

WYMTN - Head injury management

Context

Head injury is the commonest cause of death and disability in people aged 1–40 years in the UK. Each year, 1.4 million people attend emergency departments in England and Wales with a recent head injury. Between 33% and 50% of these are children aged under 15 years. Annually, about 200,000 people are admitted to hospital with head injury. Of these, one-fifth have features suggesting skull fracture or have evidence of brain damage. 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.ⁱ

Definitions

Head injury is defined as any trauma to the head other than superficial injuries to the face.

Degree of head injury	GCS score
Mild	13-15
Moderate	9-12
Severe	8 or less

IMPORTANT *In the context of multisystem trauma, low GCS may be attributable to hypoxaemia or shock.*

For children the modified GCS score must be used - full details can be found in the regional guidelines for the assessment of consciousness in children

(<http://nww.lhp.leedsth.nhs.uk/common/guidelines/detail.aspx?id=1963#table1>)

[accessible from NHS network computers].

Initial Management of patients with a head injury

The initial management is as for all major trauma patients. From the point of view of the head injury there are two key aims:

- 1/ Preventing secondary brain injury (from hypoxia, hypoperfusion, inappropriate ventilation, uncontrolled seizure etc)
- 2/ Rapid diagnosis of any surgically reversible pathology

Airway and Breathing:

- In patients with GCS 8 or less, ensure there is early involvement of an anaesthetist or critical care physician to provide appropriate airway management.
- Patients with a GCS of 8 or less should be considered for immediate intubation and ventilation.
- Consider early intubation & ventilation in the following groups:

- Loss of protective laryngeal reflexes.
- Ventilatory insufficiency as judged by blood gases: hypoxaemia ($\text{PaO}_2 < 13$ kPa on oxygen) or hypercarbia ($\text{PaCO}_2 > 6$ kPa).
- Spontaneous hyperventilation causing $\text{PaCO}_2 < 4$ kPa.
- Irregular respirations
- In addition, consider intubation and ventilation in the following circumstances:
 - Progressively deteriorating conscious level (1 or more points on the motor score, a fall of 2 points in the “non-motor” GCS), even if not coma.
 - Unstable fractures of the facial skeleton.
 - Copious bleeding into mouth (for example, from base of skull fracture).
 - Seizures
 - Patients who are too agitated to permit accurate clinical assessment.
- A general anaesthetic should be administered prior to intubation. Ventilate intubated patients with muscle relaxation and appropriate short-acting sedation **and analgesia** (eg propofol and alfentanil). Inadequate analgesia can lead to deleteriously high blood pressure. Aim for a PaO_2 greater than 13 kPa, PaCO_2 4.5 to 5.0 kPa.

Circulation:

- Do not practice permissive hypotension in patients with significant head injuries. Maintenance of normal blood pressure is the single most important factor in preventing secondary brain injury.
- For the **small** sub-set of patients who have haemorrhagic shock and a traumatic brain injury:
 - if haemorrhagic shock is the dominant condition (ie in the presence of a perceived minor head injury), continue restrictive volume resuscitation **or**
 - if traumatic brain injury is the dominant condition, use a less restrictive volume resuscitation approach to maintain cerebral perfusion.
- This decision making requires direct consultant input and a focus on achieving haemostasis ASAP. Once haemostasis has been achieved maximising cerebral perfusion takes priority.
- In most cases where the brain injury takes precedence maintain the **mean** arterial pressure at 70-80 mm Hg by infusion of fluid and vasopressors as indicated. (If the intracranial pressure is assumed to be greater than 20 mmHg, this strategy should maintain a cerebral perfusion pressure around 50 mm Hg). Peripheral phenylephrine is appropriate in the first instance whilst noradrenaline is suitable once central access is achieved. In children, maintain blood pressure at a level appropriate for the child's age.
- Insert an arterial line for accurate blood pressure monitoring in an obtunded patient (where conscious level cannot be used to assess cerebral perfusion) but don't delay the acquisition of diagnostic images

Additional considerations:

- Maintain normoglycaemia. Consider insulin if the blood glucose >10mmol/L.
- Manage pain effectively because it can lead to a rise in intracranial pressure. Provide reassurance, splintage of limb fractures and catheterisation of a full bladder, where needed.
- All intubated head injury patients should have a nasogastric (or orogastric if concerns re facial / basal fractures) tube and urinary catheter inserted - but this can be done after CT imaging is obtained.
- Aim to preserve jugular venous drainage:
 - Nurse the patient with a 15-20° head up tilt.
 - Ensure that cervical collars/ ETT ties are not too tight.
 - Internal jugular vein central lines are not contra-indicated.

Raised Intracranial Pressure

- Raised ICP may be demonstrated on the CT scan.
- Clinical signs of raised ICP include:
 - Asymmetric pupils
 - Bradycardia with hypertension
 - Fixed dilated pupils
- Patients with confirmed or suspected raised intracranial pressure should be discussed with the neurosurgical team regarding additional pharmacological therapy. Options include:
 - Mannitol 0.5/kg over 15 mins. This dose may be repeated if ineffectual
 - Ensure a catheter has been inserted if mannitol is given. The resulting diuresis may lead to urinary retention with resultant increase in ICP.

Anti-coagulation

Patients with intracranial bleeding should have anti-coagulation reversed whenever possible. For warfarin use prothrombin complex concentrate (eg octaplex) rather than fresh frozen plasma. For Novel Oral Anticoagulants (NOACs) liaise with a haematologist.

Tranexamic acid

Use tranexamic acid if indicated for suspected significant haemorrhage as per network guidelines. TXA should not be used for isolated intracranial haemorrhage outside of the CRASH 3 trial.

Criteria for urgent CT scan for Head Injury

Note that CT head and neck is usually indicated as part of the imaging protocol for patients with definite or suspected multisystem trauma regardless of history of head injury.

The MTC and all TU's within the WYMTN adhere to NICE guidelines for CT imaging of the head and neck in isolated head trauma:

<https://www.nice.org.uk/guidance/cg176/resources/cg176-head-injury-imaging-algorithm2>

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

If CT imaging at the TU is unavailable because of equipment failure, patients with GCS 15 may be admitted to the TU for observation. Patients where there is strong clinical suspicion of brain injury should be transferred to the ED at the MTC for immediate scanning.

Children under the age of 1 with a bruise, swelling or laceration greater than 5cm who are otherwise well and have a normal GCS may be admitted for overnight observation without CT if a general anaesthetic is required and a suitably experienced paediatric anaesthetist is not available. In most cases however it should be possible to obtain a CT without a GA when the child is sleeping (e.g. 'feed & wrap').

Criteria for referral for neurosurgical advice:

A patient with a head injury should be discussed with a neurosurgeon:

- when a CT scan in a general hospital shows a recent intracranial lesion
- when a patient fulfils the criteria for CT scanning but facilities are unavailable
- when the patient has clinical features that suggest that specialist neuroscience assessment, monitoring, or management are appropriate, irrespective of the result of any CT scan e.g.
 - persisting coma (GCS score 8/15 or less) after initial resuscitation
 - confusion which persists for more than four hours
 - deterioration in level of consciousness after admission (a sustained drop of one point on the motor or verbal subscales, or two points on the eye opening subscale of the GCS)
 - focal neurological signs
 - a seizure without full recovery
 - compound depressed skull fracture
 - definite or suspected penetrating injury
 - a CSF leak or other sign of a basal fracture.

Patients who may benefit from transfer to the neurosciences centre regardless of need for neurosurgery:

- Transfer to NICU benefits patients with serious head injuries (GCS 8 or less) irrespective of the need for neurosurgery, and probably is cost effective for patients defined as having a mild or moderate TBI. Evidence for cost effectiveness is lacking for patients >70 years, without major extra-cranial injury and such cases must be

assessed on a case by case basis to ensure that the care provided is the most appropriate for that patient.ⁱⁱ. These considerations must be balanced against a realistic assessment of the currently available resource.

- If transfer of those who do not require neurosurgery is not possible, ongoing liaison with the neuroscience unit over clinical management is essential.

How to refer

CT images for all patients being referred to the neurosurgical team should be transferred electronically using the IEC portal.

Ideally all referrals should be made via the on-line system at www.leedsneurosurgery.com

On-line referrals will be reviewed and responded to within 30 minutes. Use of the online referral system means a written record of the clinical information given and advice received can be printed and added to the medical record.

The following injuries warrant a telephone call to the Neurosurgical registrar via LGI switchboard (**0113 243 2799 - ask for the on call NSx Reg via mobile**) to expedite the referral:

- Acute SDH
- Extradural haematoma
- Bilateral contusions
- More than 1 contusion >1cm diameter
- Open skull #
- Depressed skull #
- Penetrating wound
- Traumatic CSF leak
- Gunshot wound to head

Patients who are being referred should have had full bloods including clotting sent and should be kept fasted.

Transfer

For patients with multiple injuries requiring immediate intervention network protocols for TU-MTC ED-ED transfer should be adhered to: <http://www.wymtn.com/immediate-transfer.html>

Some patients will have isolated head injuries in need of immediate surgical intervention but transfer should not be delayed by organising TU ED to MTC **theatre** transfer: transfer direct to the MTC ED asap.

*If you are at a trauma unit with a patient who you believe needs **immediate** neurosurgical intervention do not allow the referral process to delay transfer - follow the immediate transfer guidance above.*

Patients with impaired consciousness are at risk of physiological instability that can result in secondary insults during transport and a worse outcome. These adverse events can be minimised by resuscitation before transport and high level monitoring and care during transport. They should be accompanied by a doctor with appropriate training and experience in the transfer of patients with acute brain injury. They should be familiar with the pathophysiology of head injury, and the drugs and equipment they will use. This will usually be a senior anaesthetist.

The Intensive Care society guidance on the transfer of critically ill patients can be found here <http://www.ics.ac.uk/ics-homepage/guidelines-and-standards/>.

The AAGBI guidance on transfer of patients with a brain injury can be found here <http://www.aagbi.org/sites/default/files/braininjury.pdf> (currently under review).

Antibiotics & Immunisation

Non-penicillin allergic patients with a penetrating brain injury should receive co-amoxiclav 1.2g tds for 5 days. If penicillin allergy - discuss with local microbiologist.

Antibiotics are not indicated for base of skull fractures or CSF leaks.

All patients with penetrating brain injury, base of skull fractures or CSF leaks should be given pneumovax II vaccination if not already covered.

Rehabilitation

All in patients with a traumatic brain injury should be discussed with the local neuro-rehabilitation team. Rehabilitation contacts can be found on the WYMTN web site (www.wymtn.com). All children admitted with a head injury should be considered for referral to the Leeds Paediatric Neuro-rehabilitation team. Further guidance on the longer term management of all patients with head injury within the WYMTN will be produced in 2015/16.

The Leeds specialist hyperacute neurorehabilitation team can be contacted for advice about any patient within the region.

Dr Matthew Smith: Matthewsmith@nhs.net, phones: via LGI switch 0113 2432799

Madeleine Kenny: madeleinekenny@nhs.net, bleep: 3418

Kerry Anderson-Kay: Kerry.anderson-kay@nhs.net, bleep: 2753

Discharge from the Emergency Department

Any patient discharged home from the ED must be given appropriate written head injury advice backed up by verbal instructions on when to seek review.

Clinical incidents

All clinical incidents should be reported via local reporting systems and, if appropriate, via the WYMTN (<http://www.wymtn.com/incidents.html>)

ⁱ NICE Clinical Guideline 176 Jan 2014

ⁱⁱ Risk Adjustment In Neurocritical care (RAIN) – prospective validation of risk prediction models for adult patients with acute traumatic brain injury to use to evaluate the optimum location and comparative costs of neurocritical care: a cohort study. Health Technology Assessment, No. 17.23. Harrison DA, Prabhu G, Grieve R, et al. Southampton (UK): NIHR Journals Library; 2013 Jun.