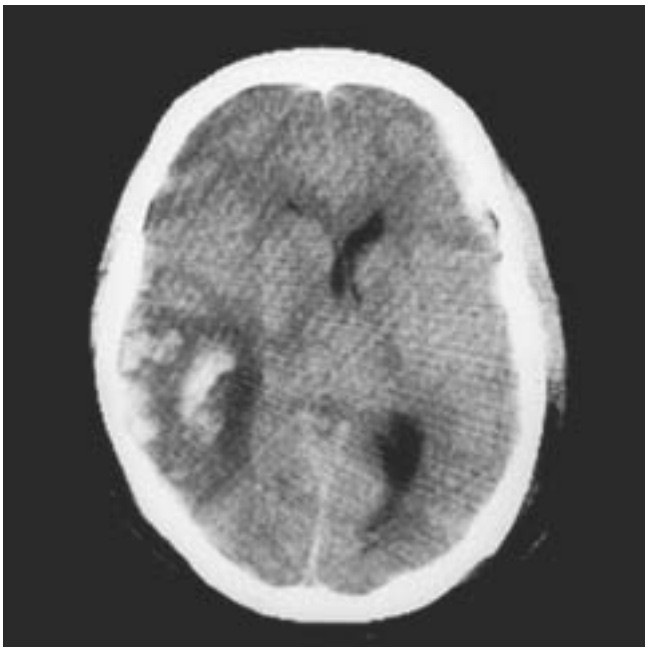
INSTITUTE OF TRAUMA AND INJURY MANAGEMENT

The NSW Institute of Trauma and Injury Management in Conjunction with the Trauma Department, Liverpool Hospital

ADULT TRAUMA CLINICAL PRACTICE GUIDELINES

Summary

Initial Management of Closed Head Injury in Adults



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Version 2 (2006)

Important Notice

"The Initial Management of Closed Head Injury in Adults" clinical practice guidelines are aimed at assisting clinicians in informed medical decision-making. They are not intended to replace decision-making. The authors appreciate the heterogeneity of the patient population and the signs and symptoms they may present with and the need to often modify management in light of a patient's co-morbidities.

The guidelines are intended to provide a general guide to the management of specified injuries. The guidelines are not a definitive statement on the correct procedures, rather they constitute a general guide to be followed subject to the clinicians judgement in each case.

The information provided is based on the best available information at the time of writing, which is December 2004. These guidelines will therefore be updated every 5 years and consider new evidence as it becomes available.

These guidelines are intended for use in adults only.

All guidelines regarding pre-hospital care should be read and considered in conjunction with NSW Ambulance Service protocols.

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Algorithm 1: Initial Management of Adult Closed Head Injuries

INITIAL MANAGEMENT OF ADULT CLOSED HEAD INJURIES

ITIM

NORTHERN SYDNEY CENTRAL COAST NSW HEALTH

TRAUMA TEAM ACTIVATION IF INITIAL GCS 3 – 13 OR OTHERWISE INDICATED

INITIAL ASSESSMENT AND STABILISATION OF ABCDES

GCS 3 – 8 | GCS 9 – 13 | GCS 14 – 15

SEVERE HEAD INJURY (10%)

- Early intubation
- Supportive care ABCDEs
- Prevent secondary injury
- Early CT scan
- Early neurosurgical consult
- Early retrieval consult if required
- Consider ICP monitoring
- Anticonvulsants optional
- ICU admission
- Routine brain injury rehabilitation consult

NB. Minimum supportive care aims to prevent secondary brain injury:

- PaO2 > 60
- SaO2 > 90
- PaCO2 35 – 40
- Systolic BP > 90
- Head up 30°

MODERATE HEAD INJURY (10%)

- Supportive care ABCDEs
- Prevent secondary injury
- Early CT scan
- Period of clinical observation
- Intubation if required to ensure adequate oxygenation and ventilation or to safely perform CT scan
- Early neurosurgical consult if not clinically improving or abnormal CT scan
- Early retrieval consult if required
- Admit to hospital unless early rapid clinical improvement, normal CT scan and absence of other risk factors as listed below
- Consider routine post traumatic amnesia testing and referral to a brain injury rehabilitation service (or neurologist) due to high risk of cognitive behavioural social sequelae

MILD HEAD INJURY (80%)

- Initial period of clinical observation
- Assess for risk factors of significant intracranial injury as listed below
- CT scan if GCS<15 at 2 hours post injury or if other risk factors present
- Admit to hospital if clinically not improving at 4 hours post injury or abnormal CT scan
- Consider hospital admission if elderly (>65), known coagulopathy (warfarin/alcoholic), intoxicated or socially isolated
- Discharge home with head injury advice at 4 hours post injury if clinically improving with either no risk factors or normal CT scan
- Refer to local doctor for routine follow up and monitoring of any post concussion symptoms
- Consider referral to a brain injury rehabilitation service (or neurologist) if still has post traumatic amnesia after 24hrs or if still has post concussion symptoms after 4 weeks

NB: See also separate mild head injury algorithm

RISK FACTORS INDICATING POTENTIALLY SIGNIFICANT MILD HEAD INJURY

- Persistent GCS < 15 at 2 hours post injury
- Deterioration in GCS
- Focal neurological deficit
- Clinical suspicion of skull fracture
- Prolonged loss of consciousness (> 5min)
- Prolonged anterograde/retrograde amnesia
- Post traumatic seizure
- Persistent abnormal alertness/behaviour/cognition
- Persistent vomiting (2 or more occasions)
- Persistent severe headache
- Known coagulopathy (eg warfarin/alcoholic)
- Age >65 years
- Multi-system trauma
- Dangerous mechanism
- Clinically obvious drug or alcohol intoxication
- Known neurosurgery/neurological impairment
- Delayed presentation or representation

WHAT TO DO IF A CLOSED HEAD INJURY PATIENT ACUTELY DETERIORATES?

INDICATIONS OF DETERIORATION

- GCS falls by two or more points
- Develops dilated pupil(s)
- Develops focal neurological deficit
- Delayed or focal seizure
- Cushings response – bradycardia and hypertension

CLINICAL APPROACH

- Re-assess ABCDEs to exclude non head injury cause
- Supportive care of ABCDEs (nb oxygenation and perfusion)
- Consider early intubation and short term hyperventilation to PaCO2 25-30
- Immediate CT scan if available
- Consult neurosurgical service
- Consult retrieval service early
- Consider use of mannitol boluses (1g/kg), in consultation with neurosurgical service, to reduce ICP for transfer
- Consider local burr holes in consultation with neurosurgical service if transfer likely to take more than two hours

PHONE NUMBERS

- **MRU (Adult) 1800 650 004**
- **NETS (Children) 1300 362 500**
- **Regional Neurosurgical**

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WHEN SHOULD PATIENTS WITH CLOSED HEAD INJURY BE TRANSFERRED TO HOSPITALS WITH NEUROSURGICAL FACILITIES?

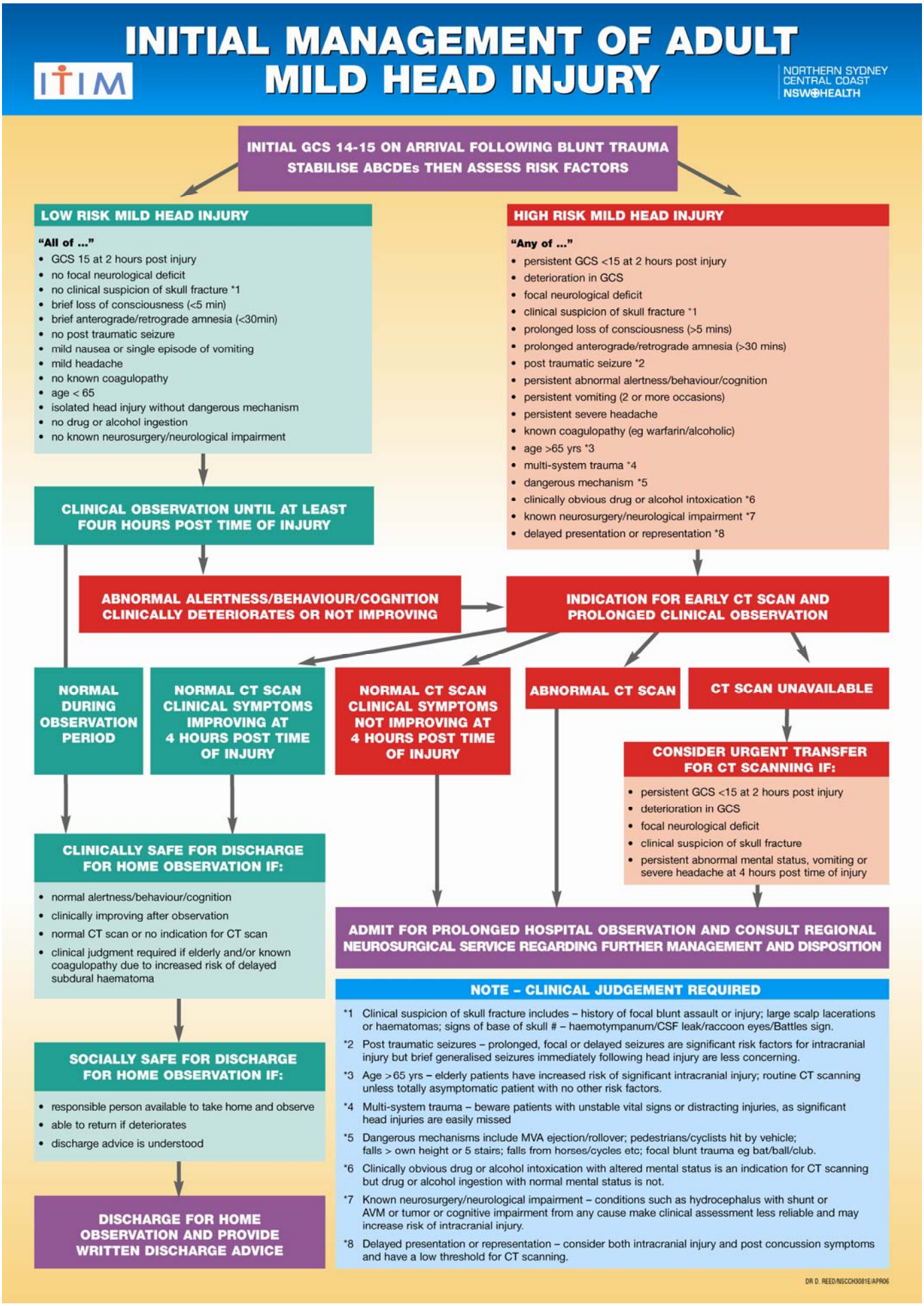
POTENTIAL INDICATIONS FOR TRANSFER

- Patients with severe head injuries (GCS 3-8)
- Patients with moderate head injuries (GCS 9-13) if:
  - clinical deterioration
  - abnormal CT scan
  - normal CT scan but not clinically improving
  - CT scan unavailable
- Patients with mild head injuries (GCS 14-15) if:
  - clinical deterioration
  - abnormal CT scan
  - normal CT scan but not clinically improving
  - high risk mild head injury with CT scan unavailable, particularly if:
    - *persistent abnormal GCS*
    - *focal neurological deficit*
    - *clinical suspicion of skull fracture*
    - *persistent abnormal mental status, vomiting or severe headache at 4 hours post injury*

CLINICAL APPROACH

- When in doubt consult your regional 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. Transfer of patients to hospitals with CT scan facilities but without neurosurgical services should be avoided

Algorithm 2: Initial Management of Adult Mild Head Injury



Summary of Guidelines

What is the definition of Mild Head Injury?

DEFINITION	Level of Evidence
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 amnesia). **Typical Characteristics** • direct blow to the head or acceleration / deceleration injury • transient loss of consciousness or amnesia • transient abnormal alertness, behaviour or cognition • neurosurgical intervention rare • post concussion symptoms common • long term functional outcome good	III-2
Risk Stratification Mild head injury may be further sub-classified into **"high"** and **"low"** risk groups, based on the risk of having an intracranial injury requiring neurosurgical intervention. Stratification of "high" and "low" risk of intracranial injury is based on: [1, 6-9, 14, 16-19, 23-46, 62] • initial GCS on admission and at two hours post injury • the duration of loss of consciousness or amnesia • the presence or absence of other specified risk factors	III-2

What are the clinically important complications of mild head injury?

GUIDELINE	Level of Evidence
Clinicians and patients should be aware of both the risk of neurosurgical intervention and the risk of cognitive-behavioural-social sequelae following mild head injury. Clinicians and patients should also be aware that the absence of a structural lesion on CT scan following mild head injury does not exclude the possibility of significant cognitive-behavioural-social sequelae.	III-2
Acute life-threatening complications requiring neurosurgical intervention are rare in mild head injury patients: [16, 17, 19, 24-32, 47, 62] - "low risk" mild head injury range 0 - 3% - "high risk" mild head injury range 0.5 - 6.5 %	IV
Post concussion symptoms are common in mild head injury patients and may have significant cognitive-behavioural-social impacts on both patients and their families [3, 8, 9, 36, 48-52]: - typical post concussion symptoms include headaches, dizziness fatigue, memory impairment, poor concentration, mood swings, behavioural changes and social dysfunction. - up to 50% of patients with mild head injury may have significant post concussion symptoms which can last several weeks. - about 10% of patients with mild head injury will have persistent disabling post concussion symptoms.	IV

How should patients with mild head injury be assessed?

GUIDELINE	Level of Evidence
Mild head injury patients should have a minimum of hourly observations for four hours post injury. These observations include: - GCS - Alertness/behaviour/cognition - Pupillary reactions -Vital signs	III-2
Serial neurological 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 requiring hospital admission [7, 53].	III-2
Assessment for post traumatic amnesia (PTA) should be performed on any mild head injury patients who fail to clinically improve at four hours post injury or who are found to have structural lesions requiring hospital admission [3, 55].	III-2
Structured clinical assessment using clinical decision rules can identify those patients at increased risk of intracranial injury requiring further investigation [16, 17, 19, 62].	III-2
Skull x-rays are not sufficiently sensitive to be used as a routine screening investigation to identify significant intracranial lesions [37].	I
CT scanning is the most appropriate investigation for the exclusion of neurosurgically significant lesions in mild head injured patients.	III-2
CT scanning is indicated for those mild head injured patients identified by structured clinical assessment as being at increased risk of intracranial injury [16, 17, 19, 25, 38, 39, 62].	III-2
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 [16, 17, 19, 25, 38, 39].	III-2

Which patients with mild head injury require a CT scan?

GUIDELINE	Level of Evidence
PATIENTS WITH "HIGH RISK" MILD HEAD INJURY REQUIRING CT SCAN 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: **"ANY OF……..."** Initial assessment • Persistent GCS <15 at 2 hours post injury** • Focal neurological deficit • Clinical suspicion of skull fracture • Prolonged loss of consciousness (>5min) • Prolonged anterograde or retrograde amnesia (>30min) • Post traumatic seizure • Repeated vomiting (≥ 2 occasions) • Persistent severe headache • Known coagulopathy • Age >65 years (clinical judgment appropriate if no other risk factors present) After a period of observation (4 hours post injury) • Any deterioration in GCS • Persistent abnormal mental status (abnormal alertness, behaviour or cognition) ** • Any patient who fails to clinically improve Clinical judgment required if: • Age >65 • Drug or alcohol ingestion • Dangerous mechanism • Multi-system trauma • Known neurosurgery/neurological impairment • Delayed presentation or representation ***NOTE: Includes patients with abnormal GCS due to drug or alcohol ingestion*	III-2

GUIDELINE	Level of Evidence
PATIENTS WITH "LOW RISK" MILD HEAD INJURY NOT REQUIRING CT SCANNING The following features indicate patients with mild head injury (initial GCS 14 - 15) at low risk of 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: **"ALL OF……..."** Initial assessment: • GCS 15 at 2 hours post injury • No focal neurological deficit • No clinical suspicion of skull fracture • No prolonged loss of consciousness (>5min) • No prolonged anterograde or retrograde amnesia (>30min) • No post traumatic seizure • No repeated vomiting (≥ 2 occasions) • No persistent severe headache • No known coagulopathy • Age <65 After a period of observation (4 hours post injury) • Normal mental status including alertness and behaviour and cognition • No deterioration during observation • Clinically improving Clinical judgment required if: • Age >65 • Drug or alcohol ingestion • Dangerous mechanism • Multi-system trauma • Known neurosurgery/neurological impairment • Delayed presentation or representation	III-2

What to do with high risk mild head injury patients when CT scan is unavailable?

GUIDELINE	Level Of Evidence
APPROACH TO HIGH RISK MILD HEAD INJURY PATIENTS WHEN CT SCANNING IS UNAVAILABLE High risk mild head injury patients should be admitted for prolonged hospital observation and considered for transfer for CT scanning. Patients at highest risk of intracranial injury who should be transferred for CT scanning include those with [16-19, 27-34, 37-39, 47, 70, 71, 76]: • Persistent GCS <15 at 2 hours post injury • Deterioration in GCS • Focal neurological deficit • Clinical suspicion of skull fracture • Persistent abnormal mental status, vomiting or headache at 4 hours post injury	III-2
• Patients at highest risk of intracranial injury should be discussed with the regional neurosurgical service and a management plan established.	Consensus
• If patients are transferred for CT scanning they should ideally be transferred to a hospital with neurosurgical facilities to avoid secondary transfer.	Consensus
• 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.	I
• All high risk patients who cannot have CT scanning should at a minimum have prolonged observation in hospital for at least 24 hours and until clinically improving.	Consensus

When can patients with mild head injury be safely discharged home?

GUIDELINE	Level of Evidence
Mild head injury patients can be discharged for home observation after initial period of in-hospital observation if they meet the following clinical, social and discharge advice criteria [16, 17, 19, 24, 26, 27, 29, 32, 66, 68, 69, 77-79].	III-2

Clinical Criteria:
• normal mental status and behaviour with clinically improving minor post concussion symptoms after observation until at least 4 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:
  • clinical deterioration
  • persistent abnormal GCS or focal neurological deficit
  • persistent abnormal mental status or behaviour
  • persistent severe post concussion symptoms
  • persistent drug or alcohol intoxication
  • presence of known coagulopathy (relative)
  • presence of multi-system injuries (relative)
  • presence of intercurrent medical problems (relative)
  • age >65 (relative)
	III-2

Social Criteria: • 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

Discharge Advice Criteria:
• discharge summary for local doctor
• written and verbal head injury advice given to patient and nominated responsible person covering:
  o symptoms and signs of acute deterioration
  o reasons for seeking urgent medical attention
  o typical post concussion symptoms
  o reasons for seeking routine follow up
	Consensus

What are the proven treatments for patients with moderate to severe head injuries?

GUIDELINE	Level Of Evidence
INITIAL MANAGEMENT OF SEVERE HEAD INJURIES (GCS 3-8) Standard Care [15, 22, 80-87]: • Initial systematic resuscitation of ABCDE's. • Early CT scanning to identify neurosurgically correctable focal intracranial haematomas. • Prevention of secondary brain injury by avoiding secondary hypoxaemia (oxygen saturation <90%) and hypotension (systolic BP <90). • Supportive care of ABCDE's with appropriate attention, posturing (30^{o} head up), basic nursing care and avoidance of hyperventilation. • Early neurosurgical consult. • Use of ICP monitoring to guide management of cerebral perfusion pressure in patients with severe brain injury. • Optional use of anticonvulsants to prevent early post traumatic seizures. • Routine brain injury rehabilitation consult • ICU admission Acute Neurological Deterioration • Resuscitation and stabilisation of ABCDE's • Short term hyperventilation to $PaCO_2$ 25 - 30 • Mannitol 1g/kg IV Bolus • Early CT scan with neurosurgical intervention as required Poor prognostic indicators: • Low GCS (especially motor component) • Age >60 (prognosis deteriorates with increasing age) • Absent pupillary reflexes (after systemic resuscitation) • Hypotension (systolic BP <90) • Hypoxaemia (oxygen saturation <90%)	III-2

GUIDELINE	Level Of Evidence
INITIAL MANAGEMENT OF MODERATE HEAD INJURIES (GCS 9-13) Standard Care [15, 22, 80-87] • Initial assessment and resuscitation of ABCDE's. • Early CT scanning to identify neurosurgically correctable focal intracranial haematomas. • Period of ED observation • Prevention of secondary brain injury by avoiding hypoxaemia (O_2 saturation <90%) and hypotension (systolic BP <90). • Supportive care of ABCDE's. • Admit for prolonged hospital observation (24-48 hours) unless rapid clinical improvement, normal CT scan and absence of other risk factors. • Early neurosurgical consult if not clinically improving and/or abnormal CT scan. • Routine post traumatic amnesia (PTA) testing. Outcome • Approximately 80% of moderate head injuries improve while 20% deteriorate and require management as per severe head injuries. • 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 4).	III-2

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

GUIDELINE	Level of Evidence
Patients with severe head injuries (GCS 3-8)	Consensus
Patients with moderate head injuries (GCS 9-13) if: (i) clinical deterioration (ii) abnormal CT scan (iii) normal CT scan but not clinically improving (iv) CT scan unavailable	Consensus
Patients with mild head injuries (GCS 14-15) if: (i) clinical deterioration (ii) abnormal CT scan (iii) normal CT scan but not clinically improving (iv) high risk mild head injury with CT scan unavailable NB Consult neurosurgical/retrieval service early	Consensus