

Guideline for North Bristol Trust

Management of Severe Traumatic Brain Injury

This guideline describes the following:

- Initial assessment and management of the patient with head injury
- Indications for CT in the patient with head injury
- Indications for neurosurgical referral and transfer to Southmead Hospital

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Key Points

1. Head injury has around a 5% mortality. Early neuroprotective measures can significantly improve outcomes.
2. Early CT brain & skull are indicated in the majority of patients with GCS <14.
3. For a rapid overview of head injury management, please see the separate key points document “Care of Head Injured Patients”
4. Levetiracetam (Keppra) is now the first line anticonvulsant for patients with significant head injury.
5. Patients already taking anticonvulsants who sustain a head injury should have their anticonvulsant therapy discussed with a neurosurgeon.

Severe Traumatic Brain Injury Guidelines

Background

Head injury is the commonest cause of death and disability in people aged 1–40 years in the UK. Most patients recover without specific or specialist intervention, but others experience long-term disability or even die from the effects of complications that could potentially be minimised or avoided with early detection and appropriate treatment.

The incidence of death from head injury is low, with as few as 0.2% of all patients attending emergency departments with a head injury dying as a result of this injury. The majority of fatal outcomes are in the moderate (GCS 9–12) or severe (GCS 8 or less) head injury groups, which account for 5% of attenders.

Appropriate guidance can enable early detection and treatment of life-threatening brain injury, where present.

This guideline is based on NICE CG176: Head Injury.

Assessment in the Emergency Department

Initial Assessment and Management

As with all major trauma, patients with a head injury should be managed according to standard trauma primary survey principles.

Neurological assessment:

The patient should be assessed and monitored using the Glasgow Coma Scale. The individual components of the GCS and the overall score should be described in all communications and documentation

In patients with a GCS of 8 or less, ensure there is early involvement of an anaesthetist or critical care physician to provide appropriate airway management and assist with resuscitation.

Patients considered high risk for clinically important brain injury and/or cervical spine injury:

Conduct a full clinical examination to establish the need to request CT imaging of head, cervical spine and other body areas.

Patients considered low risk for clinically important brain injury and/or cervical spine injury following initial assessment:

An emergency department clinician should re-examine the patient within an hour. The need to request CT imaging of the head and/or cervical spine should be established at this time.

Airway

Intubate and ventilate the patient immediately in the following circumstances:

- GCS ≤ 8
- Loss of protective laryngeal reflexes
- Ventilatory insufficiency as judged by blood gases: hypoxaemia ($\text{PaO}_2 < 13$ kPa on oxygen) or hypercapnia ($\text{PaCO}_2 > 6$ kPa)
- Spontaneous hyperventilation causing $\text{PaCO}_2 < 4$ kPa
- Irregular respirations

If transferring from a trauma unit to major trauma centre, intubation and ventilation prior to the start of the journey is indicated in the following circumstances:

- Significantly deteriorating conscious level (1 or more points on the motor score), even if GCS not ≤ 8 .
- Unstable fractures of the facial skeleton
- Copious bleeding into the mouth (for example, from skull base fracture)
- Seizures

Ventilate an intubated patient with muscle relaxation and appropriate short-acting sedation and analgesia. Aim for:

- $\text{PaO}_2 > 13$ kPa
- PaCO_2 4.5 – 5.0, unless there is clinical or radiological evidence of raised intracranial pressure, in which case more aggressive hyperventilation is justified. If hyperventilation is used, increase the oxygen concentration.
- Maintain the mean arterial pressure at ≥ 80 mmHg by infusion of fluid and vasopressors as indicated.

Analgesia

Pain can lead to an increase in intracranial pressure and should be managed effectively.

Treat significant pain with small doses of intravenous opioids titrated against clinical response and baseline cardiorespiratory measurements. All patients with head injury should receive paracetamol (IV or PO) if not contraindicated.

Imaging

The current primary investigation of choice for the detection of acute clinically important brain injuries is CT imaging of the head.

Do not perform MRI scanning as the primary investigation for clinically important brain injury. However, additional information of importance to the patient's prognosis can sometimes be detected using MRI.

Do not use plain X-rays of the skull to diagnose significant brain injury without prior discussion with a neuroscience unit.

Perform a CT Head Scan Within One Hour:

- GCS less than 13 on initial assessment in the Emergency Department
- GCS less than 15 at 2 hours after the injury on assessment in the Emergency Department
- Suspected open or depressed skull fracture
- Any sign of basal skull fracture (haemotympanum, 'panda' eyes, cerebrospinal fluid leaking from the ear or nose, Battle's sign)
- Post-traumatic seizure
- Focal neurological deficit
- More than 1 episode of vomiting

A provisional written radiology report should be made available within 1 hour of the scan being performed.

Perform a CT Head Scan Within Eight Hours in Patients who:

- Experienced some loss of consciousness or amnesia since the injury

AND any of the following

- Age ≥ 65
- Any history of bleeding or clotting disorder
- Dangerous mechanism of injury e.g pedestrian vs. motor vehicle, cyclist vs. motor vehicle, occupant ejected from a motor vehicle or fall from a height >1 meter / 5 stairs.
- More than 30 minutes of retrograde amnesia of events immediately before the head injury

A provisional written radiology report should be made available within 1 hour of the scan being performed.

Patients on warfarin:

For patients who have sustained a head injury with no other indications for a CT head scan and who have been receiving warfarin treatment, perform a CT head scan within 8 hours of the injury.

A provisional written radiology report should be made available within 1 hour of the scan being performed.

Patients with any neurosurgical shunt for CSF diversion in situ:

For patients who have sustained a head injury with no other indications for a CT head scan and who have any neurosurgical shunt for CSF diversion in situ should undergo CT scan within 8 hours of minor head injury. This patient group lies outside of NICE guidance but are at significant risk of major intracranial haemorrhage and must be imaged within this timeframe.

Neurosurgical Involvement

Neurosurgical involvement is indicated if any of the following are present:

- Surgically significant abnormalities on imaging
- Persisting coma (GCS \leq 8) after initial resuscitation
- Unexplained confusion which persists for more than 4 hours
- Deterioration in GCS score after admission (greater attention should be paid to motor response deterioration)
- Progressive focal neurological signs
- A seizure without full recovery
- Definite or suspected penetrating head injury
- A cerebrospinal fluid leak
- Neurosurgical shunt for CSF diversion

Discuss with a neurosurgeon the care of all patients with new, significant abnormality on imaging.

Transfer

All patients requiring neurosurgical involvement should be discussed with Southmead Hospital.

Transfer would benefit all patients with serious head injuries (GCS of 8 or less) irrespective of the need for neurosurgery. If transfer of these patients is not possible, ongoing liaison with Southmead Hospital over clinical management is essential.

Initial resuscitation and stabilisation of the patient must be completed prior to transfer. Do not transport a patient with persistent hypotension despite resuscitation, until the cause of the hypotension has been identified and the patient stabilised.

See page 5 for guidance on when intubation and ventilation is indicated prior to a patient with head injury being transferred.

Admission and Observation

Admission

The following criteria should be used for admitting patients to hospital following a head injury:

- New, clinically significant abnormalities on imaging
- GCS has not returned to 15 after imaging, regardless of the imaging results
- CT scan is indicated, but cannot be done within the appropriate period
- Continuing worrying signs (e.g. persistent vomiting, severe headache) of concern to the clinician
- Other sources of concern to the clinician (e.g. drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, cerebrospinal fluid leak)

Admit patients with multiple injuries under the care of the team that is trained to deal with their most severe and urgent problem.

Observation of Admitted Patients

For all patients admitted for observation following head injury, the following neurological observations must be documented as a minimum:

- GCS (assess every 30 minutes until GCS equal to 15 has been achieved)
- Pupil size and reactivity
- Limb movements
- Respiratory rate
- Heart rate
- Blood pressure
- Temperature
- SpO₂

The minimum frequency of observations for patients with GCS equal to 15 should be as followed, starting after the initial assessment in the emergency department:

- Half-hourly for 2 hours
- 1 hourly for 4 hours
- 2 hourly thereafter

Should the patient with GCS = 15 deteriorate at any time after the initial 2 hour period, observations should revert to half-hourly and follow the original frequency schedule.

The must be prompt urgent reappraisal by the supervising doctor if any of the following examples of neurological deterioration occur:

- Development of agitation or abnormal behaviour
- A sustained (for at least 30 minutes) drop of 1 point in GCS score (greater weight should be given to a drop of 1 point in the motor response score of the GCS).
- Any drop of 3 or more points in the eye-opening or verbal response scores of the GCS, or 2 or more points in the motor response score.
- Development of severe or increasing headache or persistent vomiting
- New or evolving neurological symptoms or signs such as pupil inequality or asymmetry of limb or facial movement.

A second member of staff competent to perform observation should confirm deterioration before involving the supervising doctor. Where a confirmation cannot be performed immediately, the supervising doctor should be contacted without the confirmation being performed.

If neurological deterioration as listed above is confirmed, an immediate CT scan should be considered, and the patient's clinical condition re-assessed and managed appropriately.

In the case of a patient who has had a normal CT scan, but who has not achieved GCS equal to 15 after 24 hours' observation, a further CT scan or MRI scanning should be considered and discussed with the radiology department.

Anticonvulsants for Traumatic Brain Injury

Patient Not Taking Anticonvulsants Prior to Injury:

In patients who were not taking anticonvulsants prior to injury, where no witnessed seizure has occurred since injury:

1. Start levetiracetam 1g twice daily
 - No loading dose needed
 - Initial dose intravenously
 - Give subsequent doses via NG/PO if absorbing feed, otherwise continue IV
2. Continue treatment for 7 days THEN STOP
 - May need longer duration and/or increased doses if clinical or EEG evidence of seizures during treatment
 - Maximum doses 1.5g twice daily

In patients who were not taking anticonvulsants prior to injury, where a witnessed seizure *has* occurred since the injury:

1. Give loading dose levetiracetam 20mg/kg
2. Start levetiracetam 1g twice daily
 - Initial dose 12 hours after loading
 - Give via NG/PO route if absorbing feed, otherwise continue IV
 - Treatment duration on a case-by-case basis in discussion with the admitting neurosurgical team

Levetiracetam is now the first-line anticonvulsant for TBI, replacing phenytoin. Phenytoin is the second line agent where levetiracetam is contraindicated or unavailable.

Patients Taking Anticonvulsants Prior to Injury

Patients who were taking anticonvulsants prior to a head injury should be discussed with the neurosurgical team regarding their need for additional anticonvulsant agents.

Further Information and References

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Further Information

References

NICE Clinical Guideline (CG176) Head Injury: Assessment and Early Management
<https://www.nice.org.uk/guidance/cg176>

NICE Quality Standard (QS74) Head Injury
<https://www.nice.org.uk/guidance/qs74>