initial or repeat CT scan to exclude clinically important intracranial lesions has been considered and a senior clinician has been consulted. After further clinical assessment consider adding;</p> <ul style="list-style-type: none"> ■ Codeine Phosphate, 30-60mg, q 4-6 hours* or ■ Oxycodone (immediate release), 5-10mg q 4-6 hours* <p><i>NB Avoid the use of aspirin / NSAIDS due to increased risk of bleeding</i> * See standard texts for detailed prescribing information</p>	CONSENSUS
<p>Analgesia guide for mild head injury with associated systemic injuries:</p> <ul style="list-style-type: none"> ■ More likely to need titrated intravenous opioids, procedural sedation or general anaesthesia for their associated injuries. ■ Have a lower threshold for performing CT scans. ■ Require close clinical assessment and observation. ■ Appropriate pain relief should not be withheld due to concerns of masking head injury symptoms and signs ■ Analgesia needs to be individualised under the supervision of a senior clinician. 	CONSENSUS
<p>Analgesia in moderate to severe head injury</p> <ul style="list-style-type: none"> ■ Likely to require titrated intravenous analgesia and sedation for associated injuries, clinical management or intubation. ■ Will require close clinical observation in a high dependency area following initial clinical assessment and CT scanning. ■ Analgesia needs to be individualised under the supervision of a senior clinician. 	CONSENSUS
<p>Clinical approach to pain management in closed head injury (all severities)</p> <ul style="list-style-type: none"> ■ Consult a senior clinician if any significant change in the patient's condition ■ Clinically re-assess if: <ul style="list-style-type: none"> - inadequate analgesia or worsening headache - excessive drowsiness, or other clinical deterioration ■ Before using stronger analgesia: <ul style="list-style-type: none"> - clinically re-assess patient - consider need for CT scan - consult senior clinician 	CONSENSUS

11. Which patients with closed head injury should receive anti-convulsants?

RECOMMENDATION	Strength of recommendation
Consult a senior clinician or your network neurosurgical service before commencing prophylactic anti-convulsants in patients with acute closed head injury	CONSENSUS
Prophylactic anti-convulsants are not indicated for patients with uncomplicated mild head injury	B
Prophylactic anti-convulsants should be considered in patients with complicated mild head injury or moderate to severe head injury.	B
<p>Specific indications to consider prophylactic anti-convulsants in the first week following a head injury include:</p> <ul style="list-style-type: none"> ■ Extradural, subdural or intracerebral haematoma on CT ■ Depressed skull fracture on CT ■ Early post traumatic seizure in hospital (especially if focal or prolonged) ■ Severity of head injury (low initial GCS / prolonged coma / prolonged PTA) ■ Any suspicion of penetrating injury 	B
Prophylactic anti-convulsants decrease the incidence of early post traumatic seizures within seven days of closed head injury.	B
Early post traumatic seizures have not been shown to be associated with worse patient outcomes in large population studies.	B
Clinical judgment is required on whether to prescribe anti-convulsants for individual patients.	CONSENSUS
<p>Indications for anti-convulsants by post traumatic seizure type</p> <p>Immediate post traumatic seizures (at time of injury)</p> <ul style="list-style-type: none"> ■ Anti-convulsants not warranted unless specific indication present (see above) <p>Early post traumatic seizures (up to 7 days post injury)</p> <ul style="list-style-type: none"> ■ Anti-convulsants should be considered especially if any of the other specific indications are also present (see above) <p>Late post traumatic seizures (more than 7 days post injury)</p> <ul style="list-style-type: none"> ■ Long term anti-convulsants should be considered after the first late post traumatic seizure due to the increased risk of developing post traumatic epilepsy ■ There is no evidence that the routine use of anti-convulsants following closed head injury reduces the risk of late post traumatic seizures. 	B
<p>Recommended drugs and loading doses*</p> <p>Standard therapy:</p> <p>Phenytoin:</p> <ul style="list-style-type: none"> ■ Intravenous loading dose: 20 mg/kg in NS (<6.7mg/ml) no faster than 50mg/min <p>Standard adult IVI loading dose: 1000mg phenytoin diluted in 150ml normal saline over 60 mins with in line micron filter</p>	B
<p>Alternative therapies:</p> <p>Levetiracetam:</p> <ul style="list-style-type: none"> ■ Intravenous loading dose: 10mg /kg (max 1000mg) ■ Standard adult IVI loading dose: 1000mg levetiracetam in 100ml normal saline over 15 mins <p>Sodium Valproate:</p> <ul style="list-style-type: none"> ■ Intravenous loading dose: 10mg /kg (max 800mg) ■ Standard adult IVI loading dose: 800mg in 100ml normal saline over 15 mins <p>* See standard texts for detailed prescribing information</p>	C

Appendix 1: Abbreviated Westmead PTA Scale

ABBREVIATED WESTMEAD PTA SCALE (A-WPTAS)

GCS & PTA testing of patients with MTBI following mild head injury

Abbreviated Westmead PTA Scale (A-WPTAS) incorporating Glasgow Coma Scale (GCS)

MRN sticker here

Date:		T1	T2	T3	T4	T5
Time						
Motor	Obeys commands	6	6	6	6	6
	Localises	5	5	5	5	5
	Abnormal flexion	4	4	4	4	4
	Withdraws	3	3	3	3	3
	Extension	2	2	2	2	2
Eye Opening	None	1	1	1	1	1
	Spontaneously	4	4	4	4	4
	To speech	3	3	3	3	3
	To pain	2	2	2	2	2
Verbal	None	1	1	1	1	1
	Oriented ** (tick if correct)	5	5	5	5	5
	Name	<input type="checkbox"/>				
	Place	<input type="checkbox"/>				
	Why are you here	<input type="checkbox"/>				
	Month	<input type="checkbox"/>				
	Year	<input type="checkbox"/>				
	Confused	4	4	4	4	4
	Inappropriate words	3	3	3	3	3
	Incomprehensible sounds	2	2	2	2	2
GCS	None	1	1	1	1	1
	Score out of 15	/15	/15	/15	/15	/15
	Picture 1	Show pictures (see over)				
	Picture 2					
Picture 3						
A-WPTAS	Score out of 18		/18	/18	/18	/18

Use of A-WPTAS and GCS for patients with MTBI

The A-WPTAS combined with a standardised GCS assessment is an objective measure of post traumatic amnesia (PTA).
 Only for patients with **current GCS of 13-15 (<24hrs post injury)** with impact to the head resulting in confusion, disorientation, anterograde or retrograde amnesia, or brief LOC. **Administer both tests at hourly intervals** to gauge patient's capacity for full orientation and ability to retain new information. Also, **note the following:** poor motivation, depression, pre-morbid intellectual handicap or possible medication, drug or alcohol effects. **NB: This is a screening device, so exercise clinical judgement. In cases where doubt exists, more thorough assessment may be necessary.**

Admission and Discharge Criteria:

A patient is considered to be out of PTA when they score 18/18.
 Both the GCS and A-WPTAS should be used in conjunction with clinical judgement.
 Patients scoring 18/18 can be considered for discharge.
 For patients who do not obtain 18/18 re-assess after a further hour.
 Patients with persistent score <18/18 at 4 hours post time of injury should be considered for admission.
 Clinical judgement and consideration of pre-existing conditions should be used where the memory component of A-WPTAS is abnormal but the GCS is normal (15/15).
 Referral to GP on discharge if abnormal PTA was present, provide patient advice sheet.

Target set of picture cards

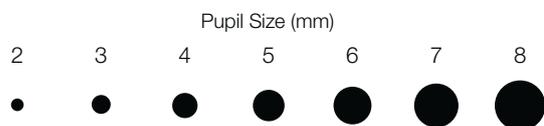


** must have all 5 orientation questions correct to score 5 on verbal score for GCS, otherwise the score is 4 (or less).

PUPIL ASSESSMENT	T1		T2		T3		T4		T5		+	=	REACTS BRISKLY
	R	L	R	L	R	L	R	L	R	L			
Size											SL	=	SLUGGISH
Reaction											-	=	NIL

Comments

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Shores & Lammel (2007) - further copies of this score sheet can be downloaded from <http://www.psy.mq.edu.au/GCS>

GLASGOW COMA SCALE (GCS) AND ABBREVIATED WESTMEAD PTA SCALE (A-WPTAS)

Administration and Scoring

1. Orientation Questions

Question 1: WHAT IS YOUR NAME?

The patient must provide their full name.

Question 2: WHAT IS THE NAME OF THIS PLACE?

The patient has to be able to give the name of the hospital. For example: Westmead Hospital. (NB: The patient does not get any points for just saying 'hospital'.) If the patient can not name the hospital, give them a choice of 3 options. To do this, pick 2 other similar sized hospitals in your local area or neighbouring region. In Westmead Hospital's case the 3 choices are 'Nepean Hospital, Westmead Hospital or Liverpool Hospital'.

Question 3: WHY ARE YOU HERE?

The patient must know why they were brought into hospital. e.g. they were injured in a car accident, fell, assaulted or injured playing sport. If the patient does not know, give them three options, including the correct reason.

Question 4: WHAT MONTH ARE WE IN?

For emphasis the examiner can ask what month are we in now? The patient must name the month. For example, if the patient answers 'the 6th month', the examiner must ask the further question 'What is the 6th month called?'.
The patient must know why they were brought into hospital. e.g. they were injured in a car accident, fell, assaulted or injured playing sport. If the patient does not know, give them three options, including the correct reason.

Question 5: WHAT YEAR ARE WE IN?

It is considered correct for patients to answer in the short form '08', instead of '2008'. Also, an acceptable alternative prompt (for the rest of the 2000's) is 'The year is 2000 and what?'

2. Picture recognition

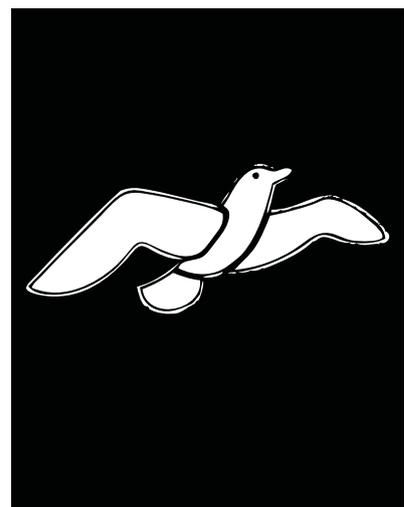
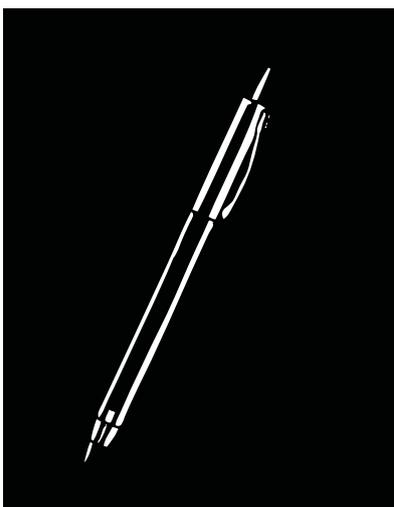
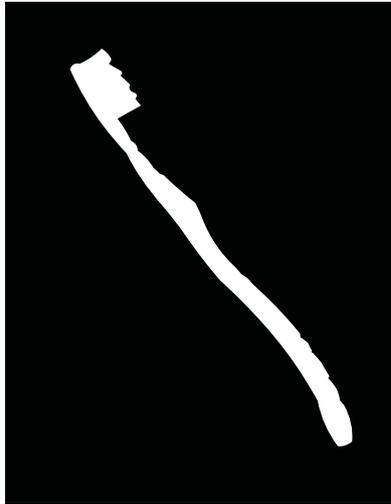
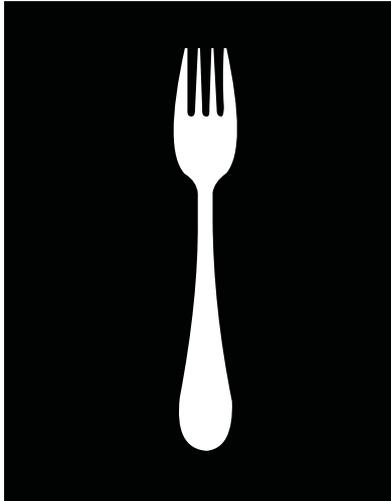
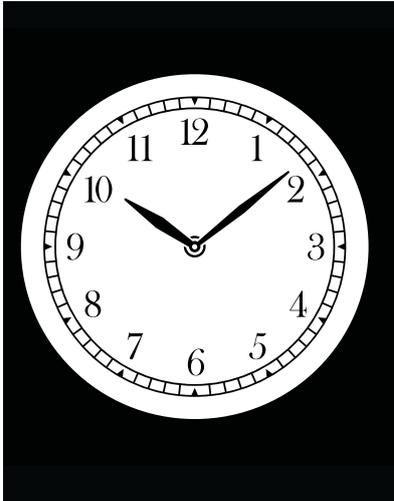
Straight after administering the GCS (standardised questions), administer the A-WPTAS by presenting the 3 Westmead PTA cards. Picture Cards the first time - T1 : Show patients the target set of picture cards for about 5 seconds and ensure that they can repeat the names of each card. Tell the patient to remember the pictures for the next testing in about one hour. Picture Cards at each subsequent time T2-T5: Ask patient, "What were the three pictures that I showed you earlier?" Scoring:

- For patients who free recall all 3 pictures correctly, assign a score of 1 per picture and add up the patient's GCS (out of 15) and A-WPTAS memory component to give the A-WPTAS score (total = 18). Present the 3 target pictures again and re-test in 1 hour.
- For patients who can not free recall, or only partially free recall, the 3 correct pictures, present the 9-object recognition chart. If patient can recognise any correctly, score 1 per correct item and record their GCS and A-WPTAS score (total = 18). Present the target set of pictures again and re-test in 1 hour.
- For patients who neither remember any pictures by free call nor recognition, show the patient the target set of 3 picture cards again for re-test in 1 hour.



Shores & Lammel (2007) - further copies of this score sheet can be downloaded from <http://www.psy.mq.edu.au/GCS>

Research and development of the A-WPTAS supported by the Motor Accidents Authority NSW



Shores & Lammell (2007) - further copies of this score sheet can be downloaded from <http://www.psy.mq.edu.au/GCS>

Appendix 2: Mild Head Injury Discharge Advice

Mild Head Injury Advice

2008

Important points about Mild Head Injury

You had a mild head injury. Most people recover rapidly following a mild head injury. A few people may suffer from symptoms over a longer period.

There is a small risk of you developing serious complications so **you should be watched closely by another adult for 24 hours after the accident. Please read the following. It outlines what signs to look out for after a head injury and what you need to do if you have problems.**



Warning Signs

If you show any of these symptoms or signs after your head injury, or you get worse, go to the nearest hospital, doctor or telephone an ambulance immediately.

- ❖ Fainting or drowsiness - or you can't wake up
- ❖ Acting strange, saying things that do not make sense (change in behaviour)
- ❖ A constant severe headache or a headache that gets worse
- ❖ Vomiting or throwing up more than twice
- ❖ Cannot remember new events, recognise people or places (increased confusion)
- ❖ Pass out or have a blackout or a seizure (any jerking of the body or limbs)
- ❖ Cannot move parts of your body or clumsiness
- ❖ Blurred vision or slurred speech
- ❖ Continual fluid or bleeding from the ear or nose

The first 24-48 hours after injury



Warning Signs You should be observed and return to hospital if you develop any of the above warning signs.



Rest / Sleeping Rest and avoid strenuous activity for at least 24 hours. It is alright for you to sleep tonight but you should be checked every four hours by someone to make sure you are alright.



Driving Do not drive for at least 24 hours. You should not drive until you feel much better and can concentrate properly. Talk to your doctor.



Drinking / Drugs Do not drink alcohol or take sleeping pills or recreational drugs in the next 48 hours. All of these can make you feel worse. They also make it hard for other people to tell whether the injury is affecting you or not.



Pain Relief Use **paracetamol** or **paracetamol/codeine** for headaches. **Do not use aspirin or anti inflammatory pain reliever** such as ibuprofen or naproxen (NSAIDs), which may increase the risk of complications.



Sports Do not play sports for at least 24 hours.



See your local doctor if you are not starting to feel better within a few days of your injury.

Adapted from "Mild Head Injury Discharge Advice" author Dr Duncan Reed (2007) Director of Trauma Gosford Hospital. NSW Institute of Trauma and Injury Management

This discharge advice information is taken from the Motor Accidents Authority of NSW, Guideline for mild traumatic brain injury following closed head injury – first edition 2008, ISBN 978-1-921422-08-9

The first 4 weeks after injury

You may have some common effects from the head injury which usually resolve in several weeks to three months. These are called **post concussive symptoms** (see below). Tiredness can exaggerate the symptoms. Return to your normal activities gradually (not all at once) during the first weeks or months. **You can help yourself get better by:**



Rest / Sleeping

Your brain needs time to recover. It is important to get adequate amounts of sleep as you may feel more tired than normal.



Driving

Do not drive or operate machinery until you feel much better and can concentrate properly. Talk to your doctor.



Drinking / Drugs

Do not drink alcohol or use recreational drugs until you are fully recovered. They will make you feel much worse. Do not take medication unless advised by your doctor.



Work / Study

You may need to take time off work or study until you can concentrate better. Most people need a day or two off work but are back full time in less than 2 weeks. How much time you need off work or study will depend on the type of job you do. See your doctor and let your employer or teachers know if you are having problems at work or with study. You may need to return to study or work gradually.



Sport / Lifestyle

It is dangerous for the brain to be injured again if it has not recovered from the first injury. Talk to your doctor about the steps you need to take to gradually increase sports activity and return to play. **If in doubt "sit it out"**.



Relationships

Sometimes your symptoms will affect your relationship with family and friends. You may suffer irritability and mood swings. See your doctor if you or your family are worried.

Recovery

You should start to feel better within a few days and be 'back to normal' within about 4 weeks. See your local doctor if you are not starting to feel better.

Your doctor will monitor these symptoms and may refer you to a specialist if you do not improve over 4 weeks up to 3 months.

Post Concussion Symptoms

There are common symptoms after a mild head injury. **They usually go away within a few days or weeks.** Sometimes you may not be aware of them until sometime after your injury like when you return to work.

- ❖ Mild headaches (that won't go away)
- ❖ Having more trouble than usual with attention & concentration
- ❖ Having more trouble than usual with remembering things (memory difficulties/forgetfulness)
- ❖ Feeling dizzy or sick without vomiting (nausea)
- ❖ Balance problems
- ❖ More difficulty than usual with making decisions and solving problems, getting things done or being organised
- ❖ Feeling vague, slowed or "foggy" thinking
- ❖ Feeling more tired than usual and lacking energy (fatigue)
- ❖ Irritability. Losing your temper and getting annoyed easily
- ❖ Mood swings
- ❖ Anxiety or depression
- ❖ Mild behavioural change
- ❖ More sensitive to sounds or lights
- ❖ Change in sleep patterns. Trouble sleeping or sleeping too much
- ❖ Reduced tolerance to alcohol

Local service information

References

1. Newcombe R, Merry G. The management of acute neurotrauma in rural and remote locations: A set of guidelines for the care of head and spinal injuries. *J Clin Neuro* 1999;6(1):85-93.
2. NSW Institute of Trauma and Injury Management. NSW Trauma Registry Profile of Serious to Critical Injuries: 2007. NSW Health; 2010.
3. Khan F, Baguley IJ, Cameron ID, Khan F, Baguley IJ, Cameron ID. 4: Rehabilitation after traumatic brain injury. *MJA* 2003;178(6):290-5.
4. Fortune N. The definition, incidence and prevalence of acquired brain injury in Australia. Australian Institute of Health and Welfare; 2009.
5. Tate R, McDonald S, Lulham J. Incidence of hospital-treated traumatic brain injury in an Australian community. *ANZ J Pub Health* 1998;22(4):419.
6. Servadei F, Teasdale G, Merry G, Neurotraumatology Committee of the World Federation of Neurosurgical S. Defining acute mild head injury in adults: a proposal based on prognostic factors, diagnosis, and management. *J Neurotrauma* 2001;18(7):657-64.
7. Bellner J, Ingebrigtsen T, Romner B. Survey of the management of patients with minor head injuries in hospitals in Sweden. *Acta Neurol Scand* 1999;100(6):355-9.
8. Cushman J, Agarwal N, Fabian T, Garcia V, Nagy K, Pasquale M, et al. Practice management guidelines for the management of mild traumatic brain injury: the EAST practice management guidelines work group. *J Trauma* 2001;51(5):1016-26.
9. Jagoda AS, Bazarian JJ, Bruns JJ, Jr., Cantrill SV, Gean AD, Howard PK, et al. Clinical policy: neuroimaging and decisionmaking in adult mild traumatic brain injury in the acute setting. *Ann Emerg Med* 2008;52(6):714-48.
10. Vos PE, Battistin L, Birbamer G, Gerstenbrand F, Potapov A, Prevec T, et al. EFNS guideline on mild traumatic brain injury: report of an EFNS task force. *Eur J Neurology* 2002;9(3):207-19.
11. Dickinson K, Bunn F, Wentz R, Edwards P, Roberts I. Size and quality of randomised controlled trials in head injury: review of published studies. *BMJ*. 2000;320(7245):1308-11.
12. Klauber M, Marshall L, Luerssen T, Frankowski R, Tabaddor K, Eisenberg H. Determinants of Head Injury Mortality: Importance of the Low Risk Patient. *Neurosurgery* 1989;24(1):31-6.
13. Mower W, Hoffman J, Herbert M, Wolfson A, Pollack C, Zucker M, et al. Developing a clinical decision instrument to rule out intracranial injuries in patients with minor head trauma: methodology of the NEXUS II investigation. *Ann Emerg Med* 2002;40(5):505-14.
14. Narayan R, Michel ME, Ansell B, Baethmann A, Biegon A, Bracken MB, et al. Clinical trials in head injury. *J Neurotrauma* 2002;19(5):503-57.
15. Brain Trauma Foundation, American Association of Neurological Surgeons, Congress of Neurological Surgeons, Joint Section on Neurotrauma and Critical Care. Guidelines for the Management of Severe Traumatic Brain Injury *J Neurotrauma* 2007;24(S1):1-106.
16. Alderson P, Roberts I. Corticosteroids for acute traumatic brain injury. *Cochrane Database of Systematic Reviews* 2005(1).

17. Arango MF, Bainbridge D. Magnesium for acute traumatic brain injury. *Cochrane Database of Systematic Reviews* 2008(4).
18. Bennett MH, Trytko B, Jonker B. Hyperbaric oxygen therapy for the adjunctive treatment of traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2004(4).
19. Fleming S, Greenwood R, Oliver D. Pharmacological management for agitation and aggression in people with acquired brain injury. *Cochrane Database of Systematic Reviews* 2006(4).
20. Forsyth R, Wolny S, Rodrigues B. Routine intracranial pressure monitoring in acute coma. *Cochrane Database of Systematic Reviews*. 2010(2).
21. Ker K, Blackhall K. Bradykinin beta-2 receptor antagonists for acute traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2008(1).
22. Langham J, Goldfrad C, Teasdale G, Shaw D, Rowan K. Calcium channel blockers for acute traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2003(4).
23. Roberts I. Aminosteroids for acute traumatic brain injury. *Cochrane Database of Systematic Reviews*. 1999(3).
24. Roberts I, Schierhout G. Hyperventilation therapy for acute traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2009(3).
25. Roberts I, Sydenham E. Barbiturates for acute traumatic brain injury. *Cochrane Database of Systematic Reviews*. 1999(3).
26. Sahuquillo J, Arikan F. Decompressive craniectomy for the treatment of refractory high intracranial pressure in traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2006(1).
27. Schierhout G, Roberts I. Anti-epileptic drugs for preventing seizures following acute traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2001(4).
28. Sydenham E, Roberts I, Alderson P. Hypothermia for traumatic head injury. *Cochrane Database of Systematic Reviews*. 2009(2).
29. Wakai A, Roberts IG, Schierhout G. Mannitol for acute traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2007(1).
30. Willis C, Lybrand S, Bellamy N. Excitatory amino acid inhibitors for traumatic brain injury. *Cochrane Database of Systematic Reviews*. 2003(1).
31. Fabbri A, Servadei F, Marchesini G, Morselli-Labate A, Dente M, Iervese T, et al. Prospective validation of a proposal for diagnosis and management of patients attending the emergency department for mild head injury. *J Neurol Neurosurg Psychiatry* 2004;75(3):410-6.
32. Haydel M, Preston C, Mills T, Luber S, Blaudeau E, DeBlieux P. Indications for computed tomography in patients with minor head injury. *NEJM* 2000;343(2):100-5.
33. Ibanez J, Arikan F, Pedraza S, Sanchez E, Poca MA, Rodriguez D, et al. Reliability of clinical guidelines in the detection of patients at risk following mild head injury: results of a prospective study. *J Neurosurgery* 2004;100(5):825-34.
34. Palchak MJ, Holmes JF, Vance CW, Gelber RE, Schauer BA, Harrison MJ, et al. A decision rule for identifying children at low risk for brain injuries after blunt head trauma. *Ann Emerg Med* 2003;42(4):492-506.
35. Stiell IG, Wells GA, Vandemheen K, Clement C, Lesiuk H, Laupacis A, et al. The Canadian CT Head Rule for patients with minor head injury. *Lancet* 2001;357(9266):1391-6.
36. Dunham C, Coates S, Cooper C. Compelling evidence for discretionary brain computed tomographic imaging in those patients with mild cognitive impairment after blunt trauma. *J Trauma* 1996;41(4):679-86.

37. Stiell IG, Wells GA, Vandemheen K, Laupacis A, Brison R, Eisenhauer MA, et al. Variation in ED Use of Computed Tomography for Patients With Minor Head Injury. *Ann Emerg Med* 1997;30:14-22.
38. Bulger E, Nathens A, Rivara F, Moore M, MacKenzie E, Jurkovich G, et al. Management of severe head injury: institutional variations in care and effect on outcome. *Crit Care Med* 2002;30(8):1870-6.
39. Af Geijerstam J, Britton M. Mild head injury: reliability of early computed tomographic findings in triage for admission. *Emerg Med J* 2005;22(2):103-7.
40. American College of Surgeons Committee on Trauma. *Advanced Trauma Life Support for Doctors*. 8th ed 2007.
41. Fabbri A, Servadei F, Marchesini G, Stein S, Vandelli A. Observational approach to subjects with mild-to-moderate head injury and initial non-neurosurgical lesions. *J Neurol Neurosurg Psychiatry* 2008;79(10):1180-5.
42. Myburgh JA, Cooper DJ, Finfer SR, Venkatesh B, Jones D, Higgins A, et al. Epidemiology and 12-month outcomes from traumatic brain injury in australia and new zealand. *J Trauma* 2008;64(4):854-62.
43. Styrke J, Stalnacke B-M, Sojka P, Bjornstig U. Traumatic Brain Injuries in a Well-Defined Population: Epidemiological Aspects and Severity. *J Neurotrauma*. 2007;24(9):1425-36.
44. National Health & Medical Research Council. NHMRC levels of evidence and grades for recommendations for developers of guidelines. 2009: Available from: www.nhmrc.gov.au/_files_nhmrc/file/guidelines/evidence_statement_form.pdf.
45. National Health & Medical Research Council. *A guide to the development, implementation and evaluation of clinical practice guidelines*. Canberra ACT. NHMRC; 1999.

