NICE National Institute for Health and Care Excellence

NICE guideline

Head injury: assessment and early management

NICE guideline

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Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Contents

This guideline replaces CG176.

This guideline is the basis of QS74.

Overview

This guideline covers assessment and early management of head injury in babies, children, young people and adults. It aims to ensure that people have the right care for the severity of their head injury, including direct referral to specialist care if needed.

See NICE's guideline on major trauma: service delivery for recommendations on pre-hospital triage, transfer and pre-alert procedures, procedures for receiving people in trauma units and major trauma centres, documentation, monitoring and audit, and access to major trauma services.

Who is it for?

- Healthcare professionals
- People with a head injury, their families and carers
- Commissioners and providers

Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in NICE's information on making decisions about your care.

Making decisions using NICE guidelines explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

For the purposes of this guideline, a head injury is defined as any trauma to the head other than superficial injuries to the face. Also, babies are defined as being under 1 year, and children and young people as being 1 year to under 16 years.

1.1 Decision making and mental capacity

1.1.1 For recommendations on promoting ways for healthcare professionals and people using services to work together to make decisions about treatment and care, see NICE's guideline on shared decision making. **[2023]**

1.1.2 For recommendations on decision making in people 16 and over who may lack capacity now or in the future, including information on advance care plans, see NICE's guideline on decision making and mental capacity. **[2023]**

For a short explanation of why the committee made these recommendations and how they might affect practice or services, see the rationale and impact section on decision making and mental capacity.

1.2 Pre-hospital assessment, advice and referral to

hospital

1.2.1 Public health literature and other non-medical sources of advice (for example, St John Ambulance and police officers) should encourage people who have any concerns after a head injury to themselves or to another person, regardless of the injury severity, to seek immediate medical advice. **[2003]**

Remote advice services

1.2.2 Remote advice services (for example, NHS 111) should refer people who have sustained a head injury to the emergency ambulance services (that is, 999) for emergency transport to the emergency department if there are any of these risk factors (see NICE's guidelines on shared decision making and decision making and mental capacity):

- unconsciousness or lack of full consciousness (for example, problems keeping eyes open)
- any focal neurological deficit since the injury
- any suspicion of a complex skull fracture or penetrating head injury
- any seizure ('convulsion' or 'fit') since the injury
- a high-energy head injury
- there is no other way of safely transporting the person to the hospital emergency department (see recommendation 1.2.3). **[2003, amended 2007, 2014 and 2023]**

1.2.3 Remote advice services (for example, NHS 111) should refer people who have sustained a head injury to a hospital emergency department if there are any of these risk factors (see NICE's guidelines on shared decision making and decision making and mental capacity):

- any loss of consciousness ('knocked out') because of the injury, from which the person has now recovered

- amnesia for events before or after the injury ('problems with memory'; it will not be possible to assess amnesia in children who are preverbal and is unlikely to be possible in children under 5)
- a persistent headache since the injury
- any vomiting episodes since the injury
- any previous brain surgery
- any history of bleeding or clotting disorders
- current anticoagulant or antiplatelet (except aspirin monotherapy) treatment
- current drug or alcohol intoxication
- any safeguarding concerns (for example, possible non-accidental injury or a vulnerable person is affected)
- irritability or altered behaviour (easily distracted, not themselves, no concentration, no interest in things around them), particularly in babies and children under 5
- continuing concern by helpline staff about the diagnosis. **[2003, amended 2014 and 2023]**

Community health services and inpatient units without an emergency department

1.2.4 Community health services (GPs, ambulance crews, NHS walk-in or minor injury centres, dental practitioners) and inpatient units without an emergency department should refer people who have sustained a head injury to a hospital emergency department, using the ambulance service if necessary, if there are any of these risk factors (see NICE's guidelines on shared decision making and decision making and mental capacity):

- a Glasgow Coma Scale (GCS) score of less than 15 on initial assessment
- any loss of consciousness because of the injury
- any focal neurological deficit since the injury

- any suspicion of a complex skull fracture or penetrating head injury since the injury
- amnesia for events before or after the injury (it will not be possible to assess amnesia in children who are preverbal and is unlikely to be possible in children under 5)
- a persistent headache since the injury
- any vomiting episodes since the injury (use clinical judgement about the cause of vomiting in children 12 years or under and the need for referral)
- any seizure since the injury
- any previous brain surgery
- a high-energy head injury
- any history of bleeding or clotting disorders
- current anticoagulant or antiplatelet (except aspirin monotherapy) treatment
- current drug or alcohol intoxication
- any safeguarding concerns (for example, possible non-accidental injury or a vulnerable person is affected)
- continuing concern by the professional about the diagnosis. **[2003, amended 2007, 2014 and 2023]**

1.2.5 In the absence of any risk factors in recommendation 1.2.4, consider referral to an emergency department if any of these factors are present, depending on judgement of severity (see NICE's guidelines on shared decision making and decision making and mental capacity):

- irritability or altered behaviour, particularly in babies and children under 5
- visible trauma to the head not covered in recommendation 1.2.4 but still of concern to the professional
- no one is able to observe the injured person at home

- continuing concern by the injured person, or their family or carer, about the diagnosis. **[2003, amended 2014 and 2023]**

Transport to hospital from community health services and inpatient units without an emergency department

1.2.6 Ensure people referred from community health services are accompanied by a competent adult during transport to the emergency department. **[2003]**

1.2.7 The referring professional should determine if an ambulance is needed, based on the person's clinical condition. If an ambulance is not needed, provided the person is accompanied, public transport or being driven in a car are appropriate means of transport. **[2003]**

1.2.8 The referring professional should inform the destination hospital (by phone) of the impending transfer. In non-emergencies, a letter summarising signs and symptoms should be sent with the person. **[2003]**

Training in risk assessment

1.2.9 Train GPs, nurse practitioners, dentists and ambulance crews, as necessary, to ensure that they are capable of assessing the presence or absence of the risk factors listed in the section on community health services and inpatient units without an emergency department. **[2003, amended 2007]**

1.3 Immediate management at the scene and transport to hospital

Glasgow Coma Scale

1.3.1 Base monitoring and exchange of information about people with a head injury on the 3 separate responses on the GCS (for example, describe a person with a GCS score of 13 based on scores of 4 on eye opening, 4

on verbal response and 5 on motor response as E4, V4, M5). **[2003]**

1.3.2 When recording or passing on information about total GCS score, give this as a score out of 15 (for example, 13 out of 15). **[2003]**

1.3.3 Describe the individual components of the GCS in all communications and every patient record and ensure that they always accompany the total score. **[2003]**

1.3.4 In the paediatric version of the GCS, include a 'grimace' alternative to the verbal score to enable scoring in children who are preverbal. **[2003]**

1.3.5 In some people (for example, people with dementia, underlying chronic neurological disorders or learning disabilities), the pre-injury baseline GCS score may be less than 15. Establish this when possible and take it into account during assessment. **[2014]**

Initial assessment and care

1.3.6 Initially assess people 16 and over who have sustained a head injury and manage their care according to clear principles and standard practice, as embodied in the:

- Advanced Trauma Life Support course or European Trauma course
- International Trauma Life Support course
- Pre-hospital Trauma Life Support course
- Advanced Trauma Nurse Course
- Trauma Nursing Core Course
- Joint Royal Colleges Ambulance Service Liaison Committee Clinical Practice Guidelines for Head Trauma. **[2003, amended 2007]**

1.3.7 Initially assess people under 16 who have sustained a head injury and manage their care according to clear principles outlined in the:

- Advanced Paediatric Life Support course or European Paediatric Life Support course
- Pre-hospital Paediatric Life Support course
- Paediatric Education for Pre-hospital Professionals course. **[2003, amended 2007]**

1.3.8 When administering immediate care, first treat the greatest threat to life and avoid further harm. For advice on volume resuscitation for people with a traumatic brain injury and haemorrhagic shock, see NICE's guideline on major trauma: assessment and initial management. **[2003]**

1.3.9 For recommendations on when to carry out full in-line spine immobilisation and how long immobilisation is needed if indicated, see NICE's guideline on spinal injury. **[2003, amended 2007]**

1.3.10 Make pre-alert calls to the destination emergency department for anyone with a GCS score of 8 or less to ensure appropriately experienced professionals are available for their treatment and to prepare for imaging. **[2003]**

1.3.11 Manage pain effectively because it can lead to a rise in intracranial pressure. Provide reassurance, splint limb fractures and catheterise a full bladder when needed. Also see NICE's guideline on major trauma: assessment and initial management. **[2007, amended 2014]**

1.3.12 Always follow best practice in paediatric coma observation and recording, as detailed by the National Paediatric Neuroscience Benchmarking Group. **[2003]**

Transport to hospital

1.3.13 Transport people who have sustained a head injury directly to a major trauma centre or trauma unit that has the age-appropriate resources to further resuscitate them, and to investigate and initially manage multiple injuries. **[2023]**

1.3.14 For guidance on the care of people with major trauma, see NICE's

guideline on major trauma: service delivery. **[2023]**

For a short explanation of why the committee made these recommendations and how they might affect practice or services, see the rationale and impact section on transport to hospital.

Full details of the evidence and the committee's discussion are in evidence review B: transport to a distant specialist neuroscience centre.

Training for ambulance crews and paramedics

1.3.15 Ambulance crews and paramedics should be fully trained in the use of the adult and paediatric versions of the GCS and its derived score. **[2003]**

1.3.16 Ambulance crews and paramedics should be trained in the safeguarding of people under 16 and people 16 and over who are vulnerable. They should document and verbally inform emergency department staff of any safeguarding concerns. **[2003, amended 2014]**

Tranexamic acid

1.3.17 For people with a head injury and a GCS score of 12 or less who are not thought to have active extracranial bleeding, consider:

- a 2 g intravenous bolus injection of tranexamic acid for people 16 and over
- a 15 mg/kg to 30 mg/kg (up to a maximum of 2 g) intravenous bolus injection of tranexamic acid for people under 16.

  Give the tranexamic acid as soon as possible within 2 hours of the injury, in the pre-hospital or hospital setting and before imaging. In March 2023, these were off-label uses of tranexamic acid. See NICE's information on prescribing medicines. **[2023]**

1.3.18 For people with a head injury, and suspected or confirmed extracranial bleeding, see the recommendations in the section on haemostatic agents

in pre-hospital and hospital settings in NICE's guideline on major trauma: assessment and initial management. **[2023]**

For a short explanation of why the committee made these recommendations and how they might affect practice or services, see the rationale and impact section on tranexamic acid.

Full details of the evidence and the committee's discussion are in evidence review A: tranexamic acid.

Direct access from the community to imaging

1.3.19 Do not refer people who have had a head injury for neuroimaging by direct access from the community. **[2023]**

For a short explanation of why the committee made this recommendation and how it might affect practice or services, see the rationale and impact section on direct access from the community to imaging.

Full details of the evidence and the committee's discussion are in evidence review C: direct access from the community to imaging.

1.4 Assessment in the emergency department

1.4.1 Be aware that the priority for all people admitted to an emergency department is to stabilise the airway, breathing and circulation (ABC) before attending to other injuries. See NICE's guideline on major trauma: assessment and initial management. **[2003]**

1.4.2 Only assume a depressed conscious level is due to intoxication after an important traumatic brain injury has been excluded. **[2003]**

1.4.3 Ensure all emergency department clinicians involved in assessing people with a head injury are capable of assessing the presence or absence of the risk factors for CT head imaging listed in the recommendations on

the criteria for doing a CT head scan and the criteria for doing a cervical spine scan in people 16 and over and people under 16. Make training available as needed to ensure this. **[2003]**

1.4.4 Ensure people presenting to the emergency department with impaired consciousness (a GCS score of less than 15) are assessed immediately by a trained member of staff. **[2003]**

1.4.5 For people with a GCS score of 12 or less, see the recommendations on tranexamic acid. **[2023]**

1.4.6 For people with a GCS score of 8 or less, ensure early involvement of an appropriately trained clinician to provide advanced airway management, as described in recommendations 1.8.7 and 1.8.8 in the section on transfer of people 16 and over, and to assist with resuscitation. **[2003]**

1.4.7 Ensure a trained member of staff assesses anyone presenting to an emergency department with a head injury within a maximum of 15 minutes of arrival at hospital. Part of this assessment should establish whether they are at high or low risk for clinically important traumatic brain or cervical spine injury, as described in the recommendations on the criteria for doing a CT head scan and the criteria for doing a CT cervical spine scan in people 16 and over and people under 16. **[2003]**

1.4.8 In people considered to be at high risk for clinically important traumatic brain or cervical spine injury, extend assessment to full clinical examination to establish any need for CT imaging of the head, or imaging of the cervical spine and other body areas. Use the recommendations on the criteria for doing a CT head scan and the criteria for doing a CT cervical spine scan in people 16 and over and people under 16 as the basis for the final decision on imaging after discussion with the radiology department. **[2003, amended 2007]**

1.4.9 Anyone triaged to be at low risk for clinically important traumatic brain or cervical spine injury at initial assessment should be re-examined by an emergency department clinician. They should establish whether CT imaging of the head or cervical spine will be needed. Use the recommendations on the criteria for doing a CT head scan and the

criteria for doing a cervical spine scan in people 16 and over and people under 16 as the basis for the final decision on imaging after discussion with the radiology department. **[2003, amended 2007 and 2023]**

1.4.10 Review people who return to an emergency department with any persistent complaint relating to the initial head injury and discuss them with a senior clinician experienced in head injuries. Consider whether a CT scan is needed. **[2003, amended 2023]**

1.4.11 Manage pain effectively to help prevent any rise in intracranial pressure. Provide reassurance, splint limb fractures and catheterise a full bladder when needed. See NICE's guideline on major trauma: assessment and initial management for information on pain management. **[2007]**

1.4.12 Consider or suspect abuse, neglect or other safeguarding issues as a contributory factor to, or cause of, a head injury. See NICE's guidelines on child maltreatment, child abuse and neglect, domestic violence and abuse and safeguarding adults in care homes for clinical features that may be associated with maltreatment. **[2023]**

For a short explanation of why the committee made this recommendation and how it might affect practice or services, see the rationale and impact section on assessment in the emergency department.

Full details of the evidence and the committee's discussion are in evidence review D: clinical decision rules selecting people with head injury for imaging.

1.4.13 Involve a clinician with training in safeguarding in the initial assessment of any person with a head injury presenting to the emergency department. If there are any concerns identified, document these and follow local safeguarding procedures appropriate to the person's age. **[2003, amended 2014]**

1.4.14 Use a standard head injury proforma for documentation when assessing and observing people with a head injury throughout their time in hospital. This form should be of a consistent format across all clinical departments and hospitals in which a person might be treated. Use a separate

proforma for people under 16. Include areas to allow extra documentation (for example, in cases of non-accidental injury). **[2003, amended 2007]**

Involving the neurosurgical department

1.4.15 Discuss with a neurosurgeon the care of anyone with new and surgically significant abnormalities on imaging. The definition of 'surgically significant' should be developed by local neurosurgical centres and agreed with referring hospitals, along with referral procedures. **[2003, amended 2014]**

1.4.16 Regardless of imaging, discuss a person's care plan with a neurosurgeon if they have:

- persisting coma (a GCS score of 8 or less) after initial resuscitation
- unexplained confusion that persists for more than 4 hours
- deterioration in GCS score after admission (pay more attention to motor response deterioration)
- progressive focal neurological signs
- a seizure without full recovery
- a definite or suspected penetrating injury
- a cerebrospinal fluid leak. **[2003]**

1.5 Investigating clinically important traumatic brain injuries

1.5.1 The current primary investigation of choice for detecting an acute clinically important traumatic brain injury is CT imaging of the head. **[2003]**

1.5.2 For safety, logistic and resource reasons, do not do MRI scanning as the primary investigation for clinically important traumatic brain injury in people who have sustained a head injury. But additional information of

importance to prognosis can sometimes be detected using MRI. **[2003]**

1.5.3 Ensure that there is appropriate equipment for monitoring people with a head injury who are having an MRI scan. Also ensure that all staff involved are aware of the dangers and necessary precautions for working near an MRI scanner. **[2003]**

1.5.4 Do not use plain X-rays of the skull to diagnose important traumatic brain injury before a discussion with a neuroscience unit. However, people under 16 presenting with suspected non-accidental injury may need a skeletal survey. **[2007]**

1.5.5 Arrange transfer to a suitable hospital for people with indications for a CT scan who present to a hospital where CT scans are not available (see the recommendations on the criteria for doing a CT head scan and the criteria for doing a CT cervical spine scan in people 16 and over and people under 16). **[2007, amended 2023]**

1.5.6 Trauma networks should make sure that people can be transferred as indicated in recommendation 1.5.5. **[2007, amended 2023]**

1.5.7 In line with good radiation exposure practice, make every effort 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. **[2003]**

Criteria for doing a CT head scan

People 16 and over

1.5.8 For people 16 and over who have sustained a head injury, do a CT head scan within 1 hour of any of these risk factors being identified:

- a GCS score of 12 or less on initial assessment in the emergency department
- a GCS score of less than 15 at 2 hours after the injury on assessment in the emergency department

- suspected open or depressed skull fracture
- any sign of basal skull fracture (haemotympanum, 'panda' eyes, cerebrospinal fluid leakage from the ear or nose, Battle's sign)
- post-traumatic seizure
- focal neurological deficit
- more than 1 episode of vomiting. **[2023]**

1.5.9 For people 16 and over who have had some loss of consciousness or amnesia since the injury, do a CT head scan within 8 hours of the head injury, or within the hour in someone presenting more than 8 hours after the injury, if they have any of these risk factors:

- age 65 or over
- any current bleeding or clotting disorders
- dangerous mechanism of injury (a pedestrian or cyclist struck by a motor vehicle, an occupant ejected from a motor vehicle or a fall from a height of more than 1 m or 5 stairs)
- more than 30 minutes' retrograde amnesia of events immediately before the head injury. **[2023]**

People under 16

1.5.10 For people under 16 who have sustained a head injury, do a CT head scan within 1 hour of any of these risk factors being identified:

- suspicion of non-accidental injury
- post-traumatic seizure
- on initial emergency department assessment, a GCS score of less than 14 or, for babies under 1 year, a GCS score (paediatric) of less than 15
- at 2 hours after the injury, a GCS score of less than 15
- suspected open or depressed skull fracture, or tense fontanelle

- any sign of basal skull fracture (haemotympanum, 'panda' eyes, cerebrospinal fluid leakage from the ear or nose, Battle's sign)
- focal neurological deficit
- for babies under 1 year, a bruise, swelling or laceration of more than 5 cm on the head. **[2023]**

1.5.11 For people under 16 who have sustained a head injury and have more than 1 of these risk factors, do a CT head scan within 1 hour of the risk factors being identified:

- loss of consciousness lasting more than 5 minutes (witnessed)
- abnormal drowsiness
- 3 or more discrete episodes of vomiting
- dangerous mechanism of injury (high-speed road traffic accident as a pedestrian, cyclist or vehicle occupant, fall from a height of more than 3 m, high-speed injury from a projectile or other object)
- amnesia (anterograde or retrograde) lasting more than 5 minutes (it will not be possible to assess amnesia in children who are preverbal and is unlikely to be possible in children under 5)
- any current bleeding or clotting disorder. **[2023]**

1.5.12 Observe people under 16 who have sustained a head injury but have only 1 of the risk factors in recommendation 1.5.11 for a minimum of 4 hours from the time of injury. If, during observation, any of the following risk factors are identified, do a CT head scan within 1 hour:

- a GCS score of less than 15
- further vomiting
- a further episode of abnormal drowsiness.

  If none of these risk factors occur during observation, use clinical judgement to determine whether a longer period of observation is needed. **[2023]**

People taking anticoagulant or antiplatelet medication

1.5.13 For people who have sustained a head injury and have no other indications for a CT head scan, but are on anticoagulant treatment (including vitamin K antagonists, direct-acting oral anticoagulants (DOACs), heparin and low molecular weight heparins) or antiplatelet treatment (excluding aspirin monotherapy), consider doing a CT head scan:

- within 8 hours of the injury (for example, if it is difficult to do a risk assessment or if the person might not return to the emergency department if they have signs of deterioration) **or**
- within the hour if they present more than 8 hours after the injury.

  For advice on reversing vitamin K antagonists for people with traumatic intracranial haemorrhage, see the section on prothrombin complex concentrate in NICE's guideline on blood transfusion. For advice on reversing DOACs, see the MHRA safety advice on DOACs for a list of reversal agents and NICE's technology appraisal guidance on andexanet alfa for reversing anticoagulation from apixaban or rivaroxaban. **[2023]**

Timing of radiology report

1.5.14 Make a provisional written radiology report available within 1 hour of a CT scan. **[2014]**

For a short explanation of why the committee made these recommendations and how they might affect practice or services, see the rationale and impact section on criteria for doing a CT head scan.

Full details of the evidence and the committee's discussion are in:

- evidence review D: clinical decision rules selecting people with head injury for imaging
- evidence review E: selecting adults, children and infants with head injury for CT or MRI head scan in sub-groups.

Investigation to predict post-concussion syndrome

1.5.15 For information on referring people with possible post-concussion syndrome, see recommendation 1.10.14 in the section on follow up. **[2023]**

For a short explanation of why the committee made this recommendation and how it might affect practice or services, see the rationale and impact section on post-concussion syndrome.

Full details of the evidence and the committee's discussion are in evidence review F: brain injury biomarkers and/or MRI for predicting post-concussion syndrome.

1.6 Investigating injuries to the cervical spine

Assessing range of movement in the neck

1.6.1 Be aware that range of movement in the neck when there is clinical suspicion of a cervical spine injury can only be assessed safely before imaging in people with a head injury if they have no high-risk factors (see recommendation 1.6.2, and recommendations 1.6.4 and 1.6.6). Only do the assessment if they have at least 1 of these low-risk features:

- they were in a simple rear-end motor vehicle collision
- they are comfortable in a sitting position
- they have been ambulatory at any time since injury
- there is no midline cervical spine tenderness
- they present with delayed onset of neck pain.

See also NICE's guideline on spinal injury: assessment and initial management. **[2014]**

Criteria for doing a CT cervical spine scan in people 16 and over

1.6.2 For people 16 and over who have sustained a head injury (including people with delayed presentation), do a CT cervical spine scan within 1 hour of the risk factor being identified if any of these high-risk factors apply:

- the GCS score is 12 or less on initial assessment
- the person has been intubated
- a definitive diagnosis of a cervical spine injury is urgently needed (for example, if cervical spine manipulation is needed during surgery or anaesthesia)
- there has been blunt polytrauma involving the head and chest, abdomen or pelvis in someone who is alert and stable

- there is clinical suspicion of a cervical spine injury and any of these factors:
  - age 65 or over
  - a dangerous mechanism of injury (that is, a fall from a height of more than 1 m or 5 stairs, an axial load to the head such as from diving, a high-speed motor vehicle collision, a rollover motor accident, ejection from a motor vehicle, an accident involving motorised recreational vehicles or a bicycle collision)
  - focal peripheral neurological deficit
  - paraesthesia in the upper or lower limbs. **[2023]**

1.6.3 For people 16 and over who have sustained a head injury, and have neck pain or tenderness but no high-risk indications for a CT cervical spine scan (see recommendation 1.6.2), do a CT cervical spine scan within 1 hour for any of these risk factors:

- it is not thought to be safe to assess the range of movement in the neck (see recommendation 1.6.1)
- safe assessment of range of neck movement shows that the person cannot actively rotate their neck 45 degrees to the left and right
- the person has a condition predisposing them to a higher risk of injury to the cervical spine (for example, axial spondyloarthritis). **[2023]**

Criteria for doing a CT cervical spine scan in people under 16

1.6.4 For people under 16 who have sustained a head injury (including those with delayed presentation), only do a CT cervical spine scan if any of these risk factors apply:

- the GCS score is 12 or less on initial assessment
- the person has been intubated
- there are focal peripheral neurological signs
- there is paraesthesia in the upper or lower limbs

- a definitive diagnosis of a cervical spine injury is needed urgently (for example, if manipulation of the cervical spine is needed during surgery or anaesthesia)
- the person is having other body areas scanned for head injury or multisystem trauma, and there is clinical suspicion of a cervical spine injury
- there is strong clinical suspicion of injury despite normal X-rays
- plain X-rays are technically difficult or inadequate
- plain X-rays identify a significant bony injury.

Do the scan within 1 hour of the risk factor being identified. **[2023]**

1.6.5 For people under 16 who have sustained a head injury, and have neck pain or tenderness but no indications for a CT cervical spine scan (see recommendation 1.6.4), do 3-view cervical spine X-rays before assessing range of movement in the neck if any of these risk factors are identified:

- there was a dangerous mechanism of injury (that is, a fall from a height of more than 1 m or 5 stairs, an axial load to the head such as from diving, a high-speed motor vehicle collision, a rollover motor accident, ejection from a motor vehicle, an accident involving motorised recreational vehicles or a bicycle collision)
- safe assessment of range of movement in the neck is not possible (see recommendation 1.6.1)
- the person has a condition that predisposes them to a higher risk of injury to the cervical spine (for example, collagen vascular disease, osteogenesis imperfecta, axial spondyloarthritis).

The X-rays should be done within 1 hour of the risk factor being identified and reviewed by a clinician trained in their interpretation. **[2023]**

1.6.6 If range of neck movement can be assessed safely (see recommendation 1.6.1) in a person under 16 who has sustained a head injury, and has neck pain or tenderness but no indications for a CT cervical spine scan, do 3-view cervical spine X-rays if they cannot actively rotate their neck 45 degrees to the left and right. When the person is unable to understand commands or open their mouth, a peg view may be omitted. The X-rays should be done within 1 hour of this risk factor being

identified, and reviewed by a clinician trained in their interpretation. **[2014]**

Timing of radiology report

1.6.7 Make a provisional written radiology report available within 1 hour of a CT scan. **[2014]**

Imaging investigations

1.6.8 Ensure that imaging reports are based on high-resolution source data and multiplanar reformatting of the entire cervical spine. **[2003, amended 2014 and 2023]**

1.6.9 Do MRI in addition to CT if there are neurological signs and symptoms suggesting injury to the cervical spine. **[2003, amended 2014 and 2023]**

1.6.10 Do CT or MRI angiography of the neck vessels if there is a suspicion of vascular injury, for example, because of:

- vertebral malalignment
- a high-risk fracture (that is, a high-grade or complex facial fracture or a base of skull fracture likely to involve the internal carotid artery or vertebral artery)
- posterior circulation syndrome. **[2003, amended 2014 and 2023]**

1.6.11 Consider MRI for assessing ligamentous and disc injuries suggested by CT or clinical findings. **[2003]**

For a short explanation of why the committee made these recommendations and how they might affect practices or services, see the rationale and impact section on investigating injuries to the cervical spine.

Full details of the evidence and the committee's discussion are in evidence review H: CT, MRI and X-ray of the cervical spine in people with head injury – diagnostic.

1.7 Information and support for families and carers

1.7.1 Staff caring for people with a head injury should introduce themselves to family members or carers, and briefly explain what they are doing. **[2003, amended 2014]**

1.7.2 Ensure that information for families and carers explains the nature of the head injury and the likely care pathway. **[2003]**

1.7.3 Staff should think about how best to share information with people under 16, and introduce them to the possibility of long-term complex changes in their parent or sibling who has had a head injury. Literature produced by patient support groups may be helpful. **[2003]**

1.7.4 Encourage family members and carers to talk to and make physical contact (for example, holding hands) with the person with a head injury. But ensure that relatives and friends do not feel obliged to spend long periods at the bedside. If they wish to stay with the person with a head injury, encourage them to take regular breaks. **[2003, amended 2007]**

1.7.5 Ensure there is a board or area displaying leaflets or contact details for local and national patient support organisations to help family members and carers gather further information. **[2003]**

1.8 Transfer from hospital to a neuroscience unit

Transfer of people 16 and over

1.8.1 Ensure local guidelines on the transfer of people with a severe traumatic brain injury are drawn up between the referring hospital trusts, the neuroscience unit and the local ambulance service, and recognise that:

- transfer would benefit anyone with serious head injuries (a GCS score of 8 or less), irrespective of the need for neurosurgery

- if transfer of people who do not need neurosurgery is not possible, ongoing liaison with the neuroscience unit over clinical management is essential. Also see the recommendations on transfer between emergency departments in NICE's guideline on major trauma: service delivery. **[2003, amended 2007]**

1.8.2 Think about the possibility of occult extracranial injuries in people 16 and over with multiple injuries, and do not transfer them to a service that is unable to deal with other aspects of trauma. **[2007]**

1.8.3 Ensure there is a designated consultant in the referring hospital with responsibility for establishing arrangements for the transfer of people with head injuries to a neuroscience unit. Also ensure there is another consultant at the neuroscience unit with responsibility for establishing arrangements for communication with referring hospitals, and for receiving people transferred. **[2003]**

1.8.4 Ensure that people with traumatic brain injuries needing emergency transfer to a neuroscience unit are accompanied by healthcare staff with appropriate training and experience in the transfer of people with an acute traumatic brain injury. They should:

- be familiar with the pathophysiology of traumatic brain injuries, the medicines and equipment they will use, and working in the confines of an ambulance (or helicopter if appropriate)
- have a dedicated and adequately trained assistant
- be provided with appropriate clothing for the transfer, medical indemnity and personal accident insurance.

Ensure that people needing non-emergency transfer are accompanied by appropriate clinical staff. **[2003, amended 2007]**

1.8.5 Provide the transfer team responsible for transferring a person with a head injury with a means of communicating changes in the person's status with their base hospital and the neurosurgical unit during the transfer. **[2003, amended 2014]**

1.8.6 Although it is understood that transfer is often urgent, complete the initial resuscitation and stabilisation of the person, and establish

comprehensive monitoring before transfer, to avoid complications during the journey. Do not transport someone with persistent hypotension, despite resuscitation, until the cause has been identified and they are stabilised. **[2003, amended 2007]**

1.8.7 Intubate and ventilate anyone with a GCS score of 8 or less needing transfer to a neuroscience unit, and anyone with the indications detailed in recommendation 1.8.8. **[2003]**

1.8.8 Intubate and ventilate the person immediately when there is:

- coma, that is, they are not obeying commands, not speaking and not eye opening (a GCS score of 8 or less)
- loss of protective laryngeal reflexes
- ventilatory insufficiency, as judged by blood gases: hypoxaemia (PaO_2 less than 13 kPa on oxygen) or hypercarbia ($PaCO_2$ more than 6 kPa)
- irregular respirations. **[2003, amended 2007]**

1.8.9 Use intubation and ventilation before the start of the journey when the person has:

- significantly deteriorating conscious level (1 or more points on the motor score), even if not coma
- unstable fractures of the facial skeleton
- copious bleeding into the mouth (for example, from a skull base fracture)
- seizures. **[2003, amended 2007]**

1.8.10 Anyone whose trachea is intubated should have appropriate sedation and analgesia along with a neuromuscular blocking drug. Aim for a PaO_2 of more than 13 kPa, and a $PaCO_2$ of 4.5 kPa to 5.0 kPa, unless there is clinical or radiological evidence of raised intracranial pressure, in which case more aggressive hyperventilation is justified. If hyperventilation is used, increase the inspired oxygen concentration. Maintain the mean arterial pressure at 80 mmHg or more by infusion of fluid and vasopressors, as indicated. **[2003, amended 2007]**

1.8.11 Give family members and carers as much access to the person with a head injury as is practical during transfer. If possible, give them an opportunity to discuss the reasons for transfer and how the transfer process works with a member of the healthcare team. **[2003, amended 2014]**

Transfer of people under 16

1.8.12 Recommendations 1.8.1 to 1.8.9 and 1.8.11 were written for people 16 and over, but apply these principles to people under 16, providing that the paediatric modification of the GCS is used for preverbal and non-verbal children. Ventilate people under 16 according to the age-appropriate level of oxygen saturation and maintain blood pressure at a level appropriate for their age. **[2003, amended 2023]**

1.8.13 Ensure that service provision for transfer to tertiary care follows the principles outlined in the NHS England service specification for paediatric intensive care retrieval (transport) and the Paediatric Critical Care Society quality standards for the care of critically ill or injured children. **[2003]**

1.8.14 Think about the possibility of occult extracranial injuries for people under 16 with multiple injuries. Do not transfer them to a service that is unable to deal with other aspects of trauma. **[2007]**

1.8.15 Ensure that transfer of people under 16 to a specialist neurosurgical unit is done either by staff experienced in the transfer of people under 16 who are critically ill or according to local guidelines with specialist paediatric retrieval teams. **[2003, amended 2023]**

1.8.16 Give family members and carers as much access to their child as is practical during transfer. If possible, give them an opportunity to discuss the reasons for transfer and how the transfer process works with a member of the healthcare team. **[2003, amended 2014]**

1.9 Admission and observation

1.9.1 Use these criteria for admitting people to hospital after a head injury:

- new, clinically important abnormalities on imaging (an isolated simple linear non-displaced skull fracture is unlikely to be a clinically important abnormality unless they are taking anticoagulant or antiplatelet medication)
- after imaging, a GCS score that has not returned to 15 or their pre-injury baseline, regardless of the imaging results
- when there are indications for CT scanning but this cannot be done within the appropriate time period, either because CT is not available or because the person is not sufficiently cooperative to allow scanning
- continuing worrying symptoms (for example, persistent vomiting, severe headaches or seizures) of concern to the clinician
- other sources of concern to the clinician (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, cerebrospinal fluid leak, or suspicion of ongoing post-traumatic amnesia).

  See the section on discharge and follow up for recommendations about other factors to consider, such as whether supervision at home is available. **[2003, amended 2023]**

1.9.2 Be aware that some people may need an extended period in a recovery setting because of having general anaesthesia during CT imaging. **[2003, amended 2007]**

1.9.3 Admit people with multiple injuries under the care of the team that is trained to deal with their most severe and urgent problem. **[2003]**

1.9.4 When someone with a head injury needs hospital admission, admit them under the care of a team led by a consultant who has been trained in managing this condition. The consultant and their team should have competence (defined by local agreement with the neuroscience unit) in:

- assessment, observation and indications for imaging (see the sections on the criteria for doing a CT head scan and the criteria for doing a CT cervical spine scan in people 16 and over and people under 16)
- inpatient management

- indications for transfer to a neuroscience unit (see the section on transfer from hospital to a neuroscience unit)
- hospital discharge and follow up (see the section on discharge and follow up). **[2003, amended 2007]**

Admission and observation of people with concussion symptoms

1.9.5 For people with concussion symptoms after normal brain imaging or no indication for early imaging, follow the indications for admission in recommendation 1.9.1. Also see the section on discharge advice. **[2023]**

For a short explanation of why the committee made these recommendations and how they might affect practice or services, see the rationale and impact section on admission and observation.

Full details of the evidence and the committee's discussion are in:

- evidence review I: admission and observation in hospital of people with head injury who are on anticoagulant or antiplatelet therapy after normal brain imaging or no indication for early imaging
- evidence review J: admission and observation of people with concussion symptoms
- evidence review K: hospital admission in people with small intracranial injuries
- evidence review L: isolated skull fracture.

Early diagnosis of hypopituitarism

1.9.6 Be aware that any severity of head injury can cause pituitary dysfunction. This may present immediately, hours, weeks or months after the injury. A variety of symptoms could indicate hypopituitarism. **[2023]**

1.9.7 In people admitted to hospital with a head injury who have persistently abnormal low sodium levels or low blood pressure, consider

investigations for hypopituitarism. **[2023]**

1.9.8 In people presenting to primary or community care with persistent symptoms consistent with hypopituitarism in the weeks or months after a head injury, consider investigations or referral for hypopituitarism. **[2023]**

For a short explanation of why the committee made these recommendations and how they might affect practice or services, see the rationale and impact section on early diagnosis of hypopituitarism.

Full details of the evidence and the committee's discussion are in:

- evidence review M: identification of hypopituitarism (who to investigate)
- evidence review N: identification of hypopituitarism (when to investigate).

Observation of people who are admitted

1.9.9 Ensure that in-hospital observation of people with a head injury is only done by professionals competent in assessing head injuries. **[2003]**

1.9.10 For people admitted for head injury observation, the minimum acceptable documented neurological observations are: GCS score, pupil size and reactivity, limb movements, respiratory rate, heart rate, blood pressure, temperature and blood oxygen saturation. **[2003]**

1.9.11 Carry out and record observations on a half-hourly basis until there is a GCS score of 15. Observations for people with a GCS score of 15 should start after the initial assessment in the emergency department and the minimum frequency should be:

- half-hourly for 2 hours, then
- 1 hourly for 4 hours, then
- 2 hourly. **[2003]**

1.9.12 Revert to half-hourly observations and follow the original frequency schedule for people with a GCS score of 15 who deteriorate at any time after the initial 2-hour period. **[2003]**

1.9.13 Urgently reassess a person with a head injury if they have any of these signs of neurological deterioration:

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

A supervising doctor should do the appraisal. **[2003, amended 2007]**

1.9.14 To reduce interobserver variability and unnecessary referrals, get a second member of staff competent in observations to confirm deterioration before involving the supervising doctor. Do this immediately if possible. If not possible (for example, because no staff member is available to do the second observation), contact the supervising doctor without the confirmation being done. **[2003]**

1.9.15 If any of the changes noted in recommendation 1.9.13 are confirmed, consider doing an immediate CT scan, and reassess the person's clinical condition and manage appropriately. **[2003, amended 2007]**

1.9.16 If a person has had a normal CT scan but does not have a GCS score of 15 after 24 hours of observation, consider a further CT or MRI scan and discuss with the radiology department. **[2003]**

Observation of babies and children under 5

1.9.17 Be aware that observation of babies and children under 5 is difficult, so

should only be done by units with staff experienced in the observation of under 5s with a head injury. Babies and children under 5 may be observed in normal paediatric observation settings, as long as staff have the appropriate experience. **[2003]**

Training in observation

1.9.18 All staff caring for people with a head injury admitted for observation should be trained in doing the observations listed in recommendations 1.9.10 to 1.9.14 in the section on observation of people who are admitted, and the recommendation on observation of babies and children under 5. **[2003]**

1.9.19 Make dedicated training available to all relevant staff to enable them to acquire and maintain observation and recording skills. Specific training is needed for the observation of people under 16. **[2003]**

1.10 Discharge and follow up

1.10.1 If CT is not indicated based on history and examination and there is no suspicion of clinically important traumatic brain injury, discharge the person from hospital if there are:

- no other factors that would warrant a hospital admission (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, or cerebrospinal fluid leak)
- appropriate support structures for safe discharge to the community and for subsequent care (for example, competent supervision at home). **[2003]**

1.10.2 If imaging of the head is normal and the risk of clinically important traumatic brain injury is low, transfer the person to the community if:

- the GCS score has returned to 15 or the pre-injury baseline GCS score
- there are no other factors that would warrant a hospital admission (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, or cerebrospinal fluid leak)

- there are appropriate support structures for safe transfer to the community and for subsequent care (for example, competent supervision at home). **[2003]**

1.10.3 After normal imaging of the cervical spine, risk of injury to the cervical spine is low enough to warrant transfer to the community if:

- the GCS score is 15
- clinical examination is normal
- there are no other factors that would warrant a hospital admission present (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, or cerebrospinal fluid leak)
- there are appropriate support structures for safe transfer to the community and for subsequent care (for example, competent supervision at home). **[2003]**

1.10.4 Do not discharge people presenting with a head injury until their GCS score is 15 or, in preverbal and non-verbal children, consciousness is normal as assessed by the paediatric version of the GCS. In people with pre-injury cognitive impairment, their GCS score should be back to that documented before the injury. **[2003]**

1.10.5 Only transfer people with any degree of head injury to their home if there is somebody suitable at home to supervise them. Discharge people with no carer at home only if suitable supervision arrangements have been organised, or when the risk of late complications is thought to be negligible. **[2003]**

People with pre-injury cognitive impairment

1.10.6 Ensure that people with pre-injury cognitive impairment (for example, dementia or a learning disability) and people returning to a custodial setting are supervised and monitored. Also, make sure that arrangements are in place should there be any signs of deterioration. **[2023]**

For a short explanation of why the committee made this recommendation and how it might affect practice or services, see the rationale and impact section on discharge and follow up.

Full details of the evidence and the committee's discussion are in evidence review E: selecting adults, children and infants with head injury for CT or MRI head scan in sub-groups.

Discharge after observation

1.10.7 People admitted after a head injury may be discharged after resolution of all significant symptoms and signs, provided they have suitable supervision arrangements at home, in custody or in continued care. **[2003, amended 2023]**

Discharge advice

1.10.8 Give verbal and printed discharge advice to people with any degree of head injury who are discharged from an emergency department or observation ward. This should also be provided to the person responsible for their care after discharge. This may include their families, carers, social workers or custodial staff. Follow the recommendations in NICE's guidelines on patient experience in adult NHS services and babies, children and young people's experience of healthcare, including on providing information in an accessible format. **[2014, amended 2023]**

1.10.9 Ensure that printed advice for people with a head injury, and their families and carers, is age appropriate and includes:

- details of the nature and severity of the injury
- risk factors that mean people need to return to the emergency department (see the recommendations on community health services and inpatient units without an emergency department)
- a specification that a responsible adult should stay with the person for the first 24 hours after their injury

- details about the recovery process, including the fact that some people may appear to make a quick recovery but later have difficulties or complications
- contact details of community and hospital services in case of delayed complications
- information about return to everyday activities, including school, work, sports and driving
- details of support organisations. **[2014]**

1.10.10 Offer information and advice on alcohol or drug misuse to people who presented to the emergency department with drug or alcohol intoxication when they are fit for discharge. **[2003]**

1.10.11 Inform people with a head injury, and their families and carers, about the possibility of persistent or delayed symptoms after a head injury and who to contact if they have ongoing problems. **[2014]**

1.10.12 For anyone who has attended the emergency department with a head injury, write to their GP within 48 hours of discharge, giving details of clinical history and examination. Also share this letter with health visitors (for preschool children) and school nurses (for school-age children and young people). If appropriate, provide a copy of the letter for the person with a head injury, and their family or carers, custodial staff or social worker. **[2014]**

Follow up

1.10.13 Refer people with a head injury to investigate its causes and manage contributing factors, if appropriate. This could include, for example, referral for a falls assessment or to safeguarding services. **[2023]**

1.10.14 Consider referring people who have persisting problems to a clinician trained in assessing and managing the consequences of traumatic brain injury (for example, a neurologist, neuropsychologist, clinical psychologist, neurosurgeon or endocrinologist, or a multidisciplinary neurorehabilitation team). **[2003, amended 2023]**

For a short explanation of why the committee made these recommendations and how they might affect practice or services, see the rationale and impact section on follow up.

Full details of the evidence and the committee's discussion are in:

- evidence review J: admission and observation of people with concussion symptoms
- evidence review N: identification of hypopituitarism (when to investigate).

Investigations for hypopituitarism

1.10.15 Consider further endocrinology investigations for people who have been discharged after a head injury if they have persistent symptoms consistent with hypopituitarism or are not recovering as expected. **[2023]**

For a short explanation of why the committee made this recommendation and how it might affect practice or services, see the rationale and impact section on investigations for hypopituitarism.

Full details of the evidence and the committee's discussion are in:

- evidence review M: identification of hypopituitarism (who to investigate)
- evidence review N: identification of hypopituitarism (when to investigate).

Terms used in this guideline

This section defines terms that have been used in a particular way for this guideline.

Complex skull fracture or penetrating head injury

Signs of a basal, open or depressed skull fracture or penetrating head injury include:

- clear fluid running from the ears or nose
- a black eye with no associated damage around the eyes
- bleeding from 1 or both ears
- bruising behind 1 or both ears
- penetrating injury signs
- visible trauma to the scalp or skull of concern to the professional.

Focal neurological deficit

Neurological problems restricted to a particular part of the body or a particular activity, for example:

- difficulties with understanding, speaking, reading or writing
- decreased sensation
- loss of balance
- weakness
- visual changes
- nystagmus
- abnormal reflexes
- problems walking
- amnesia since the injury.

Glasgow Coma Scale

In people with a head injury, the Glasgow Coma Scale (GCS) is an early assessment of the

severity of any associated traumatic brain injury. It is a standardised system used to assess the degree of brain impairment and to identify the seriousness of injury in relation to outcome. The scale has 3 domains: eye opening, verbal and motor responses. These are all evaluated independently in the scale according to a numerical value that indicates the level of consciousness and degree of dysfunction. The scores in each element of the GCS are summed to give the overall GCS score, which ranges from 3 (unresponsive in all domains) to 15 (no deficits in responsiveness):

- Mild traumatic brain injury is a GCS score of 13 to 15.
- Moderate traumatic brain injury is a GCS score of 9 to 12.
- Severe traumatic brain injury is a GCS score of 8 or less.

High-energy head injury

An injury arising from, for example, a pedestrian being struck by a motor vehicle, an occupant being ejected from a motor vehicle, a fall from a height of more than 1 m or more than 5 stairs, a diving accident, a high-speed motor vehicle collision, a rollover motor accident, an accident involving motorised recreational vehicles, a bicycle collision or any other potentially high-energy mechanism.

Hypopituitarism

Underactivity of the pituitary gland that can lead to:

- adrenocorticotropic hormone deficiency causing weakness, fatigue, weight loss, hypotension, hyponatraemia, hypoglycaemia, hypercalcaemia, anaemia and fatigue
- growth hormone deficiency causing decreased energy, low mood, neuropsychiatric and cognitive symptoms, decreased lean body mass, increased fat mass, altered metabolic profile and decreased exercise capacity
- lack of sex hormones that can cause later puberty, hot flushes, fatigue, tiredness, loss of body hair, reduced sex drive, irregular periods, erectile dysfunction and reduced fertility
- thyroid-stimulating hormone deficiency presenting with slow growth, fatigue, lethargy, cold intolerance and weight gain

- vasopressin deficiency causing polyuria, polydipsia, nocturia and incontinence.

Isolated simple linear non-displaced skull fracture

A single or solitary linear fracture that does not exhibit any inward or outward displacement, does not consist of multiple fracture lines and does not involve or cross the normal sutures of the skull.

Paraesthesia

Pins and needles, or a prickling sensation, tingling or itching in any part of the body.

Post-concussion syndrome

Post-concussion syndrome (or post-concussion symptoms) is seen in all severities of head injury and is under-recognised in mild head injuries. It is the term used in evidence review F: brain injury biomarkers and/or MRI for predicting post-concussion syndrome. The term 'concussion' is used in evidence review J: admission and observation of people with concussion symptoms.

Examples of symptoms in these reviews include, but are not limited to:

Sensory and motor:

- headache
- dizziness
- nausea
- changes in vision, such as blurred vision, double vision, 'seeing stars' and 'looking through a haze'
- visual processing problems, such as not taking in what you are seeing
- difficulties staying awake, sleeping for many more hours than usual and chronic fatigue when awake
- unusual sensitivity to noise (hyperacusis)
- unusual sensitivity to bright lights (photophobia)
- difficulties with balance, coordination and mobility, often resulting in falls, banging into objects and, at times, further traumatic brain injuries
- speech problems.

Cognition:

- cognitive difficulties (as long as the GCS score is 15), sometimes described as 'brain fog', which may include problems finding words or numbers, difficulty speaking, slowed responsiveness, short-term memory problems, difficulty concentrating and problems with information processing, such as following conversations, digesting text and finding words
- difficulties with executive functions, such as organising, planning and multitasking
- amnesia

- problems with spatial awareness and proprioception, including the sensation of touching something as if through a layer of numbness.

Emotional:

- lability, such as unusual laughing or crying (because of being overwhelmed by sense impressions) or irritability
- depression
- anxiety.

Additional symptoms that may present in children under 5:

- changes in normal behaviour after a head injury, such as crying a lot or irritability
- changes in feeding or sleeping habits
- loss of interest in people or objects
- listlessness.

Traumatic brain injury

An alteration in brain function, or other evidence of brain pathology, caused by an external force.

Recommendations for research

The guideline committee has made these recommendations for research.

Key recommendations for research

1 Indications for admission in people with a mild head injury and a confirmed abnormality on a CT scan

What are the indications for admission using clinical decision rules in people with a Glasgow Coma Scale (GCS) score of 13 to 15 (a mild head injury) and a confirmed abnormality on a CT scan? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on admission and observation.

Full details of the evidence and the committee's discussion are in evidence review K: hospital admission in people with small intracranial injuries.

2 Using biomarkers for predicting acute post-traumatic brain injury complications

What is the diagnostic accuracy of brain injury biomarkers for predicting acute complications after a traumatic brain injury? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on post-concussion syndrome.

Full details of the evidence and the committee's discussion are in evidence review G: brain injury biomarkers for predicting acute post-brain injury complications.

3 Indications for imaging for people with a history of recurrent

head injuries

What is the risk of intracranial injuries in people with a history of recurrent head injuries, including from sports and falls, and no other indications for a CT scan? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on criteria for doing a CT head scan.

Full details of the evidence and the committee's discussion are in evidence review E: selecting adults, children and infants with head injury for CT or MRI head scan in sub-groups.

4 Risk of bleeding for people with a pre-injury coagulopathy

What is the risk of any intracranial bleeding or intracranial bleeding associated with clinical deterioration after head injury in people with a pre-injury coagulopathy? This includes medical conditions such as liver failure or haemophilia, or taking anticoagulants or antiplatelets in people who:

- have a GCS score of 15 at 2 hours after the head injury and medium risk factors for intracranial bleeding **or**
- loss of consciousness or amnesia with no additional risk factors (that is, they are under 65, had a low-energy transfer injury and any retrograde amnesia has lasted for less than 30 minutes) **or**
- there is no loss of consciousness or amnesia **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on criteria for doing a CT head scan.

Full details of the evidence and the committee's discussion are in evidence review E: selecting adults, children and infants with head injury for CT or MRI head scan in sub-groups.

5 Indications for imaging for people with a pre-injury cognitive

impairment

What are the indications for selecting imaging in adults, young people, children and babies with a head injury sustained through a low-energy fall and with suspected pre-injury cognitive impairment when loss of consciousness or amnesia is difficult to assess or the pre-injury GCS score is not 15? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on criteria for doing a CT head scan.

Full details of the evidence and the committee's discussion are in evidence review E: selecting adults, children and infants with head injury for CT or MRI head scan in sub-groups.

Other recommendations for research

6 Transport to a neuroscience centre

What is the clinical and cost effectiveness of pre-hospital strategies to take people with a head injury to a distant specialist neuroscience centre instead of a closer non-specialist unit? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on transport to hospital.

Full details of the evidence and the committee's discussion are in evidence review B: transfer to a distant specialist neuroscience centre.

7 Tranexamic acid

What is the clinical and cost effectiveness of tranexamic acid before imaging in people presenting within 2 hours of a head injury with a GCS score of 13 to 15 and high-risk indications for intracranial bleeding? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on tranexamic acid.

Full details of the evidence and the committee's discussion are in evidence review A: tranexamic acid.

8 Indications for selecting people for imaging when they present more than 24 hours after a head injury

What are the indications for selecting people of any age who present more than 24 hours after a head injury for a CT or MRI head scan? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on criteria for doing a CT head scan.

Full details of the evidence and the committee's discussion are in evidence review E: selecting adults, children and infants with head injury for CT or MRI head scan in sub-groups.

9 Using biomarkers and MRI for predicting post-concussion syndrome

What is the prognostic accuracy of brain injury biomarkers or MRI for predicting post-concussion syndrome? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on post-concussion syndrome.

Full details of the evidence and the committee's discussion are in evidence review F: brain injury biomarkers and/or MRI for predicting post-concussion syndrome.

10 Timing of testing for hypopituitarism

When should people with a head injury be investigated for hypopituitarism? **[2023]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on early diagnosis of hypopituitarism.

Full details of the evidence and the committee's discussion are in evidence review N: identification of hypopituitarism (when to investigate).

Rationale and impact

These sections briefly explain why the committee made the recommendations and how they might affect practice or services.

Decision making and mental capacity

Recommendations 1.1.1 and 1.1.2

Why the committee made the recommendations

The committee recognised the need to involve people with a head injury, and their family and carers, in decisions about their care, including referral to the emergency department. They also highlighted the importance of making decisions for people who may lack capacity now or in the future, and to follow any advance care plans.

How the recommendations might affect practice or services

There is not expected to be any change to practice or services.

Return to recommendations

Transport to hospital

Recommendations 1.3.13 and 1.3.14

Why the committee made the recommendations

Evidence from 1 randomised controlled trial (RCT) and 1 retrospective cohort study was identified. This compared transport for a head injury to a specialist neuroscience centre with transport to the nearest non-specialist acute hospital or general hospital emergency department. All the evidence was in people 16 and over. No evidence was available for people under 16.

The evidence from the RCT suggested some benefit for transfer to a non-specialist

general hospital for the outcome of mortality, but this was uncertain. The evidence from the retrospective cohort study suggested that there was no difference between the 2 groups for the outcome of survival benefit. The committee agreed that there was limited evidence of a possible benefit for transfer to a specialist neuroscience centre for some outcomes but that this was uncertain. They agreed that there was no compelling evidence to change practice, and to cross refer to NICE's guideline on major trauma: service delivery.

The committee noted that the data collection for the RCT was in 2012. This was when trauma care was reorganised in the UK to enable rapid and safe transfer of people to major trauma centres. So, the evidence does not reflect the recent trauma care system, which includes more consultants, quicker CT scans and rehabilitation. So, the committee agreed that further research should be done in this area to determine the effectiveness of transport to specialist neuroscience centres in people with a head injury. They developed a recommendation for research on transport to a neuroscience centre.

How the recommendations might affect practice or services

There is not expected to be any change.

Return to recommendations

Tranexamic acid

Recommendations 1.3.17 and 1.3.18

Why the committee made the recommendations

People 16 and over

There was evidence from 2 RCTs for tranexamic acid, both of which included adults with no suspicion of extracranial bleeding. One trial was in a pre-hospital (out-of-hospital) setting and the other was in a hospital setting. There was no evidence available for people under 16 (1 trial included a few people aged 15 and 16).

In the pre-hospital setting, a single 2 g bolus dose of tranexamic acid was given within 2 hours of a head injury. The evidence suggested that it reduced all-cause mortality at

28 days and 6 months in people with moderate or severe traumatic brain injury. But there was no clinically important difference between tranexamic acid and placebo for hospital-free days at 28 days, degree of disability at discharge and after 6 months (Glasgow Outcome Scale–Extended more than 4), and serious adverse events (that is, myocardial infarction, pulmonary embolism, deep vein thrombosis and stroke).

In the hospital setting, a 1 g bolus dose of tranexamic acid was given within 3 hours of injury, followed by an 8-hour intravenous infusion of 1 g of tranexamic acid. The evidence suggested that this reduced death from traumatic brain injury at 28 days in groups with mild or moderate traumatic brain injury. Evidence suggested reduced mortality related to severe traumatic brain injury at 28 days in high-income countries, but there was no difference in mortality related to traumatic brain injury in low- and middle-income countries. No evidence was available separating the mild from moderate severity groups for mortality related to traumatic brain injury and all-cause mortality, but communication with the study authors suggested significant uncertainty about tranexamic acid's effect in mild traumatic brain injury. There was no clinically important difference between tranexamic acid and placebo for serious adverse events (that is, myocardial infarction, pulmonary embolism, deep vein thrombosis and stroke) and disability rating scale scores in a mixed severity group (mild, moderate and severe) across all income groups.

The committee considered that, despite the uncertainty in the clinical evidence, there was a benefit with tranexamic acid in terms of reducing all-cause mortality and mortality from traumatic brain injury. They also considered that the evidence showed that it caused very few adverse events. Based on the evidence, they agreed that a 2 g intravenous bolus dose of tranexamic acid, given within 2 hours of a head injury and before imaging, could be considered for people 16 and over with moderate or severe traumatic brain injury. The committee recommended a 2 g intravenous bolus injection of tranexamic acid because this dose was found to be the most safe and effective.

An economic model was developed that looked at each traumatic brain injury severity subgroup separately. It was based primarily on the pre-hospital clinical trial because:

- that provided data for moderate traumatic brain injury separately from that for mild injury
- the benefits of tranexamic acid were found to be greater when it was given earlier.

For moderate traumatic brain injury, the health benefits associated with a 2 g bolus given in the pre-hospital setting outweighed the costs in all scenarios. For severe traumatic brain

injury, the cost-effectiveness estimate was more borderline. But, when limitations in the modelling were taken into account, the committee concluded that the health benefits were likely to outweigh the costs in this group too.

People under 16

Because of a lack of trial evidence for tranexamic use in people under 16, the committee used extrapolated evidence from the trials in adults, and their expertise and knowledge. In NHS clinical practice, a tranexamic acid dose of 15 mg/kg is used in people under 16 with extracranial injuries. But, in this age group, tranexamic acid is not currently widely used for isolated head injury and dosing is variable (15 mg/kg to 30 mg/kg). Evidence for people 16 and over with a head injury from a pre-hospital setting suggested that a 2 g dose of tranexamic acid reduced all-cause mortality (at 28 days and 6 months), with no evidence of negative effects. So, the committee concluded that it could recommend the equivalent of a 2 g dose of tranexamic acid for people under 16. They discussed that, based on the average weight of people 16 and over being 70 kg, a 2 g dose of tranexamic acid for people 16 and over would equate to a 30 mg/kg dose for people under 16. So, they concluded that a dose range of 15 mg/kg to 30 mg/kg was appropriate for people under 16.

For people with mild traumatic brain injury, it is less clear whether the benefits of tranexamic acid outweigh the potential risk of blood clots. So, the committee made a recommendation for research on tranexamic acid for this group.

How the recommendations might affect practice or services

Tranexamic acid is already used for people who have a head injury and other major trauma. NICE has not previously recommended it for people with an isolated head injury. It is expected that doing so will increase tranexamic acid use by paramedics. This should lead to improved survival for people with a head injury. More resources might be needed for treatment, rehabilitation and care for the people who would not have survived without tranexamic acid.

Return to recommendations

Direct access from the community to imaging

Recommendation 1.3.19

Why the committee made the recommendation

No evidence was identified for direct access from the community for CT scans or MRI of the head compared with usual care for a suspected or confirmed head injury (including people with delayed presentation, and people in residential and care homes). The committee discussed that imaging ordered in the community setting is mainly used to exclude intracranial bleeding or provide reassurance. They noted that the timing of imaging depends on whether there is an acute injury or the person has post-concussion syndrome. Based on their experience, the committee agreed that people should go to hospital if:

- there has been important traumatic brain injury within 24 hours **or**
- there is a reduced Glasgow Coma Scale (GCS) score.

The committee were aware that some trusts have referral pathways that allow for imaging to be requested directly from the community setting or primary care. But they noted the logistical challenges in the acute phase of a head injury in getting access to, and timely reporting of, imaging. They also noted the challenges faced in primary care and general practice in interpreting complex neuroradiology reports. The committee therefore agreed that people should not be referred to imaging directly from the community.

How the recommendation might affect practice or services

This is expected to be a change in practice for a few centres that will now have to send people for imaging by the emergency department route.

Return to recommendation

Assessment in the emergency department

Recommendation 1.4.12

Why the committee made the recommendation

The committee highlighted the need to follow relevant guidance if abuse or other safeguarding issues may be factors in a head injury.

How the recommendation might affect practice or services

There is not expected to be any change to practice or services.

Return to recommendation

Criteria for doing a CT head scan

Recommendations 1.5.8 to 1.5.14

Why the committee made the recommendations

People 16 and over

Several diagnostic accuracy studies were identified but there were no diagnostic RCTs. Most of the evidence was of low to very low quality and was in people with a mild head injury (defined as a GCS score of 13 to 15 in many studies, but sometimes limited to a GCS score of 14 to 15). The committee noted that the existing recommendations for clinical decision rules for head imaging in people 16 and over were largely based on the Canadian CT Head Rule (CCHR). This involves identifying high and medium risk factors, with some modifications aimed at improving sensitivity. Updated evidence for this decision rule showed that it has good sensitivity when used as intended but that its specificity values are poor. The committee noted that specificity values of decision rules are often low because they prioritise very high sensitivity.

Evidence identified for other decision rules showed sensitivity values similar to those of the CCHR. However, specificity values were lower compared with the CCHR high and medium risk rule. Limited evidence showed that the NEXUS 2 decision rule has specificity values similar to those of the CCHR.

Only 1 study had assessed the performance of the 2014 update of NICE's head injury guideline recommendations for head imaging. This reported sensitivity values that were poorer than those for the CCHR. But the specificity values were better compared with other decision rules. The committee agreed that it was unclear why the sensitivity of the NICE recommendations would be worse than those of CCHR. They also agreed that it was unclear why the CCHR did not do as well in this study as in other studies. They thought that this possibly suggested some differences between study populations, which may

have affected the results. The committee also agreed that, in their clinical experience, the sensitivity of the NICE recommendations was not as low as suggested in this study.

The committee agreed that there was insufficient evidence to support changing the clinical decision rule recommendations for head imaging in people 16 and over. Because the NICE recommendations were largely based on the CCHR rule, this decision was further supported by cost-effectiveness evidence. This showed the CCHR rule to be the most cost effective of the multiple decision rules assessed.

People under 16

The committee noted that the existing recommendations for clinical decision rules for head imaging in people under 16 were largely based on the CHALICE rules with some modifications. These modifications were based on current practice and experience allowing for the option of an observation period with imaging if the condition of some people deteriorated, rather than immediate imaging.

Updated evidence identified for this decision rule showed that it had good sensitivity when considering clinically important injuries or neurosurgical outcomes. In the 2014 update of this guideline, the committee stated that an improvement in specificity relative to the NICE recommendations would be needed to warrant switching to another decision rule for people under 16. They noted that PECARN and CATCH-7 may have slightly better sensitivity values compared with CHALICE, but agreed that, overall:

- the specificity values for CHALICE are much better than for other rules assessed
- the sensitivity values for CHALICE are still over 90% for clinically important injuries and neurosurgical outcomes.

The committee noted that, in terms of the content of the rules, PECARN and the NICE guideline are not very different but that PECARN is vaguer and does not give timings. They thought this less useful. In addition, they noted that the PECARN and CATCH-7 rules apply to more specific populations than the NICE guideline recommendations.

The committee agreed that the recommendations in the NICE guideline are in widespread use in current practice, and used with little variation. Their opinion was that they are currently well-accepted and used with good effect. The committee therefore agreed that there was insufficient evidence to support changing the clinical decision rule recommendations for head imaging in people under 16.

The committee agreed to keep the existing recommendations in from the 2014 update of NICE's head injury guideline for people with bleeding and clotting disorders. This was because there was no new evidence to change practice in adults, and the committee agreed to extrapolate from an existing recommendation to make a new recommendation for people under 16. However, they changed the recommendation wording from 'history of bleeding or clotting disorders' to 'current bleeding or clotting disorders'. In children, some disorders are short-lived or resolve in a couple of months. In adults, a history of bleeding or clotting disorders is used to help screen people before surgery. However, this is a crude tool and may not be appropriate in this setting. So, the committee agreed to keep the changed wording for all age groups to help provide a consistent message.

People having anticoagulants or antiplatelets

There was conflicting evidence from cohort studies on whether people who are on anticoagulants or antiplatelets are at higher risk of intracranial haemorrhage than people not on anticoagulants or antiplatelets. CT scans could be limited to people with symptoms of traumatic brain injury such as loss of consciousness or amnesia. However, the committee thought that the new evidence was not strong enough to warrant stopping imaging in people with a head injury who are on anticoagulants but have no other indication for imaging. So, they decided CT scanning should be considered rather than automatically done in this group. They also agreed that antiplatelets other than aspirin monotherapy should be included in this. The review findings suggested that people on anticoagulants (including warfarin and direct-acting oral anticoagulants) or antiplatelets (excluding people on aspirin monotherapy) with low-risk factors (no loss of consciousness, amnesia, a GCS score of 15 and no other indications for CT brain scan) can be risk assessed (including for other injuries, supervision at home, cause of incident and risk of further falls). Then, if there are no risk factors and after shared decision making, they could be discharged safely without a CT scan, with the usual discharge advice (see the section on discharge and follow up). The committee highlighted that clinicians would either scan or admit someone for monitoring if any risks were identified. This might be, for example, if a person (with pre-existing cognitive impairment) may be less likely to return to the emergency department urgently if they have any signs of deterioration. The committee noted that, if an intracranial haemorrhage is not detected at initial presentation, delayed recovery is more likely rather than death. They also discussed that neurosurgical intervention for traumatic brain injury is less likely to be offered for people over 74 because risks outweigh the benefits.

In current practice, in accordance with the 2014 update of NICE's head injury guideline

recommendations, a CT head scan is done within 8 hours of a head injury in people with no other indications for a CT head scan who are having anticoagulant treatment. The 2014 update did not make specific recommendations for people on antiplatelets. The committee agreed that, in clinical practice, there is variation, with some services offering imaging to people on antiplatelets. Based on the evidence, they also agreed that antiplatelets other than aspirin monotherapy should be included but did not specify which antiplatelets. This was because they did not want to be prescriptive and exclude any newer antiplatelets in development. Based on their experience and extrapolation of evidence in people presenting within 8 hours of injury, the committee agreed that these recommendations could be applicable to people presenting more than 8 hours after their injury. However, they agreed that imaging should be done within an hour of confirming that the person with head injury is on anticoagulant or antiplatelet medication.

There was limited evidence on aspirin. From their knowledge and clinical experience, the committee highlighted that the risk of intracranial haemorrhage is low with aspirin. This is even so in people with neurological symptoms such as loss of consciousness or amnesia. So, they agreed that people on aspirin monotherapy could be discharged without a CT head scan after shared decision making if there is no other indication for a CT brain scan or hospital admission.

The committee made a recommendation for research on risk of bleeding for people with pre-injury coagulopathy.

People with liver or coagulopathy disorders

There was no evidence for people with liver or coagulopathy disorders. Current practice is variable, with some services offering imaging to people with liver disease who have no symptoms. People with liver or coagulopathy disorders are at increased risk of bleeding, although some people will have a tendency for increased clotting. People with acquired coagulation defects can be a heterogenous and complex group. They can include people with acquired haemophilia through to people with other abnormalities such as disseminated intravascular coagulation.

The committee agreed to keep the existing recommendations from the 2014 update of NICE's head injury guideline for people with bleeding and clotting disorders. This was because there was no new evidence to change practice. But they changed the recommendation wording from 'history of bleeding or clotting disorders' to 'current bleeding or clotting disorders'. In people under 16, some disorders are short-lived or

resolve in a couple of months. In adults, a history of bleeding or clotting disorders is used to help screen people before surgery. However, this may not be appropriate in the emergency department setting. So, the committee agreed to keep the changed wording for all age groups to help provide a consistent message.

People with pre-injury cognitive impairment who have a head injury through low-energy impact or low-level falls

Limited evidence from cohort studies suggested that, in people 16 and over, falling from a standing position, being over 70, having a reduced GCS score compared with normal, taking antiplatelet medication including aspirin, and having neurological symptoms (loss of consciousness, vomiting after fall) were risk factors associated with the diagnosis of an intracranial bleed. Anticoagulant medication in this population was not associated with an intracranial bleed. It was not clear if people in the studies had pre-injury cognitive impairment, so the applicability of this evidence is limited.

The committee discussed the challenges in assessing risk in people with cognitive impairment. For example, people with dementia may under-report or may be unaware of symptoms such as loss of consciousness or amnesia. It is also difficult to differentiate head injury symptoms from the pre-existing dementia in these people. There was no evidence for people under 16.

The committee acknowledged the limited evidence for this group. They made a recommendation for research on indications for imaging for people with pre-injury cognitive impairment.

People with recurrent head injuries

There was no evidence for recurrent head injuries in any age group. Recurrent head injuries could occur in people with epilepsy, people with mobility issues at high risk of falls and with some sports activities. Particularly in the context of sports injuries, these injuries can be repeated and lead to cumulative risks. Because of a lack of evidence, the committee decided to make a recommendation for research on indications for imaging for people with a history of recurrent traumatic head injuries.

People presenting more than 24 hours after a head injury

Evidence from 1 observational study suggested that there was an increased risk of any

traumatic brain injury or important traumatic brain injury on a CT head scan in babies and children under 2 years:

- the younger their age
- if they have a GCS score of less than 15
- if they present more than 24 hours after head injury.

There was no evidence for people 2 years or over. The committee discussed that people 16 and over presenting more than 24 hours after injury have increased risk factors such as vomiting and loss of consciousness. This is because they would be attending because of worsening symptoms. The 2014 update of NICE's head injury guideline recommendations are for people presenting within 24 hours of injury. But, because of a lack of evidence, the committee agreed that these could be extrapolated to people presenting more than 24 hours after a head injury (see the recommendations on the criteria for doing a CT head scan). They also agreed that this was an important area, so proposed a recommendation for research on indications for selecting people for imaging when they present more than 24 hours after a head injury.

How the recommendations might affect practice or services

Weakening the recommendation for people with a head injury who are on anticoagulants but have no other indication for imaging from 'offer' to 'consider' is expected to result in fewer scans. But expanding the recommendation to include people with a head injury who are on clopidogrel, prasugrel or ticagrelor is expected to result in more scans. It is uncertain whether this will lead to an overall increase or decrease in scanning.

Return to recommendations

Post-concussion syndrome

Recommendation 1.5.15

Why the committee made the recommendation

Post-concussion syndrome

The committee agreed that high specificity is needed for brain injury biomarkers for post-concussion syndrome. This was because the population with a mild head injury is large but only a small proportion go on to develop post-concussion syndrome. So, false positives would have a negative effect on resources if biomarkers were to be used to direct everyone towards interventions or monitoring.

Overall, the committee agreed that the evidence was too limited to be able to make recommendations for using biomarkers (including fluid biomarkers or MRI) to predict post-concussion syndrome in people with mild traumatic brain injury. There was no evidence from prognostic test-and-treat studies comparing clinical outcomes, so the committee agreed to highlight the criteria for doing a CT head scan. They also made a recommendation for research on using biomarkers and MRI for predicting post-concussion syndrome.

Using biomarkers for predicting acute complications after a traumatic brain injury

Evidence from diagnostic accuracy studies suggested that there were high sensitivity values for some biomarkers at certain thresholds for predicting acute complications after a traumatic brain injury, but the specificity values were not high enough across the evidence. Also, many biomarkers were only tested in small samples, which led to imprecise estimates. The committee noted that accuracy differed quite widely between different studies looking at the same biomarker test measured with different assays on different platforms. Also, the evidence was heterogenous, with variable thresholds and time points for different biomarkers. Most people with a head injury present to hospital within 3 hours, and the manufacturers recommend this timeframe for optimal test results. Many of the studies assessed biomarkers beyond this time point.

The committee agreed that the specificity values were equally as important as the sensitivity values, given the consequences of unnecessary radiation from CT scans. They thought this was particularly important in people under 16. But, after considering the limitations of the evidence, the committee were unable to make recommendations for using biomarkers to predict acute complications after a mild traumatic brain injury. They did think that biomarker tests had promise, so they proposed a recommendation for

research on using biomarkers for predicting acute post-traumatic brain injury complications.

How the recommendation might affect practice or services

Biomarkers are not routinely used in people with acute head injury and the recommendation for MRI has not changed. So, there is not expected to be a change in practice.

Return to recommendation

Investigating injuries to the cervical spine

Recommendations 1.6.1 to 1.6.11

Why the committee made the recommendations

The committee considered sensitivity to be the most important measure for types of investigation for cervical spine injuries in people with head injuries. This is to ensure the investigation does not miss important cervical spine injuries, which could result in subsequent negative consequences such as disability. The evidence was limited because the proportion of people with a confirmed head injury was not reported in the diagnostic accuracy studies, but it suggested that X-rays have poor sensitivity compared with CT scans in people 16 and over.

Based on the evidence, and the committee's experience and knowledge of current practice, the committee agreed that X-rays of the cervical spine should not be done initially in people 16 and over with a head injury. They also agreed that CT scans of the cervical spine should be used in people 16 and over in a way consistent with current clinical practice. There was limited evidence for MRI (less accurate at showing bony injuries, takes longer to do and younger people might need sedation). Also, MRI is rarely used as an initial imaging strategy. So, MRI is recommended as an additional form of imaging in certain circumstances (as in previous versions of the guideline). For people under 16, limitations in the evidence, and radiation exposure and risk of cancer, contributed to the committee's decision not to make any major changes to the recommendations.

How the recommendations might affect practice or services

CT scanning of the neck in people 16 and over with a head injury has already replaced X-rays when there is at least a medium risk of serious spinal injury. So, there is not expected to be a change in practice.

Return to recommendations

Admission and observation

Recommendations 1.9.1 to 1.9.5

Why the committee made the recommendations

Small intracranial injuries

Limited evidence from cohort studies in people with intracranial injuries suggested that effect sizes for the clinical decision rules were larger overall than those for individual risk factors. So, the committee agreed that clinical decision rules were likely to be the way to identify people who should be admitted in the future. This was because they thought it would be difficult to make decisions based on individual risk factors in clinical practice. But the evidence for clinical decision rules was all retrospective. So, the committee did not think any specific clinical decision rules could be recommended, particularly because they would be new to clinical practice.

For individual risk factors, the committee noted that there was consistent evidence across all studies (including 1 study in people under 16) that GCS scores of 13 and 14 were associated with a worse outcome than a GCS score of 15. But this is already an existing indication for admission (see recommendation 1.9.1).

Evidence for specific thresholds and findings on CT (including thresholds for subdural or epidural haemorrhage size, or findings such as midline shift or mass effect on CT) also indicated larger effect sizes than for some other risk factors. But, for factors such as midline shift, the committee noted that a threshold for degree of shift would be more useful in practice. They also noted that the varying thresholds used for subdural and epidural haemorrhage across the different studies made the ideal threshold to use unclear.

The evidence also suggested that thresholds for age could be associated with a worse outcome in higher age groups. But the committee noted that older age would not solely be used in practice to make decisions about admission. This is particularly because admission in older age groups can also be associated with harms such as hospital-acquired infections. The committee agreed that age or frailty may be a concern but should not be a sole indicator for admission. Overall, the committee agreed that prospective studies are needed in people with a GCS score of 13, 14 or 15 and a head injury of any size confirmed with CT to validate existing clinical decision rules for predicting deterioration. The aim would be to refine indications for admission in this group. So, the committee made a recommendation for research on indications for admission in people with a mild head injury and a confirmed abnormality on a CT scan.

Isolated skull fracture

Evidence from several case series suggested that there was low risk of death, neurosurgery, admission to critical care, unplanned hospital admission and delayed intracranial injury in babies and children (age cut-off varied across studies) with an isolated skull fracture. The evidence suggested that there was a slightly higher risk of seizure (at presentation) and evaluation for suspected non-accidental injury in this group. According to current guidelines (recommendations 1.5.8 and 1.5.10), people with seizures and suspected non-accidental injuries will be admitted to hospital after a head injury.

Based on the evidence, the committee agreed that simple linear non-displaced fractures are not likely to be a clinically important injury. So, they agreed that, after shared decision making, people under 16 with such fractures can be safely discharged if they have normal neurological status and there are no safeguarding concerns.

There was no direct evidence for people 16 and over with an isolated skull fracture. Indirect evidence from cohort studies suggested that there was low risk of clinical deterioration from a simple skull fracture compared with:

- a complex skull fracture
- 1 to 2 bleeds
- bleeds less than 5 mm in diameter
- no or minimal mass effect
- significant midline shift

- a high- or mixed-density lesion
- cerebellar or brain stem injury.

Clinical deterioration was measured by a composite of death due to traumatic brain injury, neurosurgery, seizure, a fall in GCS score of more than 1, admission into intensive care for traumatic brain injury, intubation or hospital readmission for traumatic brain injury. The simple skull fracture group included both isolated and non-isolated skull fractures. But the committee agreed that the evidence is still likely to be broadly applicable for people 16 and over with an isolated skull fracture. Based on the evidence and their collective experience, the committee agreed that, after shared decision making, people 16 and over with an isolated skull fracture can be discharged safely (except for people on anticoagulants or antiplatelets) if there are no safety concerns.

Anticoagulants and antiplatelets

The evidence was limited on admission to and observation in hospital of people who have a head injury and are on anticoagulants (warfarin and other vitamin K antagonists, and direct-acting oral anticoagulants) or antiplatelets (including aspirin, ticlopidine, clopidogrel, prasugrel and ticagrelor), and have normal brain imaging or no indication for early imaging.

Limited evidence from non-randomised studies suggested that there was no clinically important difference between pre-injury anticoagulant or no anticoagulant treatment in terms of delayed bleeding. The evidence included at least 1 propensity matched study including about 70,000 people.

The committee agreed that the evidence was not strong enough to recommend using anticoagulation status as a sole indicator for admission for people with a negative initial CT head scan. They highlighted that admission based solely on this could cause harm in people already vulnerable (because of, for example, frailty, an underlying condition such as delirium or risk of hospital-acquired infections). This is particularly so if there is not a large increase in risk of delayed bleeding. Also, when these events do occur, they are usually not clinically important.

Evidence from non-randomised studies for antiplatelet comparisons was more limited than that for anticoagulants. There were no large studies, and all reported effects were based on a difference of only 1 to 2 events between pre-injury antiplatelet and no-antiplatelet groups per study. The committee agreed that the evidence was not strong enough to recommend using antiplatelet status as a sole indicator for admission for people with a

negative initial CT or no indication for a CT. The committee did not make a recommendation for research for this group because they did not consider it to be a priority for research.

Concussion symptoms

There was no evidence on admission or discharge of people with concussion symptoms after normal imaging or no indication for imaging. The committee agreed that their discharge is based on clinical discretion, and admission is considered if non-accidental injury is suspected. From their experience, the committee also agreed that most people with concussion symptoms and normal imaging do not need further intervention and are safe to be discharged from the emergency department. They highlighted that current practice is to not admit people with concussion symptoms unless they have any of the indications in recommendation 1.9.1. The committee were unaware of any evidence indicating that current practice was causing harm (coroners reports, safety reports, patient group feedback). They also noted that someone's condition may worsen if they are admitted, for example, because of being in a noisy and unfamiliar environment, and because the risk of hospital-acquired infections could increase. When people with concussion symptoms are discharged, information is provided on when to return to hospital to seek further immediate care and ongoing support for persistent symptoms (see the recommendations on discharge advice). The committee agreed that this is important and did not think there was any evidence on which to base a change in practice.

How the recommendations might affect practice or services

Currently, most people with an isolated skull fracture are admitted for observation. It is expected that many of these people could be discharged from the emergency department without admission to hospital unless there are other indications for admission. For people on anticoagulants or antiplatelets, and people with concussion symptoms, there are no significant changes in practice recommended, and the recommendations are thought to reflect current practice.

Return to recommendations

Early diagnosis of hypopituitarism

Recommendations 1.9.6 to 1.9.8

Why the committee made the recommendations

The committee highlighted that there is a higher risk of hypopituitarism with more severe head injuries, but noted that it can be caused by a mild head injury. Also, the condition can occur immediately after a head injury or in the weeks to months afterwards. This, and the wide variety of symptoms of hypopituitarism, can make the condition difficult to diagnose.

The committee supplemented the small amount of observational evidence (cohort studies) with their expertise. They discussed that why head injury causes hypopituitarism is not fully understood, and that there could be various reasons. Current practice for screening for hypopituitarism is variable, but it is not commonly identified on CT scanning in the emergency department. The clinician's familiarity and suspicion of hypopituitarism may affect diagnosis rates. Also, testing in the emergency department may not be useful because the acute injury phase stimulates cortisol secretion. This makes it difficult to tell if there is hypoadrenalism. So, the committee agreed that it would be better to investigate for hypopituitarism in people admitted to hospital with a head injury if they have clinical symptoms or biochemical findings such as hypotension or hyponatraemia. The committee suggested this would provide an opportunity for referral to a specialist.

In the absence of evidence on the timing of investigations, the committee also made a recommendation for research on timing of testing for hypopituitarism.

How the recommendations might affect practice or services

Hospital staff are advised to look out for symptoms of hypopituitarism in people admitted to hospital after a head injury. So, there might be an increase in testing for hypopituitarism in hospital. It is also intended that people will get referred for specialist care sooner.

Return to recommendations

Discharge and follow up

Recommendation 1.10.6

Why the committee made the recommendation

People with pre-injury cognitive impairment

Pre-existing cognitive impairment such as dementia, Parkinson's disease or stroke was reported in some studies in people taking anticoagulants and antiplatelets, but the studies did not report the effect of pre-injury cognitive impairment on the outcomes. Examples of pre-injury cognitive impairments and neurodivergence seen in people of any age include developmental delay, Down's syndrome, cerebral palsy, fetal alcohol syndrome, a learning disability, autism spectrum disorder and other conditions with altered sensation. Examples of pre-injury cognitive impairment seen only in adults include depression, dementia and medication side effects. The committee noted from their experience that people with pre-existing conditions affecting cognition are less likely to recognise and to raise an alarm about the early signs of a late intracranial bleed (such as a severe headache, drowsiness and vomiting) than people with no pre-existing cognitive impairment. So, in current practice, a short overnight admission for observation is arranged for people with a pre-existing cognitive impairment when no supervision at home is available. The committee agreed that people with a pre-existing cognitive impairment will need to be appropriately supervised and monitored to ensure that their symptoms are not worsening if they are discharged from the emergency department. Supervision and monitoring was also noted to be important for people discharged to custodial settings. The committee noted that, at discharge, it is important for people and their carers to be given a written copy of the head injury discharge advice.

How the recommendation might affect practice or services

There might be a small increase in overnight admissions for people with a pre-existing cognitive impairment when no supervision is available at home. This should lead to better outcomes for people who do deteriorate and reduced longer-term care costs.

Return to recommendation

Follow up

Recommendations 1.10.13 and 1.10.14

Why the committee made the recommendations

People with a head injury may need investigation for the causes of the injury or to manage contributing factors. People with a head injury may have persisting problems, including physical, sensory, motor, cognitive, emotional and hormonal (hypopituitarism). These can occur even in people who are not admitted to hospital or have normal imaging at the time of their injury. It is important that people know how to seek help and ongoing support for these symptoms. It is also important for healthcare professionals to make appropriate outpatient referrals to other healthcare professionals trained in managing these symptoms.

Some people who have had a head injury will be at increased risk of further injury. It is important that these people can access relevant services.

How the recommendation might affect practice or services

There might be an increase in referrals from primary care to hospital outpatient clinics for people who were not admitted to hospital, or had a normal scan or no scan at the time of their head injury. This should mean that people get earlier access to effective treatment for persisting symptoms resulting from their head injury and prevention services.

Return to recommendation

Investigations for hypopituitarism

Recommendation 1.10.15

Why the committee made the recommendation

The committee discussed further endocrinology investigations for suspected hypopituitarism in people who have been discharged after a head injury if symptoms persist or they are not recovering as expected. They noted that some of the symptoms of hypopituitarism may be non-specific and caused by other conditions, making diagnosis difficult. They agreed that investigation in endocrinology may be needed.

In people under 16, delayed symptoms may include slow growth, tiredness and late puberty. The committee emphasised that, if hypopituitarism is suspected, it is important to urgently refer the person under 16 to a paediatric endocrinologist.

How the recommendation might affect practice or services

The guideline raises awareness of the symptoms of hypopituitarism for people with a head injury, and their carers and clinicians. So, there might be an increase in testing for hypopituitarism in primary care. It is also intended that people will get referred for appropriate care sooner.

Return to recommendation

Context

Head injuries are a major cause of death and disability in people aged 1 to 40 in the UK. Each year, over 1 million people attend emergency departments in England and Wales with a recent head injury. Between 33% and 50% of these people are aged under 15. About 200,000 people are admitted to hospital with a head injury every year. Of these, about 40,000 have evidence of traumatic brain injury. Most people with a head injury recover without specific or specialist intervention. Others have long-term disability or even die from associated traumatic brain or other injuries. An increasing proportion of people presenting with head injury are over 65. Many people are injured through low-level falls, which can be sustained in the context of acute illness.

The incidence of death from head injuries is low. As few as 0.2% of people attending emergency departments with a head injury die because of their injury. Of people who have sustained a head injury, 95% present with a normal or minimally impaired conscious level, that is, a Glasgow Coma Scale (GCS) score of 13 or more. Most fatal outcomes are in the groups with a moderate (GCS score of 9 to 12) or severe (GCS score of 8 or less) head injury, and account for only 5% of attenders. This means emergency departments need to identify the small number who will go on to have serious acute intracranial complications. It is estimated that, in 25% to 30% of children under 2 who are hospitalised with a head injury, it is caused by abuse. This guideline has updated some of the terminology used in relation to safeguarding people under 18 and vulnerable adults. This update addresses these areas, including in particular:

- indications for transporting people with a head injury from the scene of injury directly to the nearest neuroscience centre, bypassing the nearest emergency department
- indications for, and timing of, CT head scans and imaging of the cervical spine in the emergency department, with particular reference to anticoagulant treatment and levels of circulating brain injury biomarkers
- the clinical and cost effectiveness of administering tranexamic acid to people who have sustained a head injury and have suspected intracranial bleeding
- consideration of traumatic injury to the pituitary gland in people with a head injury

- information that should be provided to people with a head injury, and their family members and carers, on discharge from the emergency department or observation ward.

Finding more information and committee details

To find NICE guidance on related topics, including guidance in development, see the NICE topic page on injuries, accidents and wounds.

For full details of the evidence and the guideline committee's discussions, see the evidence reviews. You can also find information about how the guideline was developed, including details of the committee.

NICE has produced tools and resources to help you put this guideline into practice. For general help and advice on putting our guidelines into practice, see resources to help you put NICE guidance into practice.

Update information

May 2023: We have reviewed the evidence on pre-hospital interventions, assessment and management in the emergency department, and discharge and follow up, including follow up of people with a head injury and normal scans for deterioration. These recommendations are marked **[2023]**.

We have also made some changes without an evidence review:

- For recommendations **[2003, amended 2023]**, **[2007, amended 2023]** and **[2014, amended 2023]**, we have made changes that could affect the intent without reviewing the evidence.
- For recommendations ending **[2003]**, **[2007]**, **[2014]**, **[2003, amended 2007]**, **[2003, amended 2014]** and **[2003, amended 2007 and 2014]**, we have not reviewed the evidence. In some cases, minor changes have been made (for example, to update links, or bring the language and style up to date) without changing the intent of the recommendation.

Minor changes since publication

August 2023: We amended recommendation 1.5.12 to make it clear that the 4-hour timeframe for observation is from the time of injury. We also added a link to the MHRA safety advice on DOACs to recommendation 1.5.13.

July 2023: In recommendations 1.2.3 and 1.2.4, we clarified that risk factors can include either current anticoagulant or antiplatelet treatment.

June 2017: Recommendation 1.3.8 was updated with a cross-reference to a related NICE guideline.

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