Guideline: Assessment & Management of Adult Patients with Moderate Traumatic Brain Injury

Background/ Overview

This guideline describes a clinical pathway that outlines a multidisciplinary approach to the assessment and management of moderate traumatic brain injury (TBI).

TBI is usually considered to be mild, moderate or severe based on GCS. Moderate TBI is usually described in the literature as either GCS 9-12 or 9-13.[1-3]

For the purposes of this guideline, **'Patients ≥15 years with a moderate TBI'** includes:

- **GCS 9-13** (for at least 30 minutes)
  and/or
- **Positive finding on CT head**
  and/or
- **Protracted post-traumatic amnesia >3 days** (i.e. failing Westmead Post-traumatic amnesia assessment at Day 3)

Patients with mild and moderate TBI can experience a protracted recovery to their normal level or function. Good early management of patients with moderate TBI may reduce length of stay in hospital, allow early identification of patients who may require more active rehabilitation, improve time to full recovery, reduce symptoms and improve overall outcomes for these patients.

Despite this, there is limited published literature worldwide on this subgroup of TBI patients[1], with most research focussing either on mild or severe TBI.

As hospitals without neurosurgical services, Middlemore, North Shore and Whāngarei Hospitals rely on phone consultations with the neurosurgical service at Auckland City Hospital to guide the medical management of this group of patients. This guideline has been developed by a multidisciplinary team, with the aid and approval of the neurosurgical service at Auckland City Hospital, to help facilitate consistent management in all aspects of management.

Purpose

This guideline outlines the multidisciplinary (medical, nursing, occupational therapy and physiotherapy) aspects of evaluation and management of patients with acute moderate traumatic brain injury. The aim of this guideline is to improve clinical consistency and patient care.

Scope of Use

This guideline is applicable to patients ≥15 years with moderate traumatic brain injuries (defined as):

- **GCS 9-13** (for at least 30 minutes)
  and/or
- **Positive finding on CT head**
  and/or
- **Protracted post-traumatic amnesia >3 days** (i.e. failing Westmead Post-traumatic amnesia assessment at Day 3)

Roles and Responsibilities

This guideline may be used by any member of the clinical team involved in the care of a patient with moderate traumatic brain injury, as defined above.

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1. Cognitive screening and assessments
2. Nursing management and patient environment
3. Medical management
4. Admitting responsibilities and inpatient disposition
5. Discharge disposition
6. Outpatient follow up and supports

Appendix: Cognitive screening tools

- Abbreviated Westmead
- Full Westmead Post-Traumatic Amnesia Assessment
- Rivermead Symptom Questionnaire
- *ACE-III (or alternative TBC)*
- *Rancho Los Amigos (for reduced level of consciousness)*
- *Wessex Head Injury Matrix (for minimally conscious)*

Appendix: Occupational therapy guide (for use by OTs)

Appendix: Physiotherapy TBI Guideline (for use by PTs)

Appendix: Grouped cares timetable template

Appendix: TBI toolkit poster (ACC)

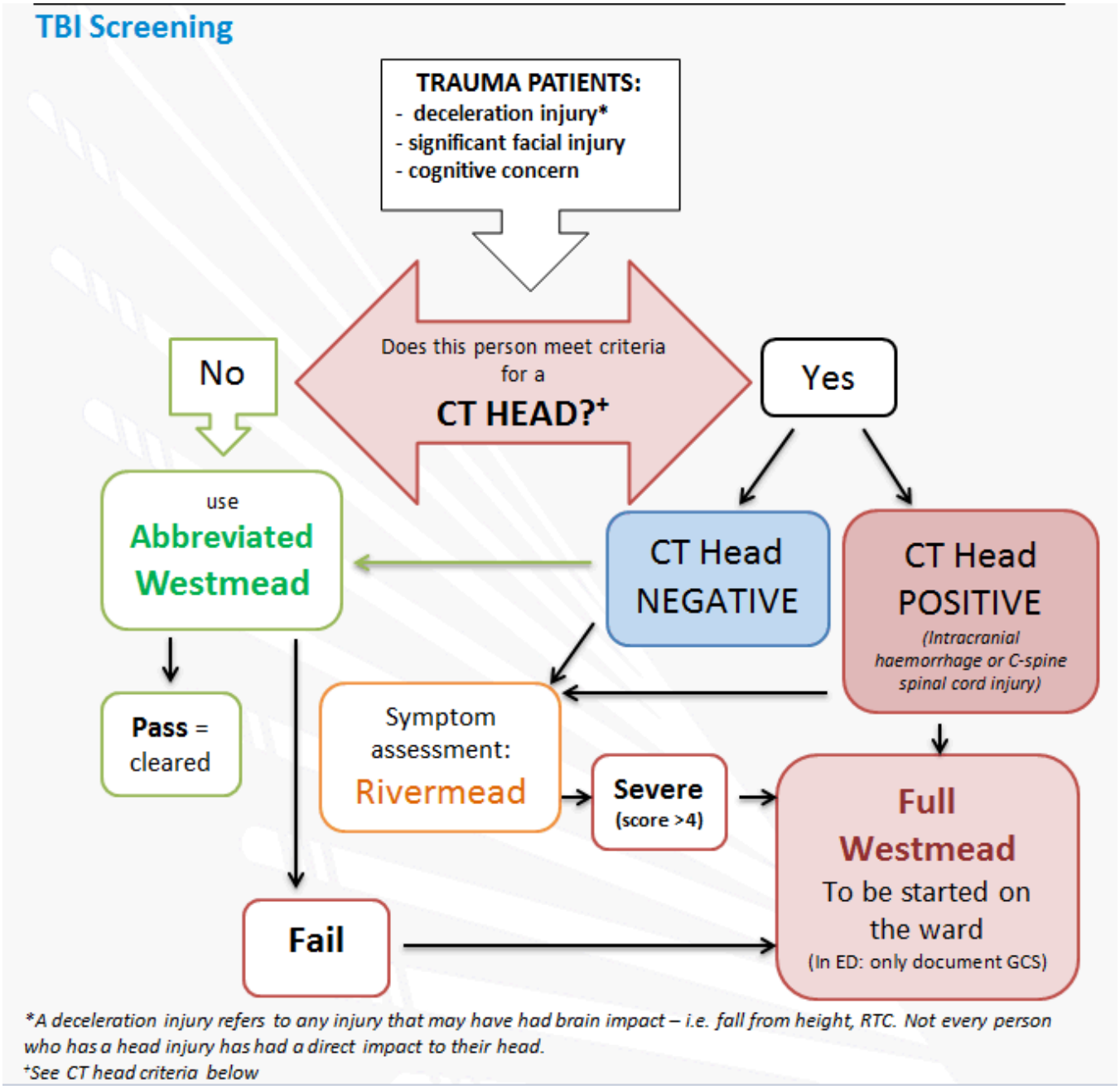
Appendix: Recovery advice

Appendix: List of Concussion Clinic providers

Guideline

There are several facets to the multidisciplinary care of patients with moderate traumatic brain injuries. The following sections of this guideline should be viewed as a whole document and all those involved in the care of these patients should familiarise themselves with the whole document, rather than as individual sections.

1. Cognitive Screening & Assessments – see appendix for summary



Step	Action
Patient selection criteria for concussion screening	*Every adult patient (≥15 years) who meets the below criteria should receive concussion screening:* - Mechanism of injury (deceleration injury – i.e. injury that may have resulted in brain impact, such as fall from height, RTC). - Significant facial injury - Cognitive concern ○ Retrograde amnesia (inability to recall events prior to injury) ○ Significant symptoms suggestive of concussion (including severe headache, fatigue, vision or balance disturbance, nausea/vomiting) ○ Loss of consciousness (although only 10% of patients with concussion have lost consciousness)
CT head	*All patients with moderate to severe head injuries, as defined by GCS ≤13 will require a CT head.* Otherwise, the decision to perform a CT should be based on the Canadian CT head rules: **CANADIAN CT HEAD RULE** A CT head should be performed on a head injured patient with a history of loss of consciousness, definite amnesia or witnessed disorientation if there are any the following: HIGH RISK FEATURES • age ≥ 65 • GCS not 15/15 at 2 hours post injury • Signs of base of skull fracture • Suspected open or depressed skull fracture • Vomiting ≥ 2 times MODERATE RISK FEATURES • amnesia before impact ≥ 30 minutes • dangerous mechanism • pedestrian struck by vehicle, ejection from vehicle, fall from height >1 metre or >5 stairs *Note – the following patients are excluded from the above rules and should receive an urgent CT head regardless:* - have a GCS <13 - are anticoagulated (*it is strongly recommended to perform CT head even if a seemingly minor HI*) - had a post traumatic seizure - have focal neurological deficits

Screening tools (see appendices for tools)	***Abbreviated Westmead*** - Screening tool validated to rule out post-traumatic amnesia - Every patient who meets the selection criteria for concussion screening above should at least receive an Abbreviated Westmead screen - Can be completed by any team member (nursing/medical/allied health) - *If waiting for a CT head – Do not start cognitive screening* ○ *If the CT head is positive, then the Abbreviated Westmead is an inappropriate tool to use* ○ *If a patient with a positive head CT passes an Abbreviated Westmead, this can falsely reassure the clinical team* ○ *If a patient is started on an Abbreviated Westmead and transferred to a Full Westmead following a positive CT finding, this can lead to confusion for the patient, due to differing pictures in the tests* ○ *Continue neuro observations in the meantime* ***Full Westmead Post-Traumatic Amnesia (PTA) Test*** - Evaluates the severity of post-traumatic amnesia - Can be started by anyone (nursing/allied health) - Usually OT is involved ***Rivermead Post-Concussion Symptom Questionnaire*** - Subjective self-reported symptom assessment
Appropriate screening tool selection	*Abbreviated Westmead* - CT head negative for intracranial haemorrhage *Full Westmead* - CT head positive for intracranial haemorrhage - Spinal cord injury - Failed Abbreviated Westmead screening - Severe symptoms of concussion (Rivermead score >48 or clinical concern) *Rivermead Post-Concussion Symptom Questionnaire* - **Every patient** who meets criteria for concussion screening *Balance & Falls Assessment* - Patients experiencing symptoms/signs of dizziness, poor coordination or gait disturbance should be identified by medical/nursing staff and referred to PT for assessment - Basic PT assessment (balance, coordination, gait, strength, ROM) - Timing: on the day of referral and prior to discharge - (See PT TBI Assessment & Management Guideline (Appendix))

Location	*Abbreviated Westmead* - Can be completed anywhere (ED & Ward) *Full Westmead* - Usually started when patient reaches the ward; unless bed blocked, in which case it should be started in ED - Started once patient is transferred out of ICU/HDU
Timing	In ED: - Patients who meet criteria should receive concussion screening (including Rivermead assessment) ***within 6 hours*** of presentation On the wards: - Patients who meet criteria for Full Westmead should have this commenced ***within 12 hours*** of admission to the ward - *OR* within 24 hours following a planned trip to the operating theatre, in the setting of significant concurrent injuries - Rivermead should be done as soon as is practical, if not already completed in ED
	Contraindications to testing: - *Baseline reduced cognitive function (e.g. dementia, previous TBI with residual functional deficits)* ○ *Assess with ACE-III* - *Active delirium* - *Sedation* *Relative contraindications that may affect timing of commencement of testing:* - *Conditions that may alter neurological state* ○ *EtOH, illicit drug toxicity, high opiate use, sedation, sleep deprivation, post-surgical anaesthetic recovery*

2. Admitting Responsibilities & Inpatient Disposition

Step	Action
	All patients with Moderate TBI should be admitted for inpatient management.
Admitting service	Patients with moderate TBI will be admitted under **General Surgery**, unless: - Concurrent SCI
Ward location	Preference for a General Surgical ward Single room (for low stimulation management)
Early Critical Care	Patients meeting the following criteria should be referred to Critical

Review	Care for early review or management advice: Clinical deterioration: **Call 777 (surgical emergency)** - Reduction in GCS ≥2 - Localising signs - Progressive pupillary dilatation Increased risk of deterioration: - Anti-coagulation or coagulopathy - Confounders to neurological assessment (e.g. alcohol, drugs, delirium, agitation) - Progression of CT head abnormalities Minimisation of secondary injury: - Haemodynamic instability (systolic BP <100 mmHg) - Hypoxia (FiO_2 >0.3 and O_2 sats <93%) - Serum glucose abnormalities - Serum Na abnormalities (≤135) High risk CT: - Consult with Critical Care for support while awaiting transfer, as required - *Mass effect (basal cistern compression or midline shift), sulcal effacement, or herniation* - *Substantial epidural or subdural hematoma (>1 cm in width, or causing mass effect)* - *Extensive subarachnoid hemorrhage, posterior fossa, intraventricular or bilateral hemorrhage* - *Depressed or diastatic skull fracture* - *Pneumocephalus* - *Cerebral edema*

3. Patient Environment

Step	Action
Single Room	Patients should be managed in a single room to allow for reduced noise pollution, wherever possible.
Low Stimulus Environment	A sign should be placed on the door to alert all entering that they are entering a 'low stimulus environment.' Consists of: - Limit screen time (initially 3 x 20 mins maximum/24 hours) - Door shut - Limited light - No music

	- Limited visitors *(should respect timetabled rest periods, as outlined below)* -

4. Nursing & Allied Health Care

Step	Action
Head Up 30°	Increases venous return, so decreases intracerebral and facial swelling.
Grouped cares	Nursing and allied health should aim to group cares together, so that the 'Low Stimulus Environment' is disturbed as little as possible. This may mean timing medications and other essential cares around other activities, such as mealtimes and Physiotherapy & Occupational Therapy sessions. Timetabled rest periods should be respected wherever possible.
Timetable *(see appendices for template example)*	Should outline periods of rest and activity. Aim to have *no disruptions* during planned rest periods. Outline: - Physiotherapy & Occupational Therapy reviews - Mealtimes - Screen-time - Visitor times Displayed: - On the door - In the patient notes - Patient copy - Whānau copy
Orientation Board	An orientation board should be visible in the room. Information should be updated regularly and should include: - Day/Month/Year - Ward location - Named nurse

5. Medical Management

Step	Action
Neurosurgery	**Ph: 021782472** (on call neurosurgical registrar)**.** Early neurosurgical consult if abnormality detected on CT head. Patients with severe TBI (GCS ≤8) should be transferred to ACH for ongoing management. Transfer should be arranged via: **0800 4 TRAUMA.**
Acute deterioration	**Call 777** (surgical emergency) Urgent repeat CT head - Reduction in GCS ≥2 - Localising signs - Progressing pupillary dilatation
Radiology	Urgent CT head required as outlined above. Repeat CT routinely: - When advised to by neurosurgery - Repeat at between 6-24 hours if initially abnormal (i.e. any intracranial haemorrhage) or not clinically improving.
Prevent secondary brain injury	***Prevent hypoxia*** – aim O_2 sats >90% ***Prevent hypotension*** – aim systolic BP >90 mmHg ***Prevent excessive hypertension*** - aim <160 mmHg - If a patient has a baseline hypertensive state, they may be better managed at a higher BP to maintain adequate brain perfusion. Take care not to over-treat hypertension in these patients.
Serum Na^+	Aim ≥140 Test daily, unless abnormal. If abnormal, test twice daily until normalised.
Serum Glucose	Aim 7.8-10.0 mmol/L
Medications	***Analgesia*** - Tramadol should be avoided ○ Lowers seizure threshold ○ Worsens symptoms ○ Similar Side Effect profile to symptoms of concussion - Avoid NSAID in acute phase (first 24 hours) ○ Antiplatelet effect

	- Use Opiates IV (to gain initial comfort) ○ Small frequent doses ***Antiemetic*** - Use Cyclizine preferentially ○ H1-receptor blocker with vestibular action, which is useful in TBI-related nausea/dizziness ○ Oral administration is preferred where possible - Avoid Scopoderm patches ○ Can cause unilateral pupillary dilatation ***Anticoagulation*** - Should be stopped and reversed with any intra-cranial haemorrhage - *Ideally, should not be restarted* - If decision is to restart, discuss with neurosurgery regarding most appropriate timing. ***Anticonvulsants*** Usually not required, unless specified by Neurosurgery
Special considerations	 ***Alcohol &/or Substance Abuse*** Extreme caution should be used when prescribing benzodiazepines in line with the Alcohol Withdrawal Management Guideline, in the setting of TBI. - Many of the criteria to score in the Alcohol Withdrawal Management Guideline are also symptoms of TBI, so care needs to be taken to avoid over-administration of benzodiazepines. ***Elderly (>65 years)*** - May present with higher GCS or delayed symptomatology, due to increased intracranial space - Increased frailty - More severe fatigue; may need adjusted timetable *Consider acute review by inpatient geriatrician to optimise medical management and aspects of early rehabilitation*
Psychological Medicine	Consider referral Psychological Medicine
Older Peoples Health	Referral to Orthopaedic or Trauma Geriatricians for a focused assessment
Cultural Support	Referral to appropriate cultural service for support during their health journey and recovery

Community Alcohol and Drug Services	Consider referral to Community Alcohol and Drug Services

6. Inpatient Rehabilitation

Step	Action
Funding	- Provided by ACC - ***ACC early cover*** must be completed prior to discharge, for any patient requiring inpatient services. Failure to do so is very likely to result in a significant delay to treatment.
Acute Brain Injury (ABI) Rehabilitation	Review/admitting criteria: - Protracted post-traumatic amnesia ○ i.e. failing Full Westmead PTA assessment - ≥15 years old age *Will take patients with multi-trauma injuries, including non-weightbearing and those requiring physical rehabilitation alongside brain rehabilitation.* *Able to take patients >65 years, if from a high functional baseline (i.e. living independently prior to injury) and showing rehabilitation potential.*
AT&R	For patients >65 years who don't meet criteria for ABI admission or decline to go to ABI, but still have some general rehabilitation potential and are not yet ready for discharge.

7. Outpatient Rehabilitation & Follow Up

Step	Action
Funding	- Provided by ACC - Must have an accepted ACC claim prior to outpatient follow up - ***ACC early cover*** should be completed prior to discharge, for any patient requiring urgent outpatient rehabilitation services. Failure to do so is very likely to result in a significant delay to treatment.
Concussion Clinic	- Private providers - Referral using ***ACC883*** - Can be referred by medical/OT
Training for Independence	- Return to work programme - Referral by OT

References

1. Reed D. Adult trauma clinical practice guidelines: Initial management of closed head injury in adults. NSW Institute of Trauma and Injury Management. Available at: http:// www. itim. nsw. gov. au/ download. cfm. 2011.
2. Haydel MJ. Assessment of traumatic brain injury, acute. BMJ Best Practice Guideline. Available at: https://bestpractice.bmj.com/topics/en-gb/515. 2018.
3. Rajajee V. Management of acute moderate and severe traumatic brain injury. UpToDate. Available at: https://www-uptodate-com.cmdhb.idm.oclc.org/contents/management-of-acute-moderate-and-severe-traumatic-brain-injury. 2019.
4. National Institute for Health and Care Excellence. Head injury: assessment and early management. London: NICE Guideline (CG176). 2014.

Definitions/Description

Terms and abbreviations used in this document are described below:

Term/Abbreviation	Description
TBI	Traumatic Brain Injury
GCS	Glasgow Coma Scale
PTA	Post-traumatic amnesia
OT	Occupational Therapist
NSAID	Non-steroidal anti-inflammatory drug
ACC	Accident Compensation Corporation
HI	Head Injury
RTC	Road traffic crash
ACH	Auckland City Hospital
IV	Intravenous
TBI	Traumatic brain injury
CT	Computed tomography

Associated Documents

Other documents relevant to this guideline are listed below:

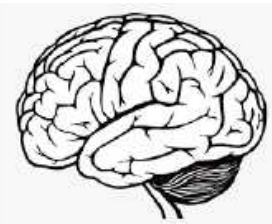
NZ Legislation & Standards	Health Practitioners Competency assurance act (2003) Health and Disability Services Act(2003) HDC Code of Health & Disability Services Consumers Rights Regulation,1996 Health and Disability Services (Safety) Act, 2001. Health & Safety in Employment Act 1992
CM Health Documents	Alcohol withdrawal management guideline Informed Consent (A5528) The Safe Management and Privacy of Health Information Policy (A5548) Tikanga Best Practice manual – Policy Procedure: Standard Precaution Standard precaution Manual
Other related documents	None

Appendix

MODERATE TBI

Important steps for diagnosis and management

Defined as: GCS 9-13 // Bleed on CT Head // Protracted Post-Traumatic Amnesia



WHO TO CALL...

0800 4 TRAUMA to arrange transfer if Severe TBI

NEUROSURGERY
021782472

Consult neurosurgery regarding any abnormality detected on CT

777

URGENT CT HEAD & CALL A SURGICAL EMERGENCY if:

- Reduction in GCS ≥2
- Localising signs
- Progressive pupillary dilatation
- Cushing Reflex#

#widened pulse pressure, bradycardia, irregular resps

SCREENING

TRAUMA PATIENTS:
- deceleration injury*
- significant craniofacial injury
- high symptom burden

Does this person meet criteria for a **CT HEAD?**+

No → use **Abbreviated Westmead** → Pass = cleared / Fail

Yes → **CT Head NEGATIVE** → use **Abbreviated Westmead**

Yes → **CT Head POSITIVE** (intracranial haemorrhage or C-spine spinal cord injury)

Symptom assessment: Rivermead → Severe (score >4) → **Full Westmead** To be started on the ward (Document GCS only in ED)

Fail → **Full Westmead** To be started on the ward (Document GCS only in ED)

**A deceleration injury refers to any injury that may have had brain impact – i.e. fall from height, RTC. Not every person who has a brain injury has had a direct impact to their head.*
+Use Canadian CT Head Rules

NURSING

QUIET ZONE

LOW STIMULUS ENVIRONMENT
- Single room
- Shut the door
- Low light
- Low noise
- Limit screen time

30° HEAD UP
GROUP CARES
PROVIDE A TIMETABLE
ORIENTATE THE PATIENT

MEDICAL

REPEAT CT HEAD in 6-24 hours
if initially abnormal or not clinically improving

PREVENT 2° BRAIN INJURY
- Aim BP 90-160 mmHg
- Aim O_2 sats >90%
- Aim Na^+ ≥140

CHECK ANTICOAGULATION—reverse if necessary
Seek guidance from Neurosurgery

OPTIMISE MEDICATIONS
Avoid Tramadol, Scopoderm patches
Avoid NSAIDs in first 24 hours

For additional information please refer to the Clinical Guideline: Assessment & Management of Adult Patients with Moderate Traumatic Brain Injury