Head injury: triage, assessment, investigation and early management of head injury in infants, children and adults

NICE guideline
Partial update
Draft for consultation, March 2007

If you wish to comment on this version of the guideline, please be aware that all the supporting information and evidence is contained in the full version.

This is the consultation draft of a partial update of NICE clinical guideline 4 (www.nice.org.uk/CG004). New recommendations are highlighted in yellow and flagged ‘[NEW]’. Amendments to recommendations in the original guideline are highlighted in green and flagged ‘[Amended]’.

Key recommendations have been selected from the whole guideline, not just new recommendations. Because they were not included in the original version they are also highlighted in yellow.

Please comment on new and amended recommendations only. Recommendations that are unchanged from the original guideline are not being consulted on.
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Introduction

Partial update of NICE clinical guideline 4

This guideline addresses the triage, assessment, investigation and early management of head injury. This guidance is evidence based and includes the original guideline published in June 2003 and this current version is the 2 year partial update of the previous guideline. There was sufficient new evidence to prompt an update to be carried out (see section 2). This update affects only a few recommendations within the original guideline. All new recommendations are clearly stated. A summary of the evidence on which the guidance is based is provided in the full guideline produced by the National Collaborating Centre for Acute Care.

The guideline offered best practice for the care of all patients who presented with a suspected or confirmed traumatic head injury with or without other major trauma. Separate advice was provided for adults and children (including infants) where different practices were indicated. It offered advice on the management of patients with a suspected or confirmed head injury who may have be unaware that they had sustained a head injury because of intoxication or other causes. The guideline does not provide advice on the management of patients with other traumatic injury to the head (for example, to the eye or face). It does not address the rehabilitation or long term care of patients with a head injury but the guideline does explore possible criteria for the early identification of patients who require rehabilitation.

Definitions

For the purposes of the guidelines it was agreed that infants are aged under 1 year, children are 1-15 years old and adults are aged 16 years or older. In certain circumstances, the age group ‘infants and young children’ (that is, those aged under 5 years) is used. Cut-off points of 10 years and 12 years are also used.
'Head injury' for the purposes of the guidelines is defined as any trauma to the head, other than superficial injuries to the face.

The primary patient outcome of concern throughout the guideline is 'clinically important brain injury'.
Patient-centred care

This guideline offers best practice advice on the care of infants, children and adults with head injury.

Treatment and care should take into account patients’ needs and preferences. People with head injury should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. If patients do not have the capacity to make decisions, healthcare professionals should follow the Department of Health guidelines – ‘Reference guide to consent for examination or treatment’ (2001) (available from www.dh.gov.uk). From April 2007 healthcare professionals will need to follow a code of practice accompanying the Mental Capacity Act (summary available from www.dca.gov.uk/menincap/bill-summary.htm).

Good communication between healthcare professionals and patients is essential. It should be supported by evidence-based written information tailored to the patient’s needs. Treatment and care, and the information patients are given about it, should be culturally appropriate. It should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English.

Carers and relatives should have the opportunity to be involved in decisions about the patient’s care and treatment, unless the patient specifically excludes them.

Carers and relatives should also be given the information and support they need.
Key priorities for implementation [THIS SECTION WAS NOT IN THE ORIGINAL GUIDELINE]

Training in risk assessment
- It is recommended that GPs, nurse practitioners, dentists and paramedics should all be capable of assessing the presence or absence of the risk factors listed in section 1.2.2. Training should be available as required to ensure head injury triage accuracy in paramedics, GPs, nurse practitioners and dentists. [1.1.3.1]

Pre-hospital management
- Patients who have sustained a head injury should be transported directly to a facility that has been identified as having the resources necessary to expeditiously assess and intervene to optimise outcome. It is expected that all acute hospitals accepting patients who have sustained a head injury should have these resources, and that these resources should be appropriate for the patient’s age. [1.3.2.5]

Initial transport to a neurosciences centre
- Isolated severely head injured patients (GCS 8 or less) should ideally be transferred directly to a neurosciences unit to receive treatment irrespective of any need for a neurosurgical operation instead of receiving treatment at an acute care centre for initial assessment. [NEW] [1.6.3.1]

Initial assessment in the emergency department
- All patients presenting to A&E with a head injury should be assessed by triage by a trained member of staff within a maximum of 15 minutes of arrival at hospital. Part of this assessment should establish whether they are high risk or low risk for clinically important brain injury and/or cervical spine injury, using the guidance on patient selection and urgency for imaging (head and neck cervical spine – see later recommendations). [1.4.1.6]
Clinical management
• Patients who have sustained a head injury should initially be assessed and
  managed according to clear principles and standard practice as embodied
  in the Advanced Trauma Life Support (ATLS) course and for children the
  principles as outlined in the Advanced Paediatric Life Support
  (APLS)/European Paediatric Life Support (EPLS) course materials. [NEW]
  [1.3.2.1]

Selecting patients for CT imaging of the head
• Adult patients who have sustained a head injury and present with any one
  of the following risk factors should have CT scanning of the head
  immediately requested.
  – GCS less than 13 on initial assessment in the emergency department.
  – GCS equal to 13 or 14 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 otorrhoea, Battle’s sign)
  – Post-traumatic seizure
  – Focal neurological deficit
  – More than one episode of vomiting.
  – Amnesia for greater than 30 minutes of events before impact. [1.4.2.8]

• Children who have sustained a head injury and present with any one of the
  following risk factors should have an immediate CT request of the head:
  – History
    ◊ Witnessed loss of consciousness of >5 min duration
    ◊ History of amnesia (either antegrade or retrograde) of >5 min duration
    ◊ Abnormal drowsiness (defined as drowsiness in excess of that
      expected by the examining clinician)
    ◊ 3 vomits after head injury (a vomit is defined as a single discrete
      episode of vomiting)
    ◊ Suspicion of non-accidental injury (NAI, defined as any suspicion of
      NAI by the examining clinician)
Seizure after head injury in a patient who has no history of epilepsy

- **Examination**
  - Glasgow Coma Score (GCS)<14, or GCS<15 if <1 year old on assessment in the emergency department.
  - Suspicion of penetrating or depressed skull injury or tense fontanelle
  - Signs of a basal skull fracture (defined as evidence of blood or cerebrospinal fluid from ear or nose, panda eyes, Battles sign, haemotympanum, facial crepitus or serious facial injury)
  - Positive focal neurology (defined as any focal neurology, including motor, sensory, coordination or reflex abnormality)
  - Presence of bruise, swelling or laceration >5 cm if <1 year old

- **Mechanism**
  - High-speed road traffic accident either as pedestrian, cyclist or occupant (defined as accident with speed >40 m/h)
  - Fall of >3 m in height
  - High-speed injury from a projectile or an object

If none of the above variables are present, the patient is at low risk of intracranial pathology. [NEW] [1.4.2.10]

**Selecting patients for CT imaging of cervical spine**

- The current initial investigation of choice for the detection of injuries to the cervical spine is three view plain radiographs of good technical quality. However, CT imaging is indicated in the following situations:
  - in patients with GCS < 8
  - if the plain film series is technically inadequate (for example, desired view unavailable), suspicious or definitely abnormal
  - if there is continued clinical suspicion of injury despite a normal X-ray
  - if other body areas are to be scanned
  - if a definitive diagnosis of cervical spine injury is required urgently.

- Children aged 10 years or more can be treated as adults for the purposes of cervical spine imaging. [1.4.3.14]
In children under 10 years, because of the increased risks associated with irradiation, particularly to the thyroid gland, and the generally lower risk of significant spinal injury, CT of the cervical spine should only be used in exceptional circumstances for example, cases where patients have a severe head injury (GCS ≤ 8), or where there is a strong suspicion of injury despite normal plain films, or cases where there is a strong suspicion of injury and plain films are inadequate). [NEW] [1.4.3.15]

Organisation of transfer of patients between receiving hospital and neuroscience unit

- Local guidelines on the transfer of patients with head injuries should be drawn up between the referring hospital trusts, the neuroscience unit and the local ambulance service. These should be consistent with established national guidelines. Details of the transfer of the responsibility for patient care should also be agreed. [1.6.1.1]

Good practice in observation of patients with head injury

- It is recommended that in-hospital observation of patients with a head injury, including all A&E observations, should only be conducted by professionals competent in the assessment of head injury. [1.4.1.11]

Advice about long-term problems and support services

- All patients and their carers should be made aware of the possibility of long-term symptoms and disabilities following head injury and should be made aware of the existence of services that they could contact should they experience long-term problems. Details of support services should be included on patient discharge advice cards. Patients should also be advised to contact their doctor about these problems. [1.8.4.1]
1 Guidance

The following guidance is based on the best available evidence. The full guideline (see draft for consultation on the NICE website, www.nice.org.uk) gives details of the methods and the evidence used to develop the guidance (see section 5 for details).

1.1 General

1.1.1 Glasgow Coma Scale

The assessment and classification of patients who have sustained a head injury should be guided primarily by the adult and paediatric versions of the Glasgow Coma Scale and its derivative the Glasgow Coma Score. Recommended versions are shown in appendices D and E. Good practice in the use of the Glasgow Coma Scale and Score should be adhered to at all times, following the principles below.

1.1.1.1 Monitoring and exchange of information about individual patients should be based on the three separate responses on the GCS (for example, a patient scoring 13 based on scores of 4 on eye-opening, 4 on verbal response and 5 on motor response should be communicated as E4, V4, M5).

1.1.1.2 If a total score is recorded or communicated, it should be based on a sum of 15, and to avoid confusion this denominator should be specified (for example, 13/15).

1.1.1.3 The individual components of the GCS should be described in all communications and every note and should always accompany the total score.

1.1.1.4 The paediatric version of the GCS should include a ‘grimace’ alternative to the verbal score to facilitate scoring in pre-verbal or intubated patients.
1.1.1.5 Best practice in paediatric coma observation and recording as detailed by the National Paediatric Neuroscience Benchmarking Group should be followed at all times (these principles are detailed in Appendix E).

1.1.2 Public health literature
1.1.2.1 Public health literature and other non-medical sources of advice (for example, St John Ambulance, police officers) should encourage people who have any concerns following a head injury to themselves or to another person, regardless of the injury severity, to seek immediate medical advice.

1.1.3 Training in risk assessment
1.1.3.1 It is recommended that GPs, nurse practitioners, dentists and paramedics should all be capable of assessing the presence or absence of the risk factors listed in section 1.2.2. Training should be available as required to ensure head injury triage accuracy in paramedics, GPs, nurse practitioners and dentists.

1.1.4 Support for families and carers
1.1.4.1 There should be a protocol for all staff to introduce themselves to family members or carers and briefly explain what they are doing. In addition a photographic board with the names and titles of personnel in the hospital departments caring for patients with head injury can be helpful.

1.1.4.2 Information sheets detailing the nature of head injury and any investigations likely to be used should be available in the A&E Department. The patient version of these NICE guidelines may be helpful.

1.1.4.3 Staff should consider how best to share information with children and introduce them to the possibility of long-term complex changes in their parent or sibling. Literature produced by patient support groups may be helpful.
1.1.4.4 Health care professionals should encourage carers and relatives to talk and make physical contact (for example, holding hands) with the patient. However, it is important that relatives and friends do not feel obliged to spend many hours at the bedside, and if they are, healthcare professionals should encourage them to take a break. [Amended]

1.1.4.5 There should be a board or area displaying leaflets or contact details for patient support organisations either locally or nationally to enable family members to gather further information.

1.2 Presentation and referral

A person with a head injury may present via a telephone advice service or to a community health service or minor injury clinic. The following recommendations apply in these settings.

1.2.1 Telephone advice services

1.2.1.1 Telephone advice services (for example, NHS Direct, A&E helplines) should refer people who have sustained a head injury to the emergency ambulance services (that is 999) for emergency transport to A&E if they have experienced any of the following (alternative terms to facilitate communication are in parentheses).

- Unconsciousness, or lack of full consciousness (for example, problems keeping eyes open).
- Any focal (that is, restricted to a particular part of the body or a particular activity) neurological deficit since the injury (examples include problems understanding, speaking, reading or writing; loss of feeling in part of the body; problems balancing; general weakness; any changes in eyesight; and problems walking).
- Any suspicion of a skull fracture or penetrating head injury (for example, clear fluid running from the ears or nose, black eye with no associated damage around the eye, bleeding from one or both ears, new deafness in one or both ears, bruising behind
one or both ears, penetrating injury signs, visible trauma to the scalp or skull).

- Any seizure (‘convulsion’ or ‘fit’) since the injury.
- A high-energy head injury (for example, pedestrian struck by motor vehicle, occupant ejected from motor vehicle, a fall from a height of greater than 1 metre or more than five stairs, diving accident, high-speed motor vehicle collision, rollover motor accident, accident involving motorised recreational vehicles, bicycle collision, or any other potentially high energy mechanism). A lower threshold for height of falls should be used when dealing with infants and young children (that is, aged less than 5 years).
- The injured person or their carer is incapable of transporting the injured person safely to the hospital A&E Department without the use of ambulance services (providing any other risk factors indicating A&E referral are present).

1.2.1.2 Telephone advice services (for example, NHS Direct, A&E helplines) should refer people who have sustained a head injury to a hospital A&E department if the history related indicates the presence of any of the following risk factors (alternative terms to facilitate communication are in parentheses).

- Any previous loss of consciousness (‘knocked out’) as a result of the injury, from which the injured person has now recovered.
- Amnesia for events before or after the injury (‘problems with memory’). The assessment of amnesia will not be possible in pre-verbal children and is unlikely to be possible in any child aged less than 5 years.
- Persistent headache since the injury.
- Any vomiting episodes since the injury.
- Any previous cranial neurosurgical interventions (‘brain surgery’).
- History of bleeding or clotting disorder.
• Current anticoagulant therapy such as warfarin.
• Current drug or alcohol intoxication.
• Age greater than or equal to 65 years.
• Suspicion of non-accidental injury.
• Irritability or altered behaviour (‘easily distracted’ ‘not themselves’ ‘no concentration’ ‘no interest in things around them’) particularly in infants and young children (that is, aged less than 5 years).
• Continuing concern by the helpline personnel about the diagnosis.

1.2.1.3 In the absence of any of the factors listed in 1.2.1.1 and 1.2.1.2, the helpline should advise the injured person to seek medical advice from community services (for example, general practice) if any of the following factors are present.

• Adverse social factors (for example, no-one able to supervise the injured person at home).
• Continuing concern by the injured person or their carer about the diagnosis.

1.2.2 Community health services and NHS minor injury clinics

1.2.2.1 Community health services (general practice, paramedics, NHS walk-in centres, dental practitioners) and NHS minor injury clinics should refer patients who have sustained a head injury to a hospital A&E department, using the ambulance service if deemed necessary [see section 1.3.1], if any of the following is present.

• GCS less than 15 on initial assessment.
• Any loss of consciousness as a result of the injury.
• Any focal neurological deficit since the injury (examples include problems understanding, speaking, reading or writing; decreased sensation; loss of balance; general weakness; visual changes; abnormal reflexes; and problems walking).
• Any suspicion of a skull fracture or penetrating head injury since the injury (for example, clear fluid running from the ears or nose, black eye with no associated damage around the eyes, bleeding from one or both ears, new deafness in one or both ears, bruising behind one or both ears, penetrating injury signs, visible trauma to the scalp or skull of concern to the professional).
• Amnesia for events before or after the injury. The assessment of amnesia will not be possible in pre-verbal children and is unlikely to be possible in any child aged under 5 years).
• Persistent headache since the injury.
• Any vomiting episodes since the injury (clinical judgement should be used regarding the cause of vomiting in those aged less than or equal to 12 years, and whether referral is necessary).
• Any seizure since the injury.
• Any previous cranial neurosurgical interventions.
• A high-energy head injury (for example, pedestrian struck by motor vehicle, occupant ejected from motor vehicle, a fall from a height of greater than 1 metre or more than five stairs, diving accident, high-speed motor vehicle collision, rollover motor accident, accident involving motorised recreational vehicles, bicycle collision, or any other potentially high energy mechanism). A lower threshold for height of falls should be used when dealing with infants and young children (that is, aged less than 5 years).
• History of bleeding or clotting disorder.
• Current anticoagulant therapy such as warfarin.
• Current drug or alcohol intoxication.
• Age greater than or equal to 65 years.
• Suspicion of non-accidental injury.
• Continuing concern by the professional about the diagnosis.

[Amended]
1.2.2.2 In the absence of any the factors listed in 1.2.2.1, the professional should consider referral to A&E if any of the following factors are present depending on their own judgement of severity.

- Irritability or altered behaviour, particularly in infants and young children (that is, aged under 5 years).
- Visible trauma to the head not covered above but still of concern to the professional.
- Adverse social factors (for example, no one able to supervise the injured person at home).
- Continuing concern by the injured person or their carer about the diagnosis.

1.3 Transport from community health services and NHS minor injury clinics and pre-hospital management

1.3.1 Transport to A&E

1.3.1.1 Patients referred from community health services and NHS minor injury clinics should be accompanied by a competent adult during transport to A&E.

1.3.1.2 The referring professional should determine if an ambulance is required, based on the patient's clinical condition. If an ambulance is deemed not required, public transport and car are appropriate means of transport providing the patient is accompanied.

1.3.1.3 The referring professional should inform the destination hospital (by phone) of the impending transfer and in non-emergencies a letter summarising signs and symptoms should be sent with the patient.

1.3.2 Pre-hospital management

The following principles should be adhered to in the immediate care of patients who have sustained a head injury.

1.3.2.1 Patients who have sustained a head injury should initially be assessed and managed according to clear principles and standard.
practice as embodied in the Advanced Trauma Life Support (ATLS) course and for children the principles as outlined in the Advanced Paediatric Life Support (APLS)/European Paediatric Life Support (EPLS) course materials. **[NEW]** [replaces 1.3.2.1 in the original guideline]

1.3.2.2 Paramedics should be fully trained in the use of the adult and paediatric versions of the GCS and its derived score.

1.3.2.3 Paramedics should have some training in the detection of non-accidental injury and should pass this information to A&E personnel when the relevant signs and symptoms arise.

1.3.2.4 The first priority for those administering immediate care is to treat first the greatest threat to life and avoid further harm.

1.3.2.5 Patients who have sustained a head injury should be transported directly to a facility that has been identified as having the resources necessary to expeditiously assess and intervene to optimise outcome. It is expected that all acute hospitals accepting patients who have sustained a head injury should have these resources, and that these resources should be appropriate for the patient’s age.

1.3.2.6 Patients who have sustained a head injury and present with any of the following risk factors should have full cervical spine immobilisation attempted unless other factors prevent this:

- GCS less than 15 **on initial assessment in the emergency department**
- neck pain or tenderness
- focal neurological deficit
- paraesthesia in the extremities
- any other clinical suspicion of cervical spine injury **[Amended]**
1.3.2.7 Cervical spine immobilisation should be maintained until full risk assessment (including clinical assessment) (and imaging if deemed necessary) indicates it is safe to remove the immobilisation device. [Amended]

1.3.2.8 Standby calls to the destination A&E department should be made for all patients with a GCS less than or equal to 8, to ensure appropriately experienced professionals are available for their treatment and to prepare for imaging.

1.3.2.9 An alerting call to the destination A&E department should be made for all patients with a GCS less than 15.

1.4 Assessment and investigation in A&E

The main focus of A&E assessment for patients who have sustained a head injury should be the risk of clinically important brain injuries and injuries to the cervical spine and the consequent need for imaging. Due attention should also be paid to co-existing injuries and to other concerns the clinician may have (for example, non-accidental injury, possible non-traumatic aetiology such as seizure). Early imaging, rather than admission and observation for neurological deterioration, will reduce the time to detection of life-threatening complications and is associated with better outcomes.

1.4.1 A&E assessment

1.4.1.1 The priority for all A&E patients is the stabilisation of airway, breathing and circulation (ABC) before attention to other injuries.

1.4.1.2 Depressed conscious level should be ascribed to intoxication only after a significant brain injury has been excluded.

1.4.1.3 All A&E clinicians involved in the assessment of patients with a head injury should be capable of assessing the presence or absence of the risk factors in the guidance on patient selection and urgency for imaging (head and neck cervical spine – see later recommendations). Training should be available as required to ensure that this is the case.
1.4.1.4 Patients presenting to A&E with impaired consciousness (GCS less than 15) should be assessed immediately by a trained member of staff (for example, triage nurse).

1.4.1.5 In patients with a GCS less than or equal to 8 there should be early involvement of an anaesthetist or critical care physician to provide appropriate airway management, as described in sections 1.6.1.7 and 1.6.1.8, and to assist with resuscitation.

1.4.1.6 All patients presenting to A&E with a head injury should be assessed by triage by a trained member of staff within a maximum of 15 minutes of arrival at hospital. Part of this assessment should establish whether they are high risk or low risk for clinically important brain injury and/or cervical spine injury, using the guidance on patient selection and urgency for imaging (head and neck cervical spine – see later recommendations).

1.4.1.7 Patients found to be high risk on triage for clinically important brain injury and/or cervical spine injury should be assessed within 10 minutes of triage by an A&E clinician. Part of this assessment should fully establish the need to request CT imaging of the head and/or imaging of the cervical spine. The guidance on patient selection and urgency for imaging (head and cervical spine) should form the basis for the final decision on imaging after discussion with the radiology department. For recommendations on selection for and urgency of CT imaging of the head see recommendations 1.4.2.8 to 1.4.2.12. For recommendations on imaging of the cervical spine see recommendations 1.4.3.12 to 1.4.3.19.

[Amended]

1.4.1.8 Patients with head injury who are discovered to be at low risk for clinically important brain injury and/or cervical spine injury on initial triage should be assessed within a further hour by an A&E clinician. Part of this assessment should fully establish the need to request CT imaging of the head and/or imaging of the cervical spine. The
guidance on patient selection and urgency for imaging (head and cervical spine) should again form the basis for the final decision on imaging after discussion with the radiology department. See recommendations 1.4.2.8 to 1.4.2.12 (imaging of the head) and 1.4.3.12 to 1.4.3.19 (imaging of the cervical spine). [Amended]

1.4.1.9 Pain management is important. Indeed, pain can lead to a rise in intra-cranial pressure. Reassurance and splintage of limb fractures is helpful; catheterisation of a full bladder will reduce irritability. Significant pain should be treated with small doses of intravenous opiates titrated against clinical response and baseline cardiorespiratory measurements. [NEW] [Replaces recommendation 1.4.1.9 in NICE clinical guideline 4.]

1.4.1.10 Throughout the hospital episode, all care professionals should use a standard head injury proforma in their documentation when assessing and observing patients with head injury. A separate proforma for those under 16 years should be used. (Excellent proformas have been produced in previous guidelines from the Scottish Intercollegiate Guidelines Network and the Royal College of Surgeons of England. Areas to allow extra documentation should be included [for example, in cases of non-accidental injury]. Examples of the proformas that should be used in patients with head injury are provided on the NICE website www.nice.org.uk.

1.4.1.11 It is recommended that in-hospital observation of patients with a head injury, including all A&E observations, should only be conducted by professionals competent in the assessment of head injury.

1.4.1.12 Patients who have returned to an A&E department within 48 hours of transfer to the community with any persistent complaint relating to the initial head injury should be seen by or discussed with a senior clinician experienced in head injuries, and considered for a CT scan.
1.4.2 Investigations for clinically important brain injuries

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

1.4.2.2 For safety, logistic and resource reasons, MRI scanning is not currently indicated as the primary investigation for clinically important brain injury in patients who have sustained a head injury, although it is recognised that additional information of importance to the patient’s prognosis can sometimes be detected using MRI.

1.4.2.3 MRI is contraindicated in both head and cervical spine investigations unless there is absolute certainty that the patient does not harbour an incompatible device, implant or foreign body.

1.4.2.4 There should be appropriate equipment for maintaining and monitoring the patient within the MRI environment and all staff involved should be aware of the dangers and necessary precautions for working near an MRI scanner.

[Recommendation 1.4.2.5 in NICE clinical guideline 4 deleted]

1.4.2.5 Plain X-rays of the skull have no role in the diagnosis of significant brain injury. However, they are useful as part of the skeletal survey in children presenting with suspected non-accidental injury. [NEW]

1.4.2.6 For patients over 65 presenting out of hours it is safe to admit for effective over-night observation instead of initiating an immediate CT unless GCS< 15. [NEW]

1.4.2.7 Skull X-rays in conjunction with high-quality in-patient observation also have a role where CT scanning resources are unavailable.
Selection of patients for CT imaging of the head

For adults

1.4.2.8 Adult patients who have sustained a head injury and present with any one of the following risk factors should have CT scanning of the head immediately requested.

- GCS less than 13 on initial assessment in the emergency department.
- GCS equal to 13 or 14 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 otorrhoea, Battle’s sign).
- Post-traumatic seizure.
- Focal neurological deficit.
- More than one episode of vomiting.
- Amnesia for greater than 30 minutes of events before impact. [Amended] [information on children deleted; covered elsewhere]

1.4.2.9 CT should also be immediately requested in patients with any of the following risk factors, provided they have experienced some loss of consciousness or amnesia since the injury:

- Age greater than or equal to 65 years.
- Coagulopathy (history of bleeding, clotting disorder, current treatment with warfarin).
- Dangerous mechanism of injury (a pedestrian struck by a motor vehicle, an occupant ejected from a motor vehicle or a fall from a height of greater than 1 metre or five stairs). [information on children deleted; covered elsewhere]
For children

1.4.2.10 Children who have sustained a head injury and present with any one of the following risk factors should have an immediate CT request of the head:

- **History**
  - Witnessed loss of consciousness of >5 min duration
  - History of amnesia (either antegrade or retrograde) of >5 min duration
  - Abnormal drowsiness (defined as drowsiness in excess of that expected by the examining clinician)
  - 3 vomits after head injury (a vomit is defined as a single discrete episode of vomiting)
  - Suspicion of non-accidental injury (NAI, defined as any suspicion of NAI by the examining clinician)
  - Seizure after head injury in a patient who has no history of epilepsy

- **Examination**
  - Glasgow Coma Score (GCS)<14, or GCS<15 if <1 year old on assessment in the emergency department.
  - Suspicion of penetrating or depressed skull injury or tense fontanelle
  - Signs of a basal skull fracture (defined as evidence of blood or cerebrospinal fluid from ear or nose, panda eyes, Battles sign, haemotympanum, facial crepitus or serious facial injury)
  - Positive focal neurology (defined as any focal neurology, including motor, sensory, coordination or reflex abnormality)
  - Presence of bruise, swelling or laceration >5 cm if <1 year old

- **Mechanism**
  - High-speed road traffic accident either as pedestrian, cyclist or occupant (defined as accident with speed >40 m/h)
  - Fall of >3 m in height
  - High-speed injury from a projectile or an object
If none of the above variables are present, the patient is at low risk of intracranial pathology. [NEW]

[Rec 1.4.2.9 in NICE clinical guideline 4 deleted]

**Urgency in performing CT imaging of the head**

1.4.2.11 CT imaging of the head should be performed (that is, imaging carried out and results analysed) within one hour of the request having been received by the radiology department in those patients where imaging is requested because of any of the following risk factors.

- GCS less than 13 on initial assessment **in the emergency department**.
- GCS equal to 13 or 14 at two hours after the injury.
- Suspected open or depressed skull fracture.
- Any sign of basal skull fracture (haemotympanum, ‘panda’ eyes, cerebrospinal fluid otorrhoea, Battle’s sign).
- More than one episode of vomiting in adults. In children more than 3 vomiting episodes (clinical judgement should be used regarding the cause of vomiting in those aged less than or equal to 12 years, and whether imaging is necessary).
- Age greater than or equal to 65 years, providing that some loss of consciousness or amnesia has been experienced.
- Post-traumatic seizure.
- Coagulopathy (history of bleeding, clotting disorder, current treatment with warfarin) providing that some loss of consciousness or amnesia has been experienced.
- Focal neurological deficit. [Amended]

1.4.2.12 Patients who have any of the following risk factors and none of the risk factors in 1.4.2.11 should have their CT imaging performed within 8 hours of the injury (imaging should be performed immediately in these patients if they present 8 hours or more after their injury).
• Amnesia for greater than 30 minutes of events before impact (the assessment of amnesia will not be possible in pre-verbal children and is unlikely to be possible in any child aged less than 5 years).
• Dangerous mechanism of injury (a pedestrian struck by a motor vehicle, an occupant ejected from a motor vehicle or a fall from a height of greater than 1 metre or five stairs) providing that some loss of consciousness or amnesia has been experienced. A lower threshold for height of falls should be used when dealing with infants and young children (that is, aged less than 5 years).

1.4.3 Investigation for injuries to the cervical spine
1.4.3.1 The current investigations of choice for the detection of injuries to the cervical spine are three view plain radiographs of good technical quality.
1.4.3.2 Where it is not possible to achieve the cervical spine views desired with X-ray, CT imaging is indicated.
1.4.3.3 CT is also indicated in patients with severe head injury (GCS ≤8), if the plain film series is technically inadequate (for example, desired view unavailable), suspicious or definitely abnormal or if there is continued clinical suspicion of injury despite a normal X ray. [NEW]

[Rec 1.4.3.3 in NICE clinical guideline 4 deleted]
1.4.3.4 CT imaging of the cervical spine should be considered if the patient is having other body areas scanned for head injury/multi-region trauma, and a definitive diagnosis of cervical spine injury is required urgently.
1.4.3.5 As a minimum, CT should cover any areas of concern or uncertainty on plain film or clinical grounds.
1.4.3.6 With modern multislice scanners the whole cervical spine can be scanned at high resolution with ease and multiplanar reformatted...
images generated rapidly. Facilities for multiplanar reformatting and interactive viewing should be available.

1.4.3.7 MRI is indicated in the presence of neurological signs and symptoms referable to the cervical spine and if there is suspicion of vascular injury (for example, subluxation or displacement of the spinal column, fracture through foramen transversarium or lateral processes, posterior circulation syndromes).

1.4.3.8 MRI may add important information about soft tissue injuries associated with bony injuries demonstrated by plain films and/or CT.

1.4.3.9 MRI has a role in the assessment of ligamentous and disc injuries suggested by plain films, CT or clinical findings.

1.4.3.10 In CT, the occipital condyle region should be routinely reviewed on 'bone windows' for patients who have sustained a head injury. Reconstruction of standard head images onto a high-resolution bony algorithm is readily achieved with modern CT scanners.

1.4.3.11 In patients who have sustained high energy trauma or are showing signs of lower cranial nerve palsy, the results of initial imaging should be considered and particular attention should be paid to the region of the foramen magnum. If necessary, additional high resolution imaging for coronal and sagittal reformatting should be performed while the patient is on the scanner table.

Selection of patients for imaging of the cervical spine

1.4.3.12 Adult patients with any one of the following risk factors should have three view radiograph imaging of the cervical spine immediately requested.

- GCS less than 15 on initial assessment in the emergency department
- Paraesthesia in the extremities

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Focal neurological deficit

Not possible to test for range of motion in the neck (safe assessment of range of motion can be performed with the following: simple rear-end motor vehicle collision, sitting position in A&E, ambulatory at any time since injury, delayed onset of neck pain, absence of midline cervical spine tenderness).

Patient not able to actively rotate neck to 45 degrees to the left and right (if assessment is possible). [Amended]

1.4.3.13 Cervical spine imaging should also be immediately requested in the patients with the following risk factors provided they have some neck pain or tenderness.

• Age greater than or equal to 65 years
• Dangerous mechanism of injury (fall from greater than 1 metre or five stairs; axial load to head for example, diving; high-speed motor vehicle collision greater than 65 miles per hour; rollover motor accident; ejection from a motor vehicle; accident involving motorised recreational vehicles; bicycle collision). A lower threshold for height of falls should be used when dealing with infants and young children (that is, aged less than 5 years).

1.4.3.14 Children aged 10 years or more can be treated as adults for the purposes of cervical spine imaging.

1.4.3.15 In children under 10 years, because of the increased risks associated with irradiation, particularly to the thyroid gland, and the generally lower risk of significant spinal injury, CT of the cervical spine should only be used in exceptional circumstances for example, cases where patients have a severe head injury (GCS ≤ 8), or where there is a strong suspicion of injury despite normal plain films, or cases where there is a strong suspicion of injury and plain films are inadequate). [NEW]

[Recommendations 1.4.3.15 and 1.4.3.19 in NICE clinical guideline 4 deleted]
1.4.3.16 Children under 10 years should receive anterior/posterior and lateral views without an anterior/posterior peg view.

1.4.3.17 Abnormalities or uncertainties in those under 10 years should be clarified by CT imaging. When minor trauma is associated with subsequent torticollis the plain films are almost uninterpretable; CT is very helpful in this situation. [Amended]

Urgency in performing cervical spine imaging

1.4.3.18 Imaging of the cervical spine should be performed within 1 hour of a request having been received by the radiology department. Where a request for urgent head CT (that is, within 1 hour) has also been received, the cervical spine imaging should also be carried out within 1 hour. [Amended]

1.4.3.19 Children less than 10 years old who have a GCS of 8 or less should have a CT of the cervical spine within 1 hour of presentation. CT should also be undertaken when the GCS is between 14 and 9 if there is high clinical concern (ie focal neurological deficit or paraesthesia in the extremities). Finally, CT should be undertaken in any child when an x ray is found to be inadequate or there is continuing clinical concern. [NEW]

1.4.4 Investigations of non-accidental injury in children

1.4.4.1 Owing to the distinct pattern of injuries involved, skull X-ray as part of a series of plain x-rays (skeletal survey), along with other well-established examinations (for example, ophthalmoscopic examination for retinal haemorrhage; examination for pallor, anaemia, tense fontanelle) and investigations (for example, CT, MRI), has a role in detecting non-accidental head injuries in children (that is, aged less than 12 years). A clinician with expertise in non accidental injury must be involved in any suspected case of non-accidental injury. [NEW]
1.4.5 Radiation exposure management

1.4.5.1 In line with good radiation exposure practice every effort should be made to minimise radiation dose during imaging of the head and cervical spine, while ensuring that image quality and coverage is sufficient to achieve an adequate diagnostic study.

1.4.5.2 Emerging evidence suggests that plain x rays of the cervical spine may fail to identify clinically important injury. CT is therefore recommended in those most at risk. In children this risk is less and the potential damage from radiation greater. The guidelines reflect this concern by restricting the recommendations for CT in children to those who have indicators of more serious injury. [NEW]

1.4.6 Involving the neurosurgeon

1.4.6.1 The care of all patients with new, surgically significant abnormalities on imaging should be discussed with a neurosurgeon. The definition of ‘surgically significant’ should be developed by local neurosurgical centres and agreed with referring hospitals. An example of a neurosurgical referral letter is provided on the NICE website www.nice.org.uk.

1.4.6.2 Regardless of imaging, other reasons for discussing a patient’s care plan with a neurosurgeon include:

- persisting coma (GCS less than or equal to 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 injury
- a cerebrospinal fluid leak.
1.5 Admission

1.5.1 The following patients meet the criteria for admission to hospital following a head injury.

- Patients with new, clinically significant abnormalities on imaging.
- Patients who have not returned to GCS equal to 15 after imaging, regardless of the imaging results.
- When a patient fulfils the criteria for CT scanning but this cannot be done within the appropriate period, either because CT is not available or because the patient is not sufficiently co-operative to allow scanning.
- Continuing worrying signs (for example, persistent vomiting, severe headaches) of concern to the clinician.
- Other sources of concern to the clinician (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, cerebrospinal fluid leak).
1.5.2 Some patients may require an extended period in a recovery setting due to the use of sedation or general anaesthetic during CT imaging. These patients should not normally require admission.

1.5.3 Patients with multiple injuries should be admitted under the care of the team that is trained to deal with their most severe and urgent problem.

1.5.4 In circumstances where a patient with a head injury requires hospital admission, it is recommended that the patient only be admitted under the care of a consultant who has been trained in the management of this condition during his/her higher specialist training.

1.5.5 It is recommended that in-hospital observation of patients with a head injury should only be conducted by professionals competent in the assessment of head injury.

1.6 Transfer from secondary settings to a neuroscience unit

1.6.1 Transfer of adults

1.6.1.1 Local guidelines on the transfer of patients with head injuries should be drawn up between the referring hospital trusts, the neuroscience unit and the local ambulance service. These should be consistent with established national guidelines. Details of the transfer of the responsibility for patient care should also be agreed. [Amended]

1.6.1.2 There should be a designated consultant in the referring hospital with responsibility for establishing arrangements for the transfer of patients with head injuries to a neuroscience unit and another Consultant at the neuroscience unit with responsibility for establishing arrangements for communication with referring hospitals and for receipt of patients transferred. [Amended]
1.6.1.3 Patients with head injuries 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, the drugs and equipment they will use and working in the confines of an ambulance (or helicopter if appropriate). They must have a dedicated and adequately trained assistant. They should be provided with appropriate clothing for the transfer, medical indemnity and personal accident insurance. [Amended]

1.6.1.4 The transfer team should be provided with a means of communication with their base hospital and the neurosurgical unit during the transfer. A portable phone may be suitable providing it is not used in close proximity (that is, within 1 metre) of medical equipment prone to electrical interference (for example, infusion pumps).

1.6.1.5 While it is understood that transfer is often urgent, initial resuscitation and stabilisation of the patient must be completed and comprehensive monitoring established before transfer to avoid complications during the journey. A patient persistently hypotensive despite resuscitation should not be transported until the cause of the hypotension has been identified and the patient stabilised. [Amended]

1.6.1.6 All patients with a GCS less than or equal to 8 requiring transfer to a neuroscience unit should be intubated and ventilated as should any patients with the indications detailed in section 1.6.1.7. [Amended]

1.6.1.7 Intubation and ventilation should be used immediately in the following circumstances:

- Coma – not obeying commands, not speaking, not eye opening (that is, GCS less than or equal to 8)
- Loss of protective laryngeal reflexes
• Ventilatory insufficiency as judged by blood gases: hypoxaemia (PaO$_2$ less than 9 kPa on air or less than 13 kPa on oxygen) or hypercarbia (PaCO$_2$ greater than 6 kPa)
• Spontaneous hyperventilation causing PaCO$_2$ less than 4 kPa)
• Respiratory arrhythmia [Amended]

1.6.1.8 Intubation and ventilation should be used before the start of the journey in the following circumstances:

• Significantly deteriorating conscious level (one or more points on the motor score), even if not coma
• Bilateral fractured mandible
• Copious bleeding into mouth (for example, from skull base fracture)
• Seizures [Amended]

1.6.1.9 An intubated patient should be ventilated with muscle relaxation and appropriate sedation and analgesia. Aim for a PaO$_2$ greater than 13 kPa, PaCO$_2$ 4.5 to 5.0 kPa unless there is clinical or radiological evidence of raised intracranial pressure when more aggressive hyperventilation is justified to a PaCO$_2$ of not less than 4 kPa. If hyperventilation is used the inspired oxygen concentration should be increased [Amended]

1.6.1.10 Education, training and audit are crucial to improving standards of transfer; appropriate time and funding for these activities should be provided.

1.6.1.11 Carers and relatives should have as much access to the patient as is practical during transfer and be fully informed on the reasons for transfer and the transfer process.

1.6.2 Transfer of children

1.6.2.1 The recommendations in section 1.6.1 above were written for adults but the principles apply equally to children and infants,
providing that the paediatric modification of the Glasgow Coma Scale is used.

1.6.2.2 Service provision in the area of paediatric transfer to tertiary care should also follow the principles outlined in the National Service Framework for Paediatric Intensive Care. These do not conflict with the principles outlined in 1.6.1.

1.6.2.3 Transfer of a child or infant to a specialist neurosurgical unit should be undertaken by staff experienced in the transfer of critically ill children.

1.6.2.4 Families should have as much access to their child as is practical during transfer and be fully informed on the reasons for transfer and the transfer process.

1.6.2.5 A multiply injured child should not be transferred to a service that is unable to deal with other aspects of trauma. [NEW]

1.6.3 Transfer of isolated severely head injured patients

1.6.3.1 Isolated severely head injured patients (GCS 8 or less) should ideally be transferred directly to a neurosciences unit to receive treatment irrespective of any need for a neurosurgical operation instead of receiving treatment at an acute care centre for initial assessment. [NEW]

1.7 Observation of admitted patients

1.7.1 Training in observation

1.7.1.1 Medical, nursing and other staff caring for patients with head injury admitted for observation should all be capable of performing the observations listed in 1.7.2 and 1.7.5.

1.7.1.2 The acquisition and maintenance of observation and recording skills require dedicated training and this should be available to all relevant staff.
1.7.1.3 Specific training is required for the observation of infants and young children.

1.7.2 Minimum documented observations

1.7.2.1 For patients admitted for head injury observation the minimum acceptable documented neurological observations are: GCS; pupil size and reactivity; limb movements; respiratory rate; heart rate; blood pressure; temperature; blood oxygen saturation.

1.7.3 Frequency of observations

1.7.3.1 Observations should be performed and recorded on a half-hourly basis until GCS equal to 15 has been achieved. The minimum frequency of observations for patients with GCS equal to 15 should be as follows, starting after the initial assessment in A&E:

- half-hourly for two hours;
- then one hourly for four hours;
- then two hourly thereafter.

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

1.7.4 Observation of children and infants

1.7.4.1 Observation of infants and young children (that is, aged less than 5 years) is a difficult exercise and therefore should only be performed by units with staff experienced in the observation of infants and young children with a head injury. Infants and young children may be observed in normal paediatric observation settings, as long as staff have the appropriate experience.
1.7.5 Patient changes requiring review while under observation

1.7.5.1 Any of the following examples of neurological deterioration should prompt urgent reappraisal by the supervising doctor.

- Development of agitation or abnormal behaviour.
- A sustained (that is, for at least 30 minutes) drop of one point in GCS level (greater weight should be given to a drop of one point in the motor score of the GCS).
- Any drop of greater than two points in GCS level regardless of duration or GCS sub-scale.
- Development of severe or increasing headache or persisting vomiting.
- New or evolving neurological symptoms or signs such as pupil inequality or asymmetry of limb or facial movement.

1.7.5.2 To reduce inter-observer variability and unnecessary referrals, a second member of staff competent to perform observation should confirm deterioration before involving the supervising doctor. This confirmation should be carried out immediately. Where a confirmation cannot be performed immediately (for example, no staff member available to perform the second observation) the supervising doctor should be contacted without the confirmation being performed.

Imaging following confirmed patient deterioration

1.7.5.3 An immediate CT scan should be considered in patients confirmed as having any of the changes noted in 1.7.5.1 above.

Further imaging if GCS equal to 15 not achieved at 24 hours

1.7.5.4 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.
1.8 Discharge

1.8.1 General

Discharge and GCS status

1.8.1.1 No patients presenting with head injury should be transferred to the community until they have achieved GCS equal to 15, or normal consciousness in infants and young children as assessed by the paediatric version of the GCS.

Discharge advice

1.8.1.2 All patients with any degree of head injury who are deemed safe for appropriate transfer to the community from A&E or the observation ward should receive verbal advice and a written head injury advice card. The details of the card should be discussed with the patients and their carers. If necessary (for example, patients with literacy problems, visual impairment or speaking languages without a written format), other formats (for example, tapes) should be used to communicate this information. Communication in languages other than English should also be facilitated.

1.8.1.3 The risk factors outlined in the card should be the same as those used in the initial community setting to advise patients on A&E attendance. Patients and carers should also be alerted to the possibility that some patients may make a quick recovery, but go on to experience delayed complications. Instructions should be included on contacting community services in the event of delayed complications.

1.8.1.4 Patients who presented to A&E with drug or alcohol intoxication and are now fit for discharge should receive information and advice on alcohol or drug misuse.

1.8.1.5 Suggested written advice cards for patients and carers are provided in appendix C.
Discharge of patients with no carer at home

1.8.1.6 All patients with any degree of head injury should only be transferred to their home if it is certain that there is somebody suitable at home to supervise the patient. Patients with no carer at home should only be discharged if suitable supervision arrangements have been organised, or when the risk of late complications is deemed negligible.

1.8.2 Discharge of specific patient groups

Low-risk patients with GCS equal to 15

1.8.2.1 If CT is not indicated on the basis of history and examination the clinician may conclude that the risk of clinically important brain injury to the patient is low enough to warrant transfer to the community, as long as no other factors that would warrant a hospital admission are present (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, cerebrospinal fluid leak) and there are appropriate support structures for safe transfer to the community and for subsequent care (for example, competent supervision at home).

Patients with normal imaging of the head

1.8.2.2 After normal imaging of the head, the clinician may conclude that the risk of clinically important brain injury requiring hospital care is low enough to warrant transfer to the community, as long as the patient has returned to GCS equal to 15, and no other factors that would warrant a hospital admission are present (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, cerebrospinal fluid leak) and there are appropriate support structures for safe transfer to the community and for subsequent care (for example, competent supervision at home).

Patients with normal imaging of the cervical spine

1.8.2.3 After normal imaging of the cervical spine the clinician may conclude that the risk of injury to the cervical spine is low enough to
warrant transfer to the community, as long as the patient has returned to GCS equal to 15 and their clinical examination is normal, and no other factors that would warrant a hospital admission are present (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, cerebrospinal fluid leak) and there are appropriate support structures for safe transfer to the community and for subsequent care (for example, competent supervision at home).

Patients admitted for observation

1.8.2.4 Patients admitted after a head injury may be transferred to the community after resolution of all significant symptoms and signs providing they have suitable supervision arrangements at home.

Patients at risk of non-accidental injury

1.8.2.5 No infants or children presenting with head injuries that require imaging of the head or cervical spine should be transferred to the community until assessed by a clinician experienced in the detection of non-accidental injury.

1.8.2.6 It is expected that all personnel involved in the triage and assessment of infants and children with head injury should have training in the detection of non-accidental injury.

1.8.3 Outpatient appointments

1.8.3.1 Every patient who has undergone imaging of their head and/or been admitted to hospital (that is, those initially deemed to be at high risk for clinically important brain injury) should be routinely referred to their GP for follow-up within a week after discharge.

1.8.3.2 When a person who has undergone imaging of the head and/or been admitted to hospital experiences persisting problems, there should be an opportunity available for referral from primary care to an out-patient appointment with a professional trained in assessment and management of sequelae of brain injury (for
example, clinical psychologist, neurologist, neurosurgeon, specialist in rehabilitation medicine).

1.8.4 Advice about long-term problems and support services
1.8.4.1 All patients and their carers should be made aware of the possibility of long-term symptoms and disabilities following head injury and should be made aware of the existence of services that they could contact should they experience long-term problems. Details of support services should be included on patient discharge advice cards. Patients should also be advised to contact their doctor about these problems.

1.8.5 Communication with community services
1.8.5.1 A communication (letter or e-mail) should be generated for all patients who have attended A&E with a head injury, and sent to the patient’s GP within one week of the end of the hospital episode. This letter should include details of the clinical history and examination. This letter should be open to the person or their carer, or a copy should be given to them.

1.8.5.2 A communication (letter or e-mail) should be generated for all children who received head or cervical spine imaging, and sent to the relevant general practitioner and school nurse for all school aged children within one week of the end of the hospital episode. This letter should include details of the clinical history and examination. [Amended]

1.8.5.3 A communication (letter or e-mail) should be generated for pre-school children who received head or cervical spine imaging, and sent to the general practitioner and health visitor within 1 week of the end of the hospital episode. This letter should include details of the clinical history and examination. [Amended]
2 Notes on the scope of the guidance

NICE guidelines are developed in accordance with a scope that defines what the guideline will and will not cover. The scope of this guideline is available from www.nice.org.uk/page.aspx?o=267085

The guideline covers the care provided by primary care, ambulance and A&E staff who have direct contact with and make decisions concerning the care of patients who present with suspected or confirmed head injury. This includes:

- assessment and prehospital management,
- transfer to hospital,
- assessment and investigation in A&E
- admission to secondary care
- transfer to a neuroscience unit
- discharge of patients.

The guideline does not address management in the intensive care or neurosurgical unit, but provides guidance on the appropriate circumstances in which to request a neurosurgical opinion. Neither does it address investigative or surgical techniques, but it does make recommendations about the appropriate use of imaging of the head and cervical spine.

After the original guideline (clinical guideline 4) was published in 2003, new studies were published containing some changes in criteria with respect to CT scanning. These studies were reviewed for the update. In addition, the update addressed some issues on interpretation of the original guideline recommendations that were raised in comments received by NICE.
How this guideline was developed

NICE commissioned the National Collaborating Centre for Acute Care to develop the original guideline (NICE clinical guideline 4) and this update. The Centre established Guideline Development Groups (see appendix A), which reviewed the evidence and developed the recommendations. An independent Guideline Review Panel oversaw the development of the guideline (see appendix B).

There is more information in the booklet: ‘The guideline development process: an overview for stakeholders, the public and the NHS’ (second edition, published April 2006), which is available from www.nice.org.uk/guidelinesprocess or by telephoning 0870 1555 455 (quote reference N0472).

3 Implementation

The Healthcare Commission assesses the performance of NHS organisations in meeting core and developmental standards set by the Department of Health in ‘Standards for better health’, issued in July 2004. Implementation of clinical guidelines forms part of the developmental standard D2. Core standard C5 says that national agreed guidance should be taken into account when NHS organisations are planning and delivering care.

NICE has developed tools to help organisations implement this guidance (listed below). These are available on our website (www.nice.org.uk/CGXXX).

[NICE to amend list as needed at time of publication]

- Slides highlighting key messages for local discussion.
- Costing tools
  - costing report to estimate the national savings and costs associated with implementation
  - costing template to estimate the local costs and savings involved.
Implementation advice on how to put the guidance into practice and national initiatives which support this locally.

Audit criteria to monitor local practice.

4 Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future. The Guideline Development Group’s full set of research recommendations is detailed in the full guideline (see section 5).

4.1 Transport to a specialist neurosciences centre compared to transport to the nearest acute centre

Is the clinical outcome of head injury patients with a reduced level of consciousness improved by direct transport from the scene of injury to a tertiary centre with neurosciences facilities compared with the outcome of those who are transported initially to the nearest hospital without neurosurgical facilities?

Why this is important

Limited evidence shown in various studies has shown that patients do better in terms of outcome if they are transported direct to a neurosciences centre when compared to those who are taken to the nearest DGH. This evidence however does not appear to have influenced current practice.

Guidelines are required for those working in the prehospital arena which define those patients who have sustained an head injury would be better served by being transported direct to a neurosciences centre.

Currently patients are either always transported to the nearest DGH as is the case in most land vehicle deployment or in some organisations especially those involving helicopter emergency medical services the decision is left to the judgement of the clinicians at the scene. Those patients transported to the nearest DGH suffer a significant delay in receiving definitive treatment for their head injury.
Information from this study will define which patients should be transported direct to a neurosciences centre bypassing the nearest hospital.

Guidance will be required to define the patient population in terms of their injuries. For example, researchers may focus on isolated injuries or head injuries associated with multi trauma. Further specification about what level of consciousness would be suitable for primary transfer to a neurosciences unit would be required.

4.2 Clinical decision rules on the selection of head-injured infants and children for CT scanning

Research is needed to establish the validity of previously derived clinical decision rules on the selection of head injured infants and children for CT scanning to exclude significant brain injury.

Why this is important

The 2002 NICE guidelines recommended that children be selected for CT scanning on the basis of the Canadian Head CT rule, a clinical decision rule derived and validated in adults. This was due to the absence of such a rule derived in children. However since this date the CHALICE rule has been published which presents a clinical decision rule derived in a large group of children and infants from the UK with good sensitivity and specificity.

However, clinical decision rules often provide an overestimate of their performance when applied to new populations. We now recommend the usage of the CHALICE rule for all patients suffering a head injury in the UK, with the caveat that a validation of the rule in a new population of head injured UK patients be urgently undertaken to ensure its reliability and reproducibility.

Such a study is now essential and performing a validation of the CHALICE study in a novel UK population may easily be performed in a 1–2 year timeframe with acceptable costs, and considerable benefits in terms of assuring clinicians as to the safety of this novel rule.
4.3 **Criteria for lesions**

Research is needed to develop consensus on criteria for lesions not currently considered to be surgically significant following imaging of a patient with head injury.

**Why this is important**

One option in the management of traumatic intracerebral haemorrhage (TICH) and cerebral contusions (CC) is to monitor the patient clinically or with intracranial pressure monitoring and other forms of brain tissue monitoring such as brain tissue oxygen (BtO2) or microdialysis. When the patient deteriorates, s/he is rushed to the operating theatre. The problem is that this approach has never been validated in a prospective randomised controlled trial (PRCT). Waiting until there is deterioration in the level of consciousness (LOC) or until there is deterioration in the monitoring parameters builds delay into the management and results in secondary brain damage occurring and becoming established prior to surgery in all such cases. The principle of early surgical evacuation of spontaneous intracerebral haemorrhage (SICH) has been investigated in the surgical trial in intracerebral haemorrhage (STICH) and reported in the Lancet (2005). The results of such a PRCT in TICH would fundamentally alter the recommendations made by NICE, in terms of which patients should be referred to neurosurgery and, more importantly, how they should be managed there. There is no Class I evidence about what to do with these patients and the need for such a PRCT in head injured patients is urgent. This research question should immediately be put to UK research funding bodies.

4.4 **Outcomes of patients who do not require operative neurosurgical intervention**

Do patients with significant traumatic brain injury who do not require operative neurosurgical intervention at presentation, but are still cared for in specialist neurosciences centres, have improved clinical outcomes when compared to similar patients who are treated in non-specialist centres?
Why this is important
Traumatic brain injury (TBI) is amongst the most important causes of death in young adults, with an overall mortality for severe TBI of over 50%. TBI care consumes one million acute hospital bed-days, and over 15,000 ICU bed-days annually, and patients who do survive significant TBI experience an enormous burden of long-term physical disability, neurocognitive deficits, and neuropsychiatric sequelae. The financial impact is significant: the NHS spends over £1 billion on just the acute hospital care of the 10,000 patients with significant TBI. The costs of rehabilitation and community care are difficult to estimate, but probably total many multiples of the figure provided for acute care. These considerations make TBI a national healthcare priority and its outcome impact is consistent with its inclusion in the National Service Framework for Long-Term Neurological Conditions.

Current referral of patients with acute traumatic brain injury practice is still dominated in many parts of the United Kingdom by the need for operative neurosurgical intervention at presentation. This may be inappropriate, since many patients with severe head injury have evidence of raised intracranial pressure in the absence of surgical lesions, and suffer morbidity and mortality equal to those with surgical lesions. Further, several studies provide strong circumstantial evidence that managing such ‘non-surgical’ patients in specialist neurosciences centres may result in substantial improvements in mortality and functional outcome, probably due to specialist expertise in areas of non-operative management, such as neurocritical care. However, these results may be confounded by case-mix effects and referral bias, and the cost effectiveness of such specialist management remains uncertain. There is a strong case to address this question in the context of a formal study, since a change in practice could have a major impact on death and disability in a condition that is a major contributor to mortality in healthy young adults. Importantly, the results of such a study could fundamentally alter the recommendations made by NICE, in terms of where patients with head injury are treated within the healthcare system, and result in better optimised (and potentially more cost effective) patient flows within the NHS.
The available evidence in this area has been addressed in the systematic review that contributed to the revision of NICE guidelines on the early management of head injury. This review could find no high-quality clinical evidence on the topic. This is unsurprising, since any study that addressed these issues would have to be undertaken within the context of a healthcare system and include ambulance services, district general hospitals and neuroscience referral centres. Such a study would therefore require the organisational backing of a body such as NICE, and careful design to account for confounds and biases. However, we believe that given careful design, such a study would be both ethically and logistically feasible. The patient group is well defined, and adequate numbers would be available to provide a definitive result within a reasonable time frame. While circumstantial evidence may support transfer of such patients to neurosciences centres, current practice is not influenced by this view in many regions, and many would argue that there is still clinical equipoise in this area. There are clear risks from transfer, and there could be clear harm, both in terms of clinical outcome and health economics, if the anticipated benefits were not realised. On the other hand, if the benefits from observational studies were confirmed by the trial, the resulting changes in management that could potentially reduce case mix adjusted mortality by 26% and increase the incidence of favourable outcome in survivors by nearly 20%.

4.5 Long-term sequelae

Research is needed to summarise and identify the optimal predictor variables for long-term sequelae following mild traumatic brain injury.

Why this is important

We performed a review of the literature in this area, repeated in this update process. While 394 studies were identified that attempted to use a wide range of variables and tests to predict a range of longer term outcome measures, no robust clinical decision tools has successfully been derived and validated to identify patients at the time of injury who could be considered for follow-up due to a higher risk of long-term sequelae. A systematic review of the literature would summarise and identify the optimal predictor variables for
such a clinical decision rule and also identify the optimal outcome variables, thus laying the foundation for a derivation cohort study.

The derivation cohort study to create this clinical decision rule could potentially be conducted in conjunction with the validation of the CHALICE rule, with follow up of patients involved in this study at 6 months to 1 year. This would ensure optimal value for money for funders and ensure good results in a large cohort of patients. Separate studies could also be performed in adults but the initial study may in fact be more urgent in the childhood population.

Identification of patients likely to suffer from long-term sequelae will allow targeted research regarding responsiveness to, or effectiveness of focused rehabilitation programmes. Preventative action could potentially be taken, thus reducing the strain on resources further down the care pathway. Furthermore, patient outcomes could potentially be improved by early identification and treatment (both curative and preventive) of problems. However, further research is required before we can be certain that a robust framework exists with which to cope with individuals identified by the clinical prediction rule proposed above.
5 Other versions of this guideline

5.1 Full guideline
The full guideline, 'Head Injury: triage, assessment, investigation and early management of head injury in infants, children and adults' contains details of the methods and evidence used to develop the guideline. It is published by the National Collaborating Centre for Acute Care, and is available from [To be added after publication], our website (www.nice.org.uk/CGXXXfullguideline) and the National Library for Health (www.nlh.nhs.uk). [Note: these details will apply to the published full guideline.]

5.2 Quick reference guide
A quick reference guide for healthcare professionals is available from www.nice.org/CGXXXquickrefguide

For printed copies, phone the NHS Response Line on 0870 1555 455 (quote reference number N1XXX). [Note: these details will apply when the guideline is published.]

5.3 ‘Understanding NICE guidance’
Information for patients and carers (‘Understanding NICE guidance’) is available from www.nice.org.uk/CGXXXpublicinfo

For printed copies, phone the NHS Response Line on 0870 1555 455 (quote reference number N1XXX). [Note: these details will apply when the guideline is published.]

6 Related NICE guidance

- To be added.

- The original NICE guideline on head injury, published in June 2003, is available from www.nice.org.uk/CG004
7 Updating the guideline

NICE clinical guidelines are updated as needed so that recommendations take into account important new information. We check for new evidence 2 and 4 years after publication, to decide whether all or part of the guideline should be updated. If important new evidence is published at other times, we may decide to do a more rapid update of some recommendations.
Appendix A: The Guideline Development Groups

2003 (NICE clinical guideline 4)

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Appendix B: The Guideline Review Panel

The Guideline Review Panel is an independent panel that oversees the development of the guideline and takes responsibility for monitoring adherence to NICE guideline development processes. In particular, the panel ensures that stakeholder comments have been adequately considered and responded to. The Panel includes members from the following perspectives: primary care, secondary care, lay, public health and industry.

[NICE to add]
The following appendices will be included in the updated guideline (see NICE clinical guideline 4 for details).

Appendix C: Suggested written discharge advice cards

Appendix D. The Glasgow Coma Scale for adults

Appendix E. Paediatric version of the Glasgow Coma Scale