

Queensland  
Trauma Education

**TRAUMATIC BRAIN INJURY**

# Management of closed head injury

## Case discussion

Facilitator resource kit

**CSDS**



Clinical Skills Development Service

Metro North  
Health



Queensland  
Government

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## Queensland Trauma Education

The resources developed for Queensland Trauma Education are designed for use in any Queensland Health facility that cares for patients who have been injured as a result of trauma. Each resource can be modified by the facilitator and scaled to the learners needs as well as the environment in which the education is being delivered, from tertiary to rural and remote facilities.

## National Safety and Quality Health Service (NSQHS) Standards



## About this training resource kit

This resource kit provides healthcare workers with the knowledge on how to effectively assess and manage a closed head injury following a traumatic incident.

### Target audience

Emergency department medical and nursing clinicians.

### Duration

30 minutes.

### Group size

Small or large groups.

### Learning objectives

By the end of this session the participant will be able to:

- Demonstrate an understanding of the medical and surgical management of mild/moderate/severe traumatic brain injury (TBI).
- Describe the differing patient disposition and features of patients with mild/moderate/severe TBI.
- Describe the appropriate follow up of mild/moderate/severe TBI.

### Facilitator guide

1. Facilitator to divide group into 3 and provide vignette to each group – mild/moderate/severe.
2. Facilitator to use cases and questions to lead discussion around assessment and management.
3. Facilitator to refer to supporting documents and incorporate into case discussion to support clinical decisions around management.

## **Participant resource kit**

- Learning objectives.
- Overview of traumatic brain injury.
- Further reading.

# Overview of traumatic brain injury

A traumatic brain injury (TBI) is an injury caused to the brain by an external force and accounts for 50% of trauma deaths and 70% of all road accident deaths.<sup>1</sup>

TBI is classified based on severity: mild, moderate and severe.

## Further reading

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Cooper, D. J., Rosenfeld, J. V., Murray, L., Arabi, Y. M., Davies, A. R., D'Urso, P., Kossman, T., Ponsford, J., Seppelt, I., Reilly, P., Wolfe, R., DECRA Trial Investigators, & Australian and New Zealand Intensive Care Society Clinical Trials Group (2011). Decompressive craniectomy in diffuse traumatic brain injury. *The New England journal of medicine*, 364(16), 1493–1502. <https://www.nejm.org/doi/full/10.1056/NEJMoa1102077>

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Abbreviated Westmead Post Traumatic Amnesia Scale (A-WPTAS)  
[https://www.ourphn.org.au/wp-content/uploads/2017/03/A\\_WPTAS-scale-for-Head-injury.pdf](https://www.ourphn.org.au/wp-content/uploads/2017/03/A_WPTAS-scale-for-Head-injury.pdf)

# Case discussion

## Case study

1. 17 yo M brought into the emergency department following a head knock at rugby training. He was witnessed to be briefly unconscious, with no seizure activity and orientated on review by the Rugby team medical officer within 5 minutes of injury. On review in the emergency department he is complaining of a mild headache, no visual changes and has no neurological deficits.

2. 32 yo F is brought into the emergency department after being involved in an alleged assault with another person. She was hit once to the back of the head and pushed to the ground. On arrival of the ambulance she was confused, agitated, moving limbs on command, pupils 3mm and reactive bilaterally. In the emergency department 1 hour post injury she remains confused to date, year and place. She opens her eyes to pain and is obeying commands.

3. 72 yo M is brought into the emergency department from his home after a trip and fall on the wet footpath whilst taking the rubbish bins out. He was found by neighbours after an unknown time on the ground. On arrival to the emergency department he is withdrawing to pain in the R UL and extending to painful stimuli on the L UL. There is no verbal response and no eye response to painful stimuli. Both pupils are 5mm and sluggishly reactive.



## Question and answer guide

### 1. What constitutes mild/moderate/severe TBI?

GCS score and localising neurological signs including: pupillary abnormalities, focal neurological deficits, lateralising weakness.

Mild	Moderate	Severe
<ul style="list-style-type: none"> <li>• <b>GCS:</b> 13-15</li> <li>• <b>Loss/alteration of consciousness:</b> &lt; 30min</li> <li>• <b>Amnesia:</b> &lt; 24hrs</li> <li>• <b>Imaging:</b> negative</li> </ul>	<ul style="list-style-type: none"> <li>• <b>GCS:</b> 9-12</li> <li>• <b>Loss/alteration of consciousness:</b> &gt; 30min, &lt; 24hrs</li> <li>• <b>Amnesia:</b> &gt; 24hrs, &lt; 7days</li> <li>• <b>Imaging:</b> transient changes</li> </ul>	<ul style="list-style-type: none"> <li>• <b>GCS:</b> &lt; 8</li> <li>• <b>Loss/alteration of consciousness:</b> &gt; 24hrs</li> <li>• <b>Amnesia:</b> 7 days</li> <li>• <b>Imaging:</b> positive, lasting abnormalities</li> </ul>

### 2. How would you initially categorise the severity of head injury in the above cases and what is your rationale?

1. GCS 15 - Mild head injury. Will require ongoing GCS assessment to accurately classify head injury.
2. GCS 13 - Mild head injury. Serial GCS assessment to monitor for deterioration.
3. GCS 5 - Severe head injury. Will require early treatment and neuroprotective management.

### 3. In mild TBI what additional assessment can aid severity classification?

- a. An Abbreviated Westmead Post Traumatic Amnesia Scale (A-WPTAS) - see supporting document.
- b. How to use A-WPTAS - see supporting document.
- c. A-WPTAS is an outpatient assessment tool and differs from the inpatient tool BRISC and 3 day PTA assessment.

### 4. What is a neuroprotective medical management strategy?

Strategy	Rationale	Management
<b>Intubation and oxygenation</b>	Avoid: <ul style="list-style-type: none"> <li>• Aspiration.</li> <li>• Secondary brain injury from hypoxaemia.</li> </ul>	<ul style="list-style-type: none"> <li>• Early RSI performed by most experienced operator.</li> <li>• Ketamine to avoid hypotension and cerebral hypoperfusion.</li> <li>• Initial FiO2 1.0 and titrate to maintain Sats &gt; 95% (avoid hyperoxia for prolonged periods).</li> </ul>
<b>Ventilation</b>	Avoid: <ul style="list-style-type: none"> <li>• Hypo and hypercarbia to reduce risk of cerebral vasoconstriction (ischaemia) and vasodilation (hyperaemia of damaged brain tissue).</li> </ul>	<ul style="list-style-type: none"> <li>• Early use of ETCO2 until invasive arterial access obtained for PaCO2 – target 35-40mmHg <ol style="list-style-type: none"> <li>a. Aggressive hyperventilation with hypocapnia is only used as a rescue strategy i.e. patient coning, needing definitive surgical care.</li> </ol> </li> </ul>

<b>Haemodynamic management</b>	<ul style="list-style-type: none"> <li>Maintain adequate cerebral perfusion pressure (CPP). CPP=MAP-ICP.</li> </ul>	<ul style="list-style-type: none"> <li>Fluid bolus (may opt for hypertonic saline if haemodynamic instability), blood/blood products, vasopressors for MAP &gt; 80mmHg (avoid if non-compressible bleeding likely) until ICP monitoring insitu then aim for CPP 50-60mmHg.</li> </ul>
<b>Sedation and paralysis</b>	<ul style="list-style-type: none"> <li>Optimise ventilation and oxygenation.</li> <li>Optimise cerebral metabolic rate (CRMO<sub>2</sub>), cerebral blood flow (CBF).</li> <li>Reduce ICP by reducing patient movement.</li> </ul>	<ul style="list-style-type: none"> <li>Sedation and analgesia titrated to desired effect via continuous infusion (morphine/midazolam).</li> <li>Paralysis agent via initial bolus, may need continuous infusion (vecuronium/rocuronium) to follow.</li> </ul>
<b>Osmotherapy</b>	<ul style="list-style-type: none"> <li>Osmotic agent: gradient created to remove water from normal brain tissue therefore reducing ICP.</li> </ul>	<ul style="list-style-type: none"> <li>Intravenous Mannitol 1g/kg <b>or</b> 5ml/kg of 3% hypertonic saline. See MNHHS RBWH Medication protocol: 000263 Hypertonic Saline (sodium chloride 3%), Traumatic Brain Injury <a href="http://hi.bns.health.qld.gov.au/RBH/policies/000263.pdf">http://hi.bns.health.qld.gov.au/RBH/policies/000263.pdf</a> NB. Mannitol may cause hypotension as it acts as osmotic diuretic.</li> </ul>
<b>Patient positioning</b>	<ul style="list-style-type: none"> <li>Head up 30 degrees to reduce ICP by augmenting venous outflow.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure patient alignment (neutral head position) and spinal immobilisation is maintained and tilt whole bed 30 degrees.</li> <li>Loose ETT ties or opt for other methods of securing ETT.</li> <li>Ensure soft cervical collars are loosened to avoid compressing jugular veins.</li> </ul>

## 5. What additional TBI management should be considered?

- Glucose:** Strict glucose monitoring to maintain normal range to avoid hypoglycaemia as may worsen brain injury.
- Corticosteroids:** Not recommended in TBI as associated with increased mortality rate.
- Anticonvulsants:** Optimise seizure prevention to reduce risk of further brain injury. Use of phenytoin or levetiracetam for 7 days – no evidence of benefit (severe TBI at risk of seizures are typically on midazolam/propofol infusions).
- Temperature control:**
  - Hypothermia - patients > 45years do worse with hypothermia.
  - > 45years aim for normothermia.
  - Hyperthermia - increases neuronal cell death when temp > 39 degrees.
  - If temp > 39 degrees, cool the patient until normothermic.
- Erythropoietin (EPO):** No effect from Hb > 100mg/dL in neurological outcomes, ongoing trials (EPO-TBI) for prevention of secondary injury.
- Barbiturate coma:** Decreases cerebral metabolic rate. However, can cause hypotension and has long half-life.



- **Deep vein thrombosis (DVT) prophylaxis:** Chemical can usually be instituted day 2-3 post injury (discuss with neurosurgeons).
- **Nutrition:** Feed early as high metabolic demand.

### **Surgical - Moderate/Severe TBI**

- a. **Burr hole** - 'Management of the rapidly deteriorating TBI patient' outlines the burr hole procedure including the flowchart for management and escalation. (<https://trauma.reach.vic.gov.au/guidelines/traumatic-brain-injury/the-rapidly-deteriorating-tbi-patient>)
- b. **Craniotomy.**
- c. **Decompressive Craniotomy (DECRA)** - In adults with severe diffuse traumatic brain injury and refractory intracranial hypertension, early bifrontotemporoparietal decompressive craniectomy decreased intracranial pressure and the length of stay in the ICU but was associated with more unfavorable outcomes. (Decompressive Craniectomy in Diffuse Traumatic Brain Injury April 21, 2011, N Engl J Med 2011; 364:1493-1502 DOI: 10.1056/NEJMoa1102077. <https://www.nejm.org/doi/full/10.1056/NEJMoa1102077>)

### **Medical - ongoing assessment**

- a. Appropriate discharge advice and information.
- b. Outpatient followup if required.

## Supporting documents

The following supporting documents are provided for this case discussion:

1. Abbreviated Westmead PTA Scale (A-WPTAS) incorporating Glasgow Coma Scale (GCS).
2. How to use the Abbreviated Westmead Post Traumatic Amnesia Scale (A-WPTAS).

# 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	
	Withdraws	4	4	4	4	4	
	Abnormal flexion	3	3	3	3	3	
	Extension	2	2	2	2	2	
	None	1	1	1	1	1	
Eye Opening	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"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Why are you here	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Month	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Year	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<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 Picture 2 Picture 3	Show pictures (see over)					
A-WPTAS	Score out of 18	/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

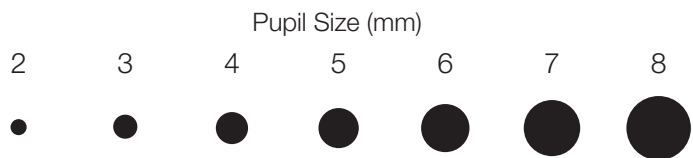


\*\* must have all 5 orientation questions correct to score 5 on verbal score for GCS, otherwise the score is 4 (or less).

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

### Comments

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## 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?'

**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

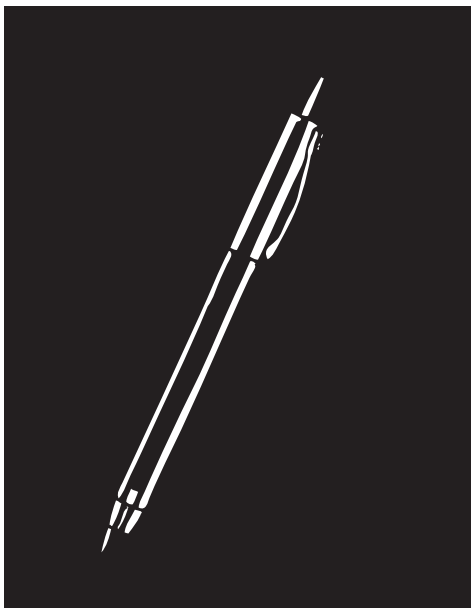
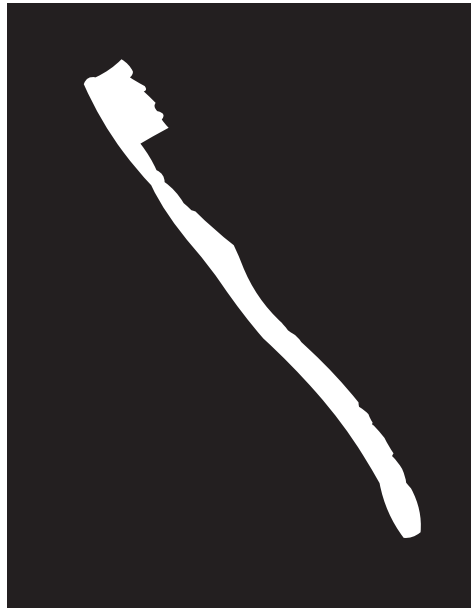
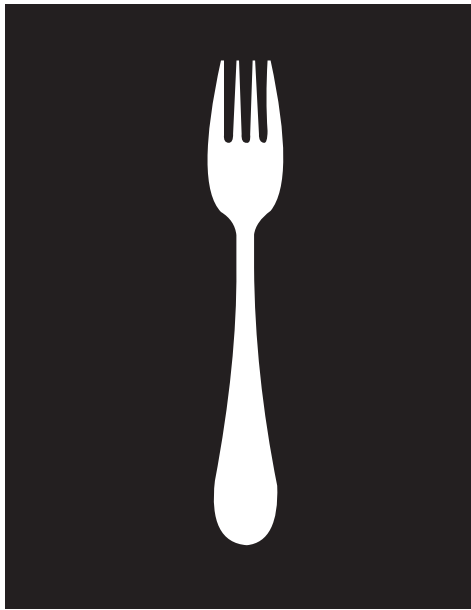
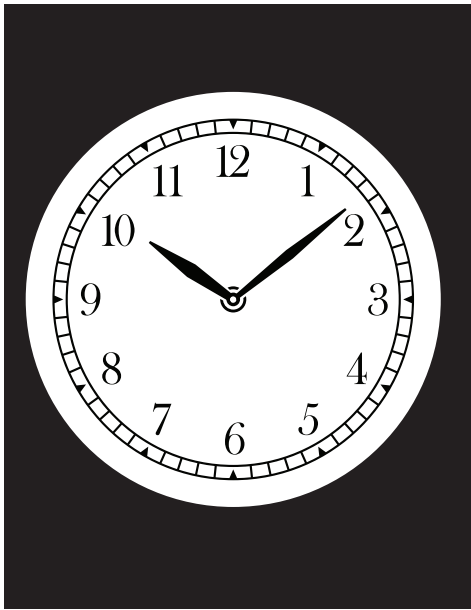
Straight after administering the GCS (standardised questions), administer the A-WPTAS by presenting the 3 Westmead PTA cards. Picture Cards the first time - T1 : Show patients the target set of picture cards for about 5 seconds and ensure that they can repeat the names of each card. Tell the patient 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



## How to use the Abbreviated Westmead Post Traumatic Amnesia Scale (A-WPTAS)

1. Perform a GCS (paying particular attention to verbal score ensuring patient is orientated).
2. Score GCS —/15.
3. Show patient the 3 picture cards and ask them to repeat the items ie. cup, key, bird.
4. State that they will be asked to recall the 3 objects in 1 hour.
5. Repeat GCS with verbal orientation questions at 1 hour from initial assessment and ask for 3 object recall.
6. If the patient scores 15/15 AND remembers the 3 objects (cup, key, bird) they are cleared of ongoing amnesia.
7. This is documented on the A-WPTAS as a total score of 18/18.
8. If the patient does not have a GCS of 15/15 or does not remember the 3 picture cards to bring their total score to 18/18, they are shown the cards again and the process is again repeated at 1 hour.
9. If the patient repeatedly scores < 18/18 for > 4 hours, they should be allowed to rest before the assessment is commenced again, i.e., let the patient sleep and recommence later in the day.



## Acronyms and abbreviations

<b>A-WPTAS</b>	Abbreviated Westmead Post Traumatic Amnesia Scale
<b>GCS</b>	Glasgow Coma Scale
<b>CPP</b>	cerebral perfusion pressure
<b>ICP</b>	intracranial pressure
<b>MAP</b>	mean arterial pressure
<b>FiO2</b>	fraction of inspired oxygen
<b>ETCO2</b>	end tidal carbon dioxide
<b>PaCO2</b>	partial pressure of carbon dioxide
<b>RSI</b>	rapid sequence induction
<b>CRMO2</b>	cerebral metabolic rate
<b>CBF</b>	cerebral blood flow

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