

Head injury

**Triage, assessment, investigation and early
management of head injury in infants,
children and adults**

Clinical Guideline 4

June 2003

Developed by the National
Collaborating Centre for Acute Care

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Issue date: June 2003

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This guidance is written in the following context:

This guidance represents the view of the Institute, which was arrived at after careful consideration of the evidence available. Health professionals are expected to take it fully into account when exercising their clinical judgment. The guidance does not, however, override the individual responsibility of health professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

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This guideline addresses the triage, assessment, investigation and early management of head injury.

The guidance in Section 1 is evidence based. The grading scheme used for the recommendations (A, B, C, D) is described in Appendix A; 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 (see Section 5).

To support the use of this guideline, observation proformas, a sample referral letter, and suggested discharge advice are available from the NICE website (www.nice.org.uk). These can be downloaded and adapted for use as necessary.

1 Guidance

Definitions

For the purposes of this guideline, 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 guideline 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’.

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 G and H. Good practice in the use of the Glasgow Coma Scale and Score should be adhered to at all times, following the principles below.

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| 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). | D |
| 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). | D |
| 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. | D |
| 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. | D |
| 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 H). | D |

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.

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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 1.2.2. Training should be available as required to ensure head injury triage accuracy in paramedics, GPs, nurse practitioners and dentists.

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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 Carers and relatives should be encouraged to talk and make physical contact (for example, holding hands) with the patient, although it is important for relatives and friends not to feel that they have to spend many hours at the bedside. It is important that they also have a break and sleep from time to time. This may be an opportune moment to mention patient support organisations and introduce their literature.
- 1.1.4.5 There should be a board/area displaying leaflets or contact details for patient support organisations either locally or nationally to enable family members to gather further information.

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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 under 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).

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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 under 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 under 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 at any time since injury.
- 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 motorized 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 under 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.

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1.2.2.2 In the absence of 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.

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- 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 to A&E 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.

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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 to be required, public transport and car are appropriate means of transport providing the patient is accompanied.

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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.

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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) system and for children the advanced paediatric life support (APLS) system.

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| 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. | D |
| 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. | D |
| 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. | D |
| 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. | D |
| 1.3.2.6 | <p>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:</p> <ul style="list-style-type: none"> • GCS less than 15 at any time since the injury • neck pain or tenderness • focal neurological deficit • paraesthesia in the extremities • any other clinical suspicion of cervical spine injury. | D |
| 1.3.2.7 | Cervical spine immobilisation should be maintained until full risk assessment (and imaging if deemed necessary) indicates it is safe to remove the immobilisation device. | D |
| 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. | D |
| 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. | D |

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

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| 1.4.1.1 | The priority for all A&E patients is the stabilisation of airways, breathing and circulation (ABC) before attention to other injuries. | D |
| 1.4.1.2 | Depressed conscious level should be ascribed to intoxication only after a significant brain injury has been excluded. | D |
| 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 cervical spine – see later recommendations). Training should be available as required to ensure that this is the case. | D |
| 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). | D |
| 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 1.6.1.6 and 1.6.1.7, and to assist with resuscitation. | D |
| 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 cervical spine – see later recommendations). | D |

- 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 – see later recommendations.
- 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.
- 1.4.1.9 In principle patients with head injury should not receive systemic analgesia until fully assessed so that an accurate measure of consciousness and other neurological signs can be made. Local anaesthetic should be delivered for fractured limbs or other painful injuries.
- 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 proformas used for 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.

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1.4.2 Investigations for clinically important brain injuries

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| 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. | A |
| 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. | D |
| 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. | D |
| 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. | D |
| 1.4.2.5 | Skull X-rays have a role in the detection of non-accidental injury in children (see 1.4.4). | D |
| 1.4.2.6 | Skull X-rays in conjunction with high-quality in-patient observation also have a role where CT scanning resources are unavailable. | D |

Selection of patients for CT imaging of the head

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| 1.4.2.7 | <p>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.</p> <ul style="list-style-type: none">• GCS less than 13 at any point since the injury.• GCS equal to 13 or 14 at 2 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).• Post-traumatic seizure.• Focal neurological deficit.• More than one episode of vomiting (clinical judgement should be used regarding the cause of vomiting in those aged 12 years or younger, and whether imaging is necessary).• 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 under 5 years. | B |
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1.4.2.8 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:

B

- 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). A lower threshold for height of falls should be used when dealing with infants and young children (that is, aged under 5 years).

Imaging of the head in children and infants

1.4.2.9 Validated adult rules on imaging of the head may be safely used in children and infants.

D

Urgency in performing CT imaging of the head

1.4.2.10 CT imaging of the head should be performed (that is, imaging carried out and results analysed) within 1 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.

B

- GCS less than 13 at any point since the injury.
- GCS equal to 13 or 14 at 2 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 (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.

1.4.2.11 Patients who have any of the following risk factors and none of the risk factors in 1.4.2.10 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).

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- 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 under 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 under 5 years).

1.4.3 Investigations 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.

B

1.4.3.2 Where it is not possible to achieve the cervical spine views desired with X-ray, CT imaging is indicated.

B

1.4.3.3 CT is also indicated 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 study.

B

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.

B

1.4.3.5 As a minimum, CT should cover any areas of concern or uncertainty on plain film or clinical grounds.

B

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.

B

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| 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). | B |
| 1.4.3.8 | MRI may add important information about soft tissue injuries associated with bony injuries demonstrated by plain films and/or CT. | B |
| 1.4.3.9 | MRI has a role in the assessment of ligamentous and disc injuries suggested by plain films, CT or clinical findings. | B |
| 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. | B |
| 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. | B |

Selection of patients for imaging of the cervical spine

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| 1.4.3.12 | <p>Patients with any one of the following risk factors should have three-view radiograph imaging of the cervical spine immediately requested.</p> <ul style="list-style-type: none"> • GCS less than 15 at the time of assessment. • Paraesthesia in the extremities. • 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). | A |
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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.

A

- 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 under 5 years).

Cervical spine imaging of infants and children

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

D

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 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).

D

1.4.3.16 Children under 10 years should receive anterior/posterior and lateral views without an anterior/posterior peg view.

D

1.4.3.17 Abnormalities or uncertainties in those under 10 years should be clarified by CT imaging. Minor trauma associated with subsequent torticollis results in plain films that are almost uninterpretable and CT is very helpful in this situation.

D

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 be carried out immediately.

D

Using adult rules with infants and children

- 1.4.3.19 As the best evidence on selecting patients with head injury for imaging exists for adults, and children and infants have a lower risk of brain and cervical spine injury than adults, validated adult rules on imaging of the head and cervical spine may be safely used in children and infants.

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1.4.4 Investigations for non-accidental injury in children

- 1.4.4.1 Due 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, those aged under 12 years).

D

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 CT imaging of the cervical spine should only be used in exceptional circumstances in children aged under 10 years.

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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

D

D

- 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.

D

1.5 Admission

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

D

- 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 of concern to the clinician (for example, persistent vomiting, severe headaches).
- 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.

D

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.

D

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.

D

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.

D

1.6 Transfer from secondary to tertiary care settings

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 and the neurosurgical unit and should be consistent with established national guidelines. Details of the transfer of the responsibility for patient care should also be agreed. | D |
| 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 neurosurgical unit and another consultant at the neurosurgical unit with responsibility for establishing arrangements for communication with referring hospitals and for receipt of patients transferred. | D |
| 1.6.1.3 | Patients with head injuries should be accompanied by a doctor with at least 2 years' experience in an appropriate specialty (usually anaesthesia). They should be familiar with the pathophysiology of head injury, the drugs and equipment they will use, working in the confines of an ambulance (or helicopter if appropriate) and have received supervised training in the transfer of patients with head injuries. They should have an adequately trained assistant. They should be provided with appropriate clothing for the transfer, medical indemnity and personal insurance. | D |
| 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). | D |
| 1.6.1.5 | Thorough resuscitation and stabilisation of the patient should be completed before transfer to avoid complications during the journey. A patient persistently hypotensive despite resuscitation should not be transported until all possible causes of the hypotension have been identified and the patient stabilised. | D |
| 1.6.1.6 | All patients with a GCS less than or equal to 8 requiring transfer to tertiary care should be intubated and ventilated as should any patients with the indications detailed in 1.6.1.7. | D |

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

D

- 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 3.5 kPa).
- Respiratory arrhythmia.

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

D

- Significantly deteriorating conscious level, even if not coma.
- Bilateral fractured mandible.
- Copious bleeding into mouth (for example, from skull base fracture).
- Seizures.

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.

D

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

D

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.

D

1.6.2 Transfer of children

1.6.2.1 The recommendations in 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.

D

- | | | |
|---------|--|---|
| 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. | D |
| 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. | D |
| 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. | D |

1.7 Observation of admitted patients

1.7.1 Training in observation

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

1.7.2 Minimum documented observations

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|---------|--|---|
| 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. | D |
|---------|--|---|

1.7.3 Frequency of observations

- | | | |
|---------|--|---|
| 1.7.3.1 | <p>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:</p> <ul style="list-style-type: none"> • half-hourly for 2 hours • then 1 hourly for 4 hours • then 2 hourly thereafter. | D |
|---------|--|---|

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

D

1.7.4 Observation of children and infants

- 1.7.4.1 Observation of infants and young children (that is, aged under 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.

D

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.

D

- 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.

D

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.

D

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.

D

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.

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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 F.

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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.

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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).

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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).

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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).

D

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.

D

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 some training in the detection of non-accidental injury.

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1.8.3 Outpatient appointments

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

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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.

D

1.8.5 Communication with community services

- 1.8.5.1 A communication (letter or email) should be generated for all patients who have attended A&E with a head injury, and sent to the patient's GP within 1 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.

D

- 1.8.5.2 A communication (letter or email) should be generated for all children who received head or cervical spine imaging, and sent to the relevant community paediatrician and school medical officer within 1 week of the end of the hospital episode. This letter should include details of the clinical history and examination.

D

- 1.8.5.3 A communication (letter or email) should be generated for all infants who received head or cervical spine imaging, and sent to the relevant community paediatrician and health visitor within 1 week of the end of the hospital episode. This letter should include details of the clinical history and examination.

D

2 Notes on the scope of the guideline

All NICE guidelines are developed in accordance with a scope document that defines what the guideline will and will not cover. The scope of this guideline was established at the start of the development of this guideline, following a period of consultation; it is available from www.nice.org.uk/Docref.asp?d=22775

The clinical areas outlined in the scope were:

- pre-hospital management including assessment, airway management and ventilation, cervical spine protection and appropriate transfer
- indications for referral to hospital from pre-hospital care
- secondary care with the aim of early detection of intracranial complications, including admission for observation, skull X-ray and other imaging procedures, including CT scanning and nuclear magnetic resonance
- criteria for transfer and discharge including circumstances when patients should be admitted to a neurosurgical unit, admitted for a short period or discharged home
- criteria for surgical intervention
- information for patients and their carer/s prior to and during hospital admission
- management at home of patients who are discharged within 48 hours of admission including advice to primary care and A&E staff on the management of patients who re-present with suspicious symptoms
- guidance on appropriate handover arrangements
- information for patients and carers.

The guideline offers best practice for the care of all patients who present with a suspected or confirmed traumatic head injury with or without other major trauma. Separate advice is provided for adults and children (including infants) where different practices are indicated. It offers advice on the management of patients with a suspected or confirmed head injury who may be unaware that they have 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 it does explore possible criteria for the early identification of patients who require rehabilitation.

The guideline covers the care received from NHS advice sources (for example, NHS Direct, A&E helplines) primary care, ambulance, and hospital staff who have direct contact with and make decisions concerning the care of patients who present with suspected or confirmed head injury. It recognises the need for care to be integrated between the primary, secondary and tertiary sectors, and the need to ensure that none of these sectors is unnecessarily overburdened. It addresses the management of patients in primary care, pre-hospital, in A&E or similar units, and in the different hospital settings to which they may be transferred where observation for possible deterioration is indicated.

The guideline does not address management within the intensive care or neurosurgical unit, but provides guidance on the appropriate circumstances in which to request a neurosurgical opinion.

Service configuration, competencies, skill mix and training requirements of staff are outside the scope of the guidelines, as they are the remit of the NHS Modernisation Agency, but good practice points on these matters are introduced in places.

3 Implementation in the NHS

3.1 In general

Local health communities should review their existing practice for the triage, assessment, investigation and early management of head injury in infants, children and adults against this guideline as they develop their Local Delivery Plans. The review should consider the resources required to implement the recommendations set out in Section 1, the people and processes involved and the timeline over which full implementation is envisaged. It is in the interests of patients that the implementation timeline is as rapid as possible.

Relevant local clinical guidelines, care pathways and protocols should be reviewed in the light of this guidance and revised accordingly.

This guideline should be used in conjunction with the National Service Framework for Long Term Conditions, which is expected to be published in 2004 (see www.doh.gov.uk/nsf/longterm/longterm.htm).

3.2 Audit

Suggested audit criteria are listed in Appendix E. These can be used as the basis for local clinical audit, at the discretion of those in practice.

4 Research recommendations

The following research recommendations have been identified for this NICE guideline, not as the most important research recommendations, but as those that are most representative of the full range of recommendations. The Guideline Development Group's recommendations for research are detailed in the full guideline produced by the National Collaborating Centre for Acute Care (see Section 5).

- Research on the effectiveness of pre-hospital interventions is needed.
- Research is needed to establish validated clinical decision rules on the selection of infants and children for imaging.
- Research is needed to develop consensus on criteria for lesions not considered to be surgically significant.
- Research is needed on the early identification of head-injured patients who are likely to suffer late sequelae.

In addition, consensus is needed on what constitutes a surgically significant abnormality following imaging of a patient with head injury.

5 Full guideline

The National Institute for Clinical Excellence commissioned the development of this guidance from the National Collaborating Centre for Acute Care. The Centre established a Guideline Development Group, which reviewed the evidence and developed the recommendations. The full guideline, *Head Injury: Triage, Assessment, Investigation and Early Management in Infants, Children and Adults* will be published by the National Collaborating Centre for Acute Care; it will be available on the NICE website (www.nice.org.uk) and on the website of the National Electronic Library for Health (www.nelh.nhs.uk).

The members of the Guideline Development Group are listed in Appendix B. Information about the Institute's Guidelines Advisory Committee is given in Appendix C.

The booklet *The Guideline Development Process – Information for the Public and the NHS* has more information about the Institute's guideline development process. It is available from the Institute's website and copies can also be ordered by telephoning 0870 1555 455 (quote reference N0038).

6 Related NICE guidance

No related NICE guidance is currently in existence or preparation.

7 Review date

The process of reviewing the evidence is expected to begin 2 years after the date of issue of this guideline, which is earlier than is usual for NICE guidelines. It is expected that the results from a number of studies that may affect the guidance will be available at the time of the review. The updated guideline will be available within 12 months of the start of the review process.

Appendix A: Grading scheme

Following agreement with the Institute, the Guideline Development Group used classifications adapted from the Oxford Centre for Evidence-based Medicine Levels of Evidence (May 2001), to summarise the evidence levels for reviewed studies.

The levels of evidence used for studies on the development of clinical decision rules were as follows.

1. Cohort study with consecutive patients and good reference standards, used to validate clinical decision rules
2. Cohort study with consecutive patients and good reference standards used to derive clinical decision rules (or validated on split samples only)
3. Non-consecutive study or without consistently applied reference standards
4. Case-control study, poor or non-independent reference standard
5. Expert opinion without explicit critical appraisal, or based on physiology, bench research or 'first principles'

The levels of evidence used for systematic reviews were as follows:

1. Systematic review (with homogeneity) of mostly level 1 studies
2. Systematic review (with homogeneity) of mostly level 2 studies
3. Systematic review (with homogeneity) of mostly level 3 studies

It was also agreed to adopt the Oxford Centre for Evidence-based Medicine classification for grade of recommendations (May 2001). This was used so that a symmetry with the levels of evidence classification could be achieved.

The grades of recommendation used in this guideline are as follows:

- A. Consistent level 1 studies
- B. Consistent level 2 or 3 studies or extrapolations from level 1 studies
- C. Level 4 studies or extrapolations from level 2 or 3 studies
- D. Level 5 evidence or troublingly inconsistent or inconclusive studies of any level

Appendix B: The Guideline Development Group

Professor David Yates

Chairman and Trauma Audit and Research Network

Mr Kieran Breen

Child Brain Injury Trust; patient representative

Dr Patricia Brennan

British Paediatric Accident and Emergency Group

Dr Niall Cartlidge

Association of British Neurologists

Professor Helen Carty

Royal College of Radiologists

Dr Nicola Chater

British Society of Rehabilitation Medicine

Mr Jack Collin

Association of Surgeons of Great Britain and Ireland

Mr Roger Evans

British Association for Accident and Emergency Medicine

Professor Charles Galasko

British Orthopaedic Association

Ms Gabby Lomas

Royal College of Nursing, Accident and Emergency Association

Professor David Lloyd

British Association of Paediatric Surgeons

Mr Tim Lynch

Ambulance Association

Professor David Mendelow

Society of British Neurological Surgeons

Dr Edward Moss

Royal College of Anaesthetists

Dr David Murfin

Royal College of General Practitioners

Mr Graham Nickson
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Dr Christopher Rowland-Hill
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National Collaborating Centre for Acute Care

Dr John Browne
Project manager and systematic reviewer

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Mr Joel Desmond
Systematic reviewer

Dr Jan van der Meulen
Statistical advice

Mr Carlos Sharpin
Information science support

Mr David Wonderling
Health economics

Appendix C: The Guidelines Advisory Committee

The Guidelines Advisory Committee is an independent Committee established by NICE to validate the clinical guidelines developed by the National Collaborating Centres. The multidisciplinary Committee includes experts on guideline methodology, health professionals and people with experience of the issues affecting patients and carers. A full list of members of the Guidelines Advisory Committee can be found on the NICE website.

For each guideline, a number of Committee members oversee the development of the guideline and take responsibility for monitoring its quality. The Committee members who took on this role for this guideline were:

Mrs Joyce Cormie
Lay Representative

Professor Martin Eccles (Chairman of the Committee)
Professor of Clinical Effectiveness
Centre for Health Services Research
University of Newcastle upon Tyne

Professor Gene Feder (review of scope only)
Professor of Primary Care Research and Development
Barts and The London, Queen Mary's School of Medicine & Dentistry
University of London

Dr Marcia Kelson
Director
Patient Involvement Unit for NICE
College of Health
London

Professor James Mason (review of scope only)
Director
National Guideline Support and Research Unit
University of Newcastle upon Tyne

Dr John Young
Medical Director
Merck Sharp and Dohme

Appendix D: *The early management of head injuries*

Understanding NICE guidance – information for patients, carers and families, and the public

The information in this appendix has been designed to support the production of your own information leaflets. English and English/Welsh versions can be downloaded from our website at www.nice.org.uk. For printed copies, ring the NHS Response Line on 0870 1555 455 and quote reference number N0235 for an English-only version and N0236 for an English and Welsh version.

About this information

This information describes the guidance that NICE has issued to the NHS on head injuries. It has been written for people who want to understand what NICE has told the NHS in a document called *Head Injury: Triage, Assessment, Investigation and Early Management of Head Injury in Infants, Children and Adults*. This is a clinical guideline produced by NICE for doctors, nurses and others working in the NHS in England and Wales.

Clinical guidelines

Clinical guidelines are recommendations for good practice. The recommendations in NICE guidelines are produced by groups of health professionals, lay people (with experience or knowledge of the condition) and scientists. The groups look at the evidence available on the best way of diagnosing and treating conditions and make recommendations based on this evidence.

There is more about NICE and the way that NICE guidelines are developed on the NICE website (www.nice.org.uk). You can download the booklet *The Guideline Development Process – Information for the Public and the NHS* from the website, or you can order a copy by phoning 0870 1555 455 (the reference number is N0038).

What the recommendations cover

This booklet covers the recommendations contained in the NICE guideline *Head Injury: Triage, Assessment, Investigation and Early Management of Head Injury in Infants, Children and Adults*. This NICE guideline makes recommendations about:

- what should happen to a person with a head injury before he or she gets to hospital
- who should go to hospital
- the initial assessment, tests and investigations, including the use of head and neck scanning machines and X-rays
- who needs admitting to hospital
- who needs surgery
- sending people home safely
- information for injured people and their carer/s before and during their hospital stay
- dealing with problems after a person has been discharged
- transferring people between different departments and hospitals.

This guideline covers head injuries that might cause damage to the brain, skull or neck; it does not deal with other head injuries (such as eye injuries). It does not cover the long-term care or rehabilitation of people with a head injury, although it does explore possible ways of identifying people who may need rehabilitation.

This booklet tells you about the NICE guideline on head injuries. It doesn't attempt to explain head injuries or describe the treatments in detail. If you have any questions or concerns about your or a family member's condition or treatment, speak to the doctor or nurse responsible for treatment.

You can also get information, including information about patient and carer support groups from NHS Direct (telephone 0845 46 47; website www.nhsdirect.nhs.uk).

How guidelines are used in the NHS

In general, health professionals working in the NHS are expected to follow NICE's clinical guidelines. But there will be times when the recommendations won't be suitable for someone because of their medical condition, general health, or their wishes. If you think that the treatment or care you, your friend or relative gets does not match what is described in this booklet, you should discuss your concerns with the doctor or nurse responsible for treatment.

If you want to read other versions of this guideline

The NICE guideline *Head Injury: Triage, Assessment, Investigation and Early Management of Head Injury in Infants, Children and Adults* and a longer version that contains all the details of the guideline recommendations and how they were developed are both available from the NICE website (www.nice.org.uk).

About head injuries

A large number of people have head injuries each year. The most common reasons for these injuries are falls, road traffic accidents and assaults (such as fights). Young men and children are more likely to have a head injury.

Most head injuries are mild and do not lead to hospital admission. About nine out of ten people seen in hospital have a mild or minor head injury and will go home without being admitted to hospital. And of those admitted to hospital, most will be able to go home after 48 hours.

A small number of people who have damaged their head (fewer than one in a hundred) have a severe injury to their brain. Severe brain injury is unusual, because the scalp and skull absorb much of the impact. Complications such as swelling, bruising or bleeding can happen inside the skull or inside the brain. How much damage is done depends on the force and speed of the blow. People who have had a severe injury to their brain may recover completely if they are treated quickly. However, it is also possible that they may experience serious disability or even death as a result of the injury.

Even mild head injuries can result in long-term problems, for example a headache that won't go away, or problems with concentration. This happens because a less severe, but still quite troubling, injury to the brain has occurred.

If a person gets help for a head injury, he or she should be checked carefully by specially trained and experienced paramedics (ambulance staff), doctors and nurses who can recognise the important signs and symptoms.

About concussion

Many people who go to the accident and emergency (A&E) department of a hospital with a head injury will have been 'knocked out', or concussed. This means that they lost consciousness for a short time, but afterwards appeared to be back to normal. Sometimes they cannot recall what happened just before the incident and immediately afterwards.

A test may fail to show up any problems, but there may be tiny areas of damage that cannot be seen. These can have a major impact on the person's life at home and at work in the weeks, months or years after the injury (see 'Post-concussion syndrome' opposite). Many people are unaware that their earlier head injury caused these problems, which are often called 'unseen injuries'.

About coma

A person is said to be in coma if he or she appears unconscious, unaware and uncommunicative; someone in coma will not open his or her eyes even in response to pain, and will not speak or respond to spoken commands. This type of unconsciousness can follow a head injury even if the person has not been 'knocked out'. When it occurs, it can last from a few seconds up to weeks. It may last even longer in a very small number of people.

There are many levels of consciousness between a deep coma and normal consciousness. People with a head injury can fall anywhere between the two. Doctors, nurses, ambulance staff and others looking after people with head injuries use the Glasgow Coma Scale to assess consciousness after a head injury. The scale measures three aspects of consciousness: eye-opening, verbal response (for example, speaking) and the responsiveness of the body (for example, response to pain). The scale is often summarised as a score which has a maximum level of 15 (normal consciousness) and a lowest level of 3 (severe coma). A special scale is used for babies and children.

It is difficult to predict how a person will recover from a coma, as the process of recovery differs from individual to individual. This can be an area of particular concern to carers and relatives, who often play a key role in helping a person to recover from coma.

About complications

Most complications happen quite quickly after the injury, but problems can show up weeks or months later. This is why people should be checked regularly in hospital and why they should see their GP for follow up after they return home (see 'Leaving the hospital'). If problems arise it is important to get help and treatment. After they leave hospital, people and their carers should be made aware of the signs and symptoms to watch out for. They should also be given a discharge advice card that explains these signs and symptoms and what to do if they occur. The main complications are as follows.

- Bleeding inside the skull, which is called intracranial haemorrhage. When this happens it will usually occur within the first few hours after the injury. The bleeding puts pressure on the brain and is very serious unless treated quickly.
- Blood and fluid build up on the surface of the brain, which is called chronic subdural haematoma. When this happens it is usually within several days or weeks after a minor head injury. The pressure on the brain causes headaches, drowsiness, confusion, speech problems or problems down one side of the body. People with any of these symptoms should return to hospital quickly so they can be treated.
- Post-concussion syndrome. This can happen in the weeks or months after having a head injury. It is caused by tiny areas of bruising or other damage to the nerve cells in the brain. Symptoms include headaches, dizziness, poor concentration, memory problems, speaking or listening difficulties, problems working or looking after themselves, or emotional and behavioural problems such as irritability or short temper (see 'Problems after leaving hospital').

What to do if someone has a head injury

Who should go to accident and emergency (A&E)?

Listed in Box 1 are signs that may indicate a high risk of having a complication after head injury, or a high risk of other injuries. If a person gets any of these after hurting their head, they, or the person looking after them should dial the ambulance services (dial 999) and the injured person should be taken to the nearest hospital A&E department as quickly as possible.

Box 1 Signs that mean an ambulance should be called

- Unconsciousness, or lack of full consciousness (for example, problems keeping eyes open)
- Problems understanding, speaking, reading or writing
- Loss of feeling in part of the body
- Problems balancing or walking
- General weakness
- Any changes in eyesight
- Any clear fluid running from ears or nose
- A 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
- Any evidence of scalp or skull damage, especially when the skull has been penetrated
- A forceful blow to the head at speed (for example, a pedestrian struck by a car, a car or bicycle crash, a diving accident, a fall of 1 metre or more [less in the case of a child or baby], or a fall down more than 5 stairs [less in the case of a child or baby])
- Any convulsions or having a fit

If a person doesn't have any of the problems in Box 1, but has one or more of the things in the next list (in Box 2), there's still a chance that he or she could have a complication. The injured person should go or be taken to A&E straightaway. If the person cannot get or be taken to the hospital A&E department safely, an ambulance should be called.

Box 2 Signs that the person should go or be taken to an A&E department straightaway

- Any loss of consciousness (being 'knocked out') from which the person has now recovered
- Any problems with memory
- A headache that won't go away
- Any vomiting or sickness
- Previous brain surgery
- A history of bleeding problems or taking medicine (for example, warfarin) that may cause bleeding problems
- Age 65 years or more
- Irritability or altered behaviour such as being easily distracted, not themselves, no concentration, or no interest in things around them, particularly in infants and young children (younger than 5 years)
- The person is drunk or has taken drugs
- Suspicion that the injury was caused intentionally by the person himself or herself, or by someone else

Who should go to their GP?

The injured person should see their GP if they or the person looking after them have any worries about the head injury, even if they don't have any of the signs listed in Boxes 1 and 2, or if there is nobody to look after them at home.

The GP or whoever sees them (for example, the practice nurse) may send the injured person to the hospital's A&E department if they are concerned. This could be by ambulance, car or public transport but they should ensure that the injured person is accompanied by someone (for example, a family member or a carer).

If the GP decides that the injured person can go home, they should give the person (or their carer) some advice about what to do and what symptoms to be aware of over the next few days (see 'Do's and Don'ts' and 'Problems after Leaving Hospital').

What happens at the hospital

When people with head injuries arrive in the A&E department, the first priority for staff should be to make the airways, breathing and circulation stable. This should be done before other injuries are attended to.

Another priority should be making sure that the person's neck is protected while they are being assessed. People with any of the problems in Box 3 should have a neck collar put on them unless this is not possible for other reasons.

Box 3 Signs that a person needs a neck collar

- A Glasgow Coma Scale score of less than 15 at the time of assessment (meaning that the person hasn't recovered full consciousness by the time of assessment)
- Neck pain or tenderness
- Problems understanding, speaking, reading or writing
- Loss of feeling in part of the body
- Problems balancing or walking
- General weakness
- Any changes in eyesight
- Any other suspicion of injury to the spine in the neck region

The person may have already had a neck collar put on them if they arrived by ambulance or went to see their GP before coming to hospital. The collar should remain on the injured person's neck until an X-ray or other scan confirms that it can be safely removed.

If the airways, breathing and circulation are not in immediate danger, the injured person should be seen within 15 minutes of their arrival by a triage nurse or doctor who should decide how urgently they need to be dealt with. A triage doctor or nurse is one who is trained to assess how seriously a person is injured so that he or she can be treated urgently if necessary. People who are at high risk of having further problems as a result of their head injury should be treated immediately. If the injured person does not need immediate treatment, they may have to wait for a short time to be seen by a doctor.

The doctor should examine the injured person to see whether their brain has been affected by the injury and a complication has occurred or is about to occur. This includes checking the level of consciousness and physical responses. The doctor should ask the injured person about what happened to them. If they can't remember, carers or relatives might be asked to help.

The injured person should not normally be offered any systemic pain relief (which is pain relief that involves the whole body) until a full accurate assessment of their consciousness and responses has been made. They may be offered local or regional pain relief for fractures or other painful injuries.

If the doctor thinks that the risk of a complication is very low, the person should be allowed home with some advice regarding things to do and not to do over the next few weeks. Written advice should be given and this should list the signs and symptoms that the person and their family members or carers should look out for when they get home. The advice should also provide information on what to do if any of these signs or symptoms occurs.

What tests should be done on the injured person's head?

If the doctor thinks the injured person is at risk of developing bleeding inside the skull, a brain scan (a CT scan) should be performed. This gives the doctors a picture of the brain inside the skull.

People with any of the signs listed in Box 4 are likely to get a CT scan of their head within 1 hour of being assessed by a doctor at the hospital.

Box 4 Signs that mean a person is likely to have a CT scan of their head within 1 hour of assessment by a doctor

- A Glasgow Coma Scale score of less than 13 at any point since the injury took place (that is, if there is a quite serious problem with consciousness at some point after the injury)
- A Glasgow Coma Scale score of 13 or 14 at 2 hours after the injury (where the person hasn't recovered full consciousness by the time of assessment)
- Any sign of a fracture to the base of the skull (any clear fluid running from ears or nose, bleeding in one or both ears, new deafness in one or both ears, a black eye with no associated damage around the eye, bruising behind one or both ears)
- Any other skull damage of concern to the doctor, especially when the skull has been penetrated
- More than one episode of vomiting (the doctor should use his or her judgement regarding the cause of vomiting in children of 12 years and younger and then decide whether imaging is necessary)
- Age 65 years or more, providing that there has been some loss of consciousness or amnesia
- Any convulsions or having a fit
- A history of bleeding problems or taking medicine for bleeding problems, providing that there has been some loss of consciousness or amnesia
- Problems understanding, speaking, reading or writing
- Loss of feeling in part of the body
- Problems balancing or walking
- General weakness
- Any changes in eyesight

People who don't have the signs in Box 4 but who have had either of the things listed below should have a CT scan performed within 8 hours of the injury having occurred. (Imaging should be performed immediately in these people if they arrive at hospital 8 hours or more after their injury.)

- Loss of memory for greater than 30 minutes of things that happened immediately before the injury.
- A forceful blow to the head at speed (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 5 stairs) providing that there has been some loss of consciousness or amnesia.

The CT scan will usually be carried out by a professional called a radiographer, and the results should be looked at and interpreted by a doctor called a radiologist.

A CT scan is painless. The person lies on a couch that slides into the CT machine and their head goes into the scanner. It usually takes between 3 and 20 minutes to perform the scan. A baby or child, or someone who is very agitated, may be given sedatives or an anaesthetic so that they keep still when they are inside the scanner.

The NICE guideline recommends CT scanning as the preferred option for most people with a head injury but sometimes the person may be given a skull X-ray rather than a CT scan. This might be because the hospital doesn't have enough CT facilities at that time, or it might be for other reasons (for example, if the doctors are concerned about how the injury happened). If this happens, the injured person or their carer should ask the doctor why an X-ray rather than a CT scan is being used.

A few people are given an extra test called magnetic resonance imaging (MRI). This is similar to a CT scan, except that the whole body goes into the machine. An MRI scan takes longer to perform than a CT scan, is more difficult to interpret and is less useful soon after an injury. However, it gives a very detailed picture of the brain and so it is sometimes used when there is a suspicion that the person has complications that have not been detected by a CT scan.

What tests should be done on the injured person's neck?

If the doctors are worried about a possible injury to the person's spine in the neck region (called the cervical spine), they should ask for a neck X-ray. Alternatively, a CT scan of the neck may be done because the X-ray machine cannot cover all the areas the doctor wants to look at, or because it is more convenient to perform a CT of the head and neck at the same time.

People with any of the signs listed in Box 5 are likely to have an X-ray or scan of their neck.

Box 5 Signs that mean a person is likely to have an X-ray or scan of their neck

- A Glasgow Coma Scale score of less than 15 at the time of assessment (where the person hasn't recovered full consciousness by the time of assessment)
- Problems understanding, speaking, reading or writing
- Loss of feeling in part of the body
- Problems balancing or walking
- General weakness
- Any changes in eyesight
- Where a person is not able to actively turn their neck to 45 degrees to the left and right (this assessment will only be carried out if it is safe: safe assessment is possible if the person had a simple rear-end motor vehicle collision, was in a sitting position in A&E, was walking at any time since the injury, had delayed onset of neck pain, or has no current neck pain or tenderness)

Where it is not safe to assess whether the person's neck can turn properly, an X-ray or scan should be performed instead.

An X-ray or scan should be carried out if the person has some neck pain or tenderness following a forceful blow to the head at speed (fall from a height of greater than 1 metre or 5 stairs; diving accident; high-speed motor vehicle collision at greater than 65 miles per hour; roll-over motor accident; ejection from a motor vehicle; accident involving motorized recreational vehicles; bicycle collision). A person of 65 or older should also have an X-ray or scan of their neck if there is some neck pain or tenderness.

If an X-ray is necessary, it should usually happen within 1 hour of the initial examination by an A&E doctor. The X-ray will usually be carried out by a professional called a radiographer, and the results should be looked at and interpreted by a doctor. An X-ray is painless and usually takes between 2 and 10 minutes to perform. A baby or child, or someone who is very agitated, may be given sedatives or an anaesthetic so that they keep still while the X-ray is being performed.

Are these tests safe?

X-rays and CT scans use radiation to get the pictures the doctors want. Having too many X-rays and CT scans can slightly increase the risks of diseases like cancer, so they are used with care. CT scans give a much more detailed picture than X-rays, so they need to use more radiation. The radiation from a CT scan is between 30 and 40 times higher than an X-ray.

The radiation difference between X-rays and CT scans is even greater for babies and children, so doctors should be very careful when using a CT scan with children. They should use a CT scan on the neck only if absolutely necessary in children aged less than 10 years.

When thinking about the radiation from a scan, it's important to remember that the risks of developing a disease like cancer because of a CT scan are tiny. In an average year, people absorb slightly more radiation from their natural environment (such as water, earth and air) than they would from one CT scan. The benefits of finding out about possible damage to the brain vastly outweigh considerations of radiation risk, and doctors are extremely careful when carrying out a CT scan, so these tests should be considered generally safe.

Who gets admitted to hospital?

If the test results come back normal, the injured person will usually be sent home. However, some people with normal results are kept in hospital for observation. This is often because there is no one at home to look after the person who has been injured. It may also be because they are under the influence of alcohol or drugs, they have other injuries (such as broken bones) or health problems, or because they are in shock.

If the tests show a possible problem, the person should be admitted to hospital. Some people have bruises on their brain that do not lead to serious bleeding or brain swelling, but which need to be monitored. Regular checks are made, including shining lights into their eyes, and checking their reflexes. Action should be taken quickly if complications develop, so the injured person may need to be woken and checked throughout the night.

Most people are allowed home within a day or two after admission. If the person does not progress as expected, further assessment and tests may be carried out and the doctors looking after the injured person may consult a neurosurgeon (a doctor who carries out brain surgery). If there is a complication inside the head or the neurosurgeon considers there are other reasons why the person should have specialist care, the injured person may be transferred to a neurosurgical unit. This may be within the same hospital but usually it will be in another hospital, which is often some distance away.

Transfer to another hospital

Decisions to transfer a person with a head injury are not taken lightly as the transfer process could be dangerous. Hospital transfer is done with great care to make sure that no further harm is done. Normally the person will be transferred by ambulance, but a helicopter may be

used for long distances. An experienced anaesthetist or other doctor who has received training in the transfer of people with a head injury should usually travel with the person to make it as safe as possible. Children should be accompanied by staff experienced in the transfer of critically ill children.

The injured person may be given artificial breathing support through a tube during the journey if there is a chance of breathing problems. People who get this type of breathing support should also be given muscle relaxation and appropriate sedation and pain control.

Families and carers should be fully informed about why the person needs to be transferred, and about how this will happen. Whenever practical, a family member should travel in the ambulance or helicopter if the injured person is a baby or a young child. In other circumstances, passengers are not normally allowed.

Operations on the brain

Neurosurgical operations are performed with the aim of avoiding the brain becoming damaged, for example as a result of pressure from a blood clot. Sometimes the need for surgery is urgent and there may not be time to discuss fully beforehand what it involves. In these situations, detailed discussions may have to be left until after the operation. However, the neurosurgeon should explain everything afterwards to the person having the surgery or to their family.

Support for families and carers

Early support can help the injured person's family or carers prepare for the effects of head injury. This support can reduce the problems experienced by the family or carers and result in better long-term results for both the injured person and their family.

For a patient's family, suddenly finding themselves in a hospital and dealing with different members of staff can be overwhelming and can cause additional stress. Hospital staff caring for the injured person should introduce themselves to family members or carers and briefly explain what they are doing. A photographic board with the names and titles of professionals in the hospital departments caring for patients with head injury is helpful and should be available.

The presence of familiar friends and relatives at the early stage following admission can be very helpful. The person recovering consciousness can easily be confused by strange faces and the strange environment in which they find themselves. Talking and making physical contact, such as holding hands, can be helpful and aid recovery.

Such contact should be encouraged by hospital staff, although it is important for relatives and friends not to feel that they have to spend many hours at the bedside. It is important that they also have a break and sleep from time to time.

It can be a difficult experience for a child visiting a brother, sister or parent with a head injury. Hospitals should try to share information with children and introduce them to the possibility of long-term changes in their parent or brother or sister.

Information sheets detailing the nature of head injury and any investigations likely to be used should be available in the A&E department. There should also be a board or area displaying leaflets or contact details for patient support organisations. Voluntary support groups can speak from experience about the real life impact of head injury and can offer support following discharge from hospital.

Leaving the hospital

People will be able to go home when the doctors think it is safe. No one should be discharged until they have normal levels of consciousness, all other problems (such as other injuries) have received attention and there is someone to care for the injured person at home. If there's risk that a child or infant was harmed intentionally, he or she should be seen by a doctor who has been trained to look for signs of ill treatment before being allowed home. Before the injured person leaves hospital, they should get some verbal advice about what to do and what symptoms to look out for in the first few weeks at home (see 'Do's and don'ts' in Box 6). This advice should also cover what to do if certain signs and symptoms arise. They should also get a discharge advice card which covers the same issues. Details of community support services should also be included on the patient discharge advice card.

The person who had the head injury or their carer should be given a letter from the hospital to give to the person's GP, as she or he needs to know about the head injury. This letter should be open to the person or their carer, or a copy should be given to them.

The person who had the head injury may be asked to make an appointment with their GP. The GP should get the results of any tests from the hospital, but this may take some time. For a baby or a school-age child, the test results should also be sent to their community paediatrician, health visitor or to their school medical officer.

Do's and don'ts for people who have had a head injury

The do's and don'ts are listed in Box 6. Carers should make sure the injured person is not alone in the home for the first 48 hours after leaving hospital. They should also make sure that there is a telephone nearby and that the person stays within easy reach of medical help. Parents of school-age children should not allow them to return to school until they feel their child has completely recovered from their injury.

Box 6 Do's and don'ts for people who have had a head injury and have been discharged from hospital

- **Do** make sure you stay within easy reach of a telephone and medical help.
- **Do** have plenty of rest and avoid stressful situations.
- **Don't** stay at home alone for the first 48 hours after leaving hospital.
- **Don't** take any alcohol or drugs.
- **Don't** take sleeping pills, sedatives or tranquillisers unless they are given by a doctor.
- **Don't** play any contact sport (such as rugby or football) for at least 3 weeks without talking to your doctor first.
- **Don't** return to your normal school, college or work activity until you feel you have completely recovered.
- **Don't** drive a car, motorbike or bicycle or operate machinery unless you feel you have completely recovered.

Problems after leaving hospital

If a person who has had a head injury gets any of the symptoms listed in Box 7 after leaving hospital, they should go straight to their nearest hospital A&E department.

Box 7 Signs that a person who has been discharged from hospital following a head injury should go or be taken to their nearest A&E department

- Unconsciousness, or lack of full consciousness (for example, problems keeping their eyes open)
- Any confusion (not knowing where they are, getting things muddled up)
- Any drowsiness (feeling sleepy) that goes on for longer than 1 hour when they would normally be wide awake
- Any problems understanding or speaking
- Any loss of balance or problems walking
- Any weakness in one or both arms or legs
- Any problems with eyesight
- Very painful headache that won't go away.
- Any vomiting – getting sick
- Any fits (collapsing or passing out suddenly)
- Clear fluid coming out of the ear or nose

Carers should take the injured person to hospital if they are difficult to wake up.

Some people may feel other symptoms over the first few days after discharge which should disappear in the following 2 weeks. These include a mild headache, feeling sick (without vomiting), dizziness, irritability or bad temper, problems concentrating or problems with memory, tiredness, lack of appetite or problems sleeping. If the person or their carer feels very concerned about any of these symptoms in the first few days after discharge, they should see their GP. If these problems do not go away after 2 weeks, the person should see their GP – he or she should also check with their doctor that it's OK to carry on driving.

Long-term problems

Most people recover quickly from their accident and experience no long-term problems. However, a small number of people will have had a serious injury and are likely to have problems (such as physical and mental disability) which require rehabilitation and ongoing treatment.

Post-concussion syndrome can also cause problems for months or even much longer after the injury, even if the head injury was a mild one. Some people will have ongoing problems as a result of post-concussion syndrome, and life can be very difficult for them and their families. Some people develop problems immediately, others after a few weeks or months or sometimes even longer. In some cases the person's personality may be affected.

Sometimes it is not until the person has returned to school or work that they feel different. They may have memory problems, and forget names, appointments, or where they have put things. They may become easily distracted and have difficulty concentrating, planning and organising. They may feel they cannot achieve anything and become depressed.

People experiencing any of the above problems should visit their GP as soon as possible. They may be given an appointment to see a specialist to discuss, and help with, any difficulties that have arisen. This appointment may be with a clinical psychologist, neurologist, neurosurgeon, or a specialist in rehabilitation medicine.

Voluntary organisations can also help people who are having problems after a head injury. The details of support organisations for people who have had a head injury are available from NHS Direct (telephone 0845 46 47; website www.nhsdirect.nhs.uk).

Further information

People have the right to be fully informed and to share in decision making about their healthcare. If you need further information about any aspects of your care, please ask your specialist, GP or a relevant member of your health team. You can discuss this guideline with them if you wish – if you aren't sure about anything in this booklet, they will be able to explain things to you.

For further information about the National Institute for Clinical Excellence (NICE), the Clinical Guidelines Programme or other versions of this guideline (including the sources of evidence used to inform the recommendations for treatment and care), you can visit the NICE website at www.nice.org.uk.

Some technical terms explained

Amnesia

Loss of memory that can happen after a person has been concussed.

Anaesthetist

A doctor who specialises in giving anaesthetic.

Brain contusions

Bruises on the brain that can be seen on a CT scan.

Chronic subdural haematoma

A build up of blood and fluid on the surface of the brain.

Coma

A state of unconsciousness from which a person can't be roused.

Complication

Problem that happens as a result of the injury.

Concussion

Loss of consciousness for a short time followed by an apparent return to normality.

Convulsion

A fit or a seizure.

CT scan

CT stands for computed tomography. A CT scan is a computer-aided X-ray used to provide clear pictures of the brain.

Glasgow Coma Scale

Scale used to assess consciousness after a head injury.

Haematoma

A blood clot.

Haemorrhage

Bleeding.

Intracranial pressure (ICP)

Pressure inside the skull caused by brain swelling or bleeding.

MRI

MRI stands for magnetic resonance imaging, which is a method of building up pictures of the body.

Neurosurgeon

A brain surgeon.

Neurosurgery

Operations on the brain.

Post-concussion syndrome

Problems, including headaches, dizziness, poor concentration, memory problems, speaking or listening difficulties, and emotional and behavioural problems that can happen in the weeks or months after having a head injury. The syndrome is caused by tiny areas of bruising or other damage to the nerve cells in the brain.

Radiography

Using techniques involving radiation to build up pictures of the body.

Reflex

An involuntary movement that shows that the nerves are working normally.

Triage

A system to prioritise patients according to the seriousness of their injuries.

Ventilator

A machine designed to move air in and out of a person's lungs mechanically (life-support system).

Appendix E: Technical detail on the criteria for audit

Possible objectives for an audit

One or more audits can be carried out in the A&E setting to ensure that:

- individuals with head injury are selected appropriately for imaging of the head
- individuals with head injury are selected appropriately for imaging of the cervical spine.

People that could be included in an audit

A single audit could include all individuals with head injury.

Measures that could be used as a basis for an audit

See tables overleaf.

Those involved in audit of patients with head injury should note that previous work on the development of datasets, proformas and a data collection infrastructure for head injury audit has been carried out by the Trauma Audit and Research Network (TARN). Collaboration with this organisation on any future audit of these guidelines is likely to be fruitful.

Criterion	Standard	Exception	Definition of terms
<p>1. CT imaging of the head is immediately requested for a patient with a head injury who has any one of the following.</p> <ul style="list-style-type: none"> a. GCS less than 13 at any point since the injury. b. GCS equal to 13 or 14 at 2 hours after the injury. c. Suspected open or depressed skull fracture. d. Any sign of basal skull fracture. e. Post-traumatic seizure. f. Focal neurological deficit. g. More than one episode of vomiting. h. Amnesia for greater than 30 minutes of events before impact. 	100% of patients with a head injury assessed in the A&E department.	Children of 12 years and younger for whom the clinician considers that episodes of vomiting do not warrant immediate CT imaging.	<p>Immediate = request should be sent to radiology department now.</p> <p>Signs of basal skull fracture = haemotympanum, 'panda' eyes, cerebrospinal fluid otorrhoea, Battle's sign.</p> <p>Note that the assessment of amnesia will not be possible in pre-verbal children and is unlikely to be possible in any child aged < 5 years of age.</p>
<p>2. CT imaging of the head is requested immediately for a patient with a head injury who has any one of the following if he or she has experienced some loss of consciousness or amnesia since the injury.</p> <ul style="list-style-type: none"> a. Age \geq 65 years. b. Coagulopathy. c. Dangerous mechanism of injury. 	100% of patients with a head injury assessed in the A&E department.	None.	<p>Coagulopathy = history of bleeding, clotting disorder, current treatment with warfarin.</p> <p>Dangerous mechanism of injury = a pedestrian struck by a motor vehicle, an occupant ejected from a motor vehicle or fall from \geq 1 metre or 5 stairs. A lower threshold for height of falls should be used when dealing with infants and young children (i.e. < 5 years) and this should be decided at a local level.</p>

Criterion	Standard	Exception	Definition of terms
<p>3. Cervical spine imaging is requested immediately for a patient with any one of the following risk factors.</p> <ul style="list-style-type: none"> a. GCS less than 15 at the time of assessment. b. Paraesthesia in the extremities. c. Focal neurological deficit. d. Not possible to test for range of motion in the neck. e. Patient not able to actively rotate neck to 45 degrees to the left and right (if assessment is possible). 	100% of patients with a head injury assessed in the A&E department.		<p>Range of motion of the neck can be assessed in the following circumstances: simple rear-end motor vehicle collision, sitting position in A&E, ambulatory at any time since the injury, delayed onset of neck pain, absence of midline c-spine tenderness. Simple rear-end motor vehicle collision excludes: pushed into oncoming traffic; hit by bus/large truck; rollover; hit by high-speed vehicle.</p>
<p>4. Cervical spine imaging is requested immediately for a patient with any one of the following risk factors if he or she has some neck pain or tenderness.</p> <ul style="list-style-type: none"> a. Age \geq 65 years. b. Dangerous mechanism of injury. 	100% of patients with a head injury assessed in the A&E department.		<p>Dangerous mechanism of injury = fall from \geq 1 metre or 5 stairs; axial load to head (e.g. 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).</p> <p>A lower threshold for height of falls should be used when dealing with infants and young children (i.e. < 5 years) and this should be decided at a local level.</p>

Calculation of compliance

Compliance (%) with each measure described in the table is calculated as follows.

$$\frac{\text{Number of patients whose care is consistent with the criterion *plus* number of patients who meet any exception listed}}{\text{Number of people to whom the measure applies}} \times 100$$

Clinicians should review the findings of measurement, identify whether practice can be improved, agree on a plan to achieve any desired improvement and repeat the measurement of actual practice to confirm that the desired improvement is being achieved.

Appendix F: Suggested written discharge advice cards

The information in this appendix has been designed to support the production of your own written discharge advice cards. The text can be downloaded from our website at www.nice.org.uk.

Three suggested written discharge advice cards follow.

1. For people aged over 12 years who have sustained a head injury
2. For carers of children who have sustained a head injury
3. For carers of adults who have sustained a head injury

1. Suggested written discharge advice card for people aged over 12 years who have sustained a head injury

We think that it is all right for you to leave hospital now. We have checked your symptoms and you seem well on the road to recovery. When you get home it is very unlikely that you will have any further problems. But, if any of the following symptoms do return, we suggest you come back, or get someone to bring you back to your nearest hospital A&E department as soon as possible:

- unconsciousness, or lack of full consciousness (for example, problems keeping eyes open)
- any confusion (not knowing where you are, getting things muddled up)
- any drowsiness (feeling sleepy) that goes on for longer than 1 hour when you would normally be wide awake
- any problems understanding or speaking
- any loss of balance or problems walking
- any weakness in one or more arms or legs
- any problems with your eyesight
- very painful headache that won't go away
- any vomiting – getting sick
- any fits (collapsing or passing out suddenly)
- clear fluid coming out of your ear or nose
- bleeding from one or both ears
- new deafness in one or both ears

Things you shouldn't worry about

You may feel some other symptoms over the next few days which should disappear in the next 2 weeks. These include a mild headache, feeling sick (without vomiting), dizziness, irritability or bad temper, problems concentrating or problems with your memory, tiredness, lack of appetite or problems sleeping. If you feel very concerned about any of these symptoms in the first few days after discharge, you should go and see your own doctor to talk about them.

If these problems do not go away after 2 weeks, you should go and see your doctor. We would also recommend that you seek a doctor's opinion about your ability to drive a car or motorbike.

Things that will help you get better

If you follow this advice you should get better more quickly and it may help any symptoms you have to go away:

- DO NOT stay at home alone for the first 48 hours after leaving hospital.
- DO make sure you stay within easy reach of a telephone and medical help.
- DO have plenty of rest and avoid stressful situations
- DO NOT take any alcohol or drugs
- DO NOT take sleeping pills, sedatives or tranquilisers unless they are given by a doctor
- DO NOT play any contact sport (for example, rugby or football) for at least 3 weeks without talking to your doctor first
- DO NOT return to your normal school, college or work activity until you feel you have completely recovered
- DO NOT drive a car, motorbike or bicycle or operate machinery unless you feel you have completely recovered

Telephone number to call at the hospital _____

Long-term problems

Most patients recover quickly from their accident and experience no long-term problems. However, some patients only develop problems after a few weeks or months. If you start to feel that things are not quite right (for example, memory problems, not feeling yourself), then please contact your doctor as soon as possible so that we can check to make sure you are recovering properly.

2. Suggested written discharge advice card for carers of children who have sustained a head injury

We think that it is all right for your child to leave hospital now. We have checked their symptoms and they seem well on the road to recovery. When you get them home it is very unlikely that they will have any further problems. But, if any of the following symptoms do return, we suggest you bring them back to their nearest hospital A&E department as soon as possible:

- unconsciousness, or lack of full consciousness (for example, problems keeping eyes open)
- any confusion (not knowing where they are, getting things muddled up)
- any drowsiness (feeling sleepy) that goes on for longer than 1 hour when they would normally be wide awake
- difficulty waking the patient up
- any problems understanding or speaking
- any loss of balance or problems walking
- any weakness in one or more arms or legs
- any problems with their eyesight
- very painful headache that won't go away
- any vomiting – getting sick
- any fits (collapsing or passing out suddenly)
- clear fluid coming out of their ear or nose
- bleeding from one or both ears
- new deafness in one or both ears

Things you shouldn't worry about

They may feel some other symptoms over the next few days which should disappear in the next 2 weeks. These include a mild headache, feeling sick (without vomiting), dizziness, irritability or bad temper, problems concentrating or problems with their memory, tiredness, lack of appetite or problems sleeping. If you feel very concerned about any of these symptoms in the first few days after discharge, you should bring the patient to their doctor.

If these problems do not go away after 2 weeks, you should bring the patient to see their doctor.

Things that will help the patient get better

If the patient follows this advice it should help them get better more quickly and it may help any symptoms they have to go away:

- DO have plenty of rest and avoid stressful situations
- DO NOT take sleeping pills, sedatives or tranquilisers unless they are given by a doctor
- DO NOT play any contact sport (for example, football) for at least 3 weeks without talking to their doctor first

Things you should do to make sure the patient is OK

- DO NOT allow them to return to school until you feel they have completely recovered
- DO NOT leave the patient alone in the home for the first 48 hours after leaving hospital
- DO make sure that there is a nearby telephone and that the patient stays within easy reach of medical help

Telephone number to call at the hospital _____

Long-term problems

Most patients recover quickly from their accident and experience no long-term problems. However, some patients only develop problems after a few weeks or months. If you start to feel that things are not quite right for your child (for example, memory problems, not feeling themselves), then please contact your doctor as soon as possible so that we can check to make sure they are recovering properly.

3. Suggested written discharge advice card for carers of adults who have sustained a head injury

We think that it is all right for your friend/relative/client to leave hospital now. We have checked their symptoms and they seem well on the road to recovery. When you get them home it is very unlikely that they will have any further problems. But, if any of the following symptoms do return, we suggest you bring them back to their nearest hospital A&E department as soon as possible:

- unconsciousness, or lack of full consciousness (for example, problems keeping eyes open)
- any confusion (not knowing where they are, getting things muddled up)
- any drowsiness (feeling sleepy) that goes on for longer than 1 hour when they would normally be wide awake
- difficulty waking the patient up
- any problems understanding or speaking
- any loss of balance or problems walking
- any weakness in one or more arms or legs
- any problems with their eyesight
- very painful headache that won't go away
- any vomiting – getting sick
- any fits (collapsing or passing out suddenly)
- clear fluid coming out of their ear or nose
- bleeding from one or both ears
- new deafness in one or both ears

Things you shouldn't worry about

They may feel some other symptoms over the next few days which should disappear in the next 2 weeks. These include a mild headache, feeling sick (without vomiting), dizziness, irritability or bad temper, problems concentrating or problems with their memory, tiredness, lack of appetite or problems sleeping. If you feel very concerned about any of these symptoms in the first few days after discharge, you should bring the patient to their doctor to talk about them.

If these problems do not go away after 2 weeks, you should bring the patient to see their doctor. We would also recommend that they seek a doctor's opinion about their ability to drive a car or motorbike.

Things that will help the patient get better

If the patient follows this advice it should help them get better more quickly and it may help any symptoms they have to go away:

- DO have plenty of rest and avoid stressful situations
- DO NOT take any alcohol or drugs
- DO NOT take sleeping pills, sedatives or tranquilisers unless they are given by a doctor
- DO NOT return to their normal college or work activity until they feel they have completely recovered
- DO NOT play any contact sport (for example, football) for at least 3 weeks without talking to their doctor first
- DO NOT drive a car, motorbike or bicycle or operate machinery unless they feel they have completely recovered.

Things you should do to make sure the patient is OK

- DO NOT leave the patient alone in the home for the first 48 hours after leaving hospital
- DO make sure that there is a nearby telephone and that the patient stays within easy reach of medical help

Telephone number to call at the hospital _____

Long-term problems

Most patients recover quickly from their accident and experience no long-term problems. However, some patients only develop problems after a few weeks or months.

If you start to feel that things are not quite right for your friend/relative/client (for example, memory problems, not feeling themselves), then please contact your doctor as soon as possible so that we can check to make sure they are recovering properly.

Appendix G: The Glasgow Coma Scale for adults

The Glasgow Coma Scale is scored between 3 and 15, 3 being the worst, and 15 the best. It is composed of three parameters: Best Eye Response, Best Verbal Response, Best Motor Response. The definition of these parameters is given below.

Best Eye Response (4)

1. No eye opening
2. Eye opening to pain
3. Eye opening to verbal command
4. Eyes open spontaneously

Best Verbal Response (5)

1. No verbal response
2. Incomprehensible sounds
3. Inappropriate words
4. Confused
5. Orientated

Best Motor Response (6)

1. No motor response
2. Extension to pain
3. Flexion to pain
4. Withdrawal from pain
5. Localising pain
6. Obeys commands

Appendix H: Paediatric version of the Glasgow Coma Scale

The paediatric version of the Glasgow Coma Scale is scored between 3 and 15, 3 being the worst, and 15 the best. It is composed of three parameters: Best Eye Response, Best Verbal Response, Best Motor Response. The definition of these parameters is given below.

Best Eye Response (4)

1. No eye opening
2. Eye opening to pain
3. Eye opening to verbal command
4. Eyes open spontaneously

Best Verbal Response (5)

1. No vocal response
2. Occasionally whimpers and/or moans
3. Cries inappropriately
4. Less than usual ability and/or spontaneous irritable cry
5. Alert, babbles, coos, words or sentences to usual ability

Communication with the infant or child's caregivers is required to establish the best usual verbal response. A 'grimace' alternative to verbal responses should be used in pre-verbal or intubated patients.

Best Grimace Response (5)

1. No response to pain
2. Mild grimace to pain
3. Vigorous grimace to pain
4. Less than usual spontaneous ability or only response to touch stimuli
5. Spontaneous normal facial/oro-motor activity

Best Motor Response (6)

1. No motor response to pain
2. Abnormal extension to pain (decerebrate)
3. Abnormal flexion to pain (decorticate)
4. Withdrawal to painful stimuli
5. Localises to painful stimuli or withdraws to touch
6. Obeys commands or performs normal spontaneous movements

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