Head injury is the commonest cause of death and disability in people aged 1-40 years in the UK. Each year, 1.4 million people attend emergency departments in England and Wales with a recent head injury. The National Institute for Health and Care Excellence (NICE) published guidance on managing head injury in 2003 (clinical guideline 4) and updated this in 2007 (clinical guideline 56), which resulted in computed tomography (CT) replacing skull radiography as the primary imaging modality for assessing head injury. Key changes driving this update include the introduction of regional trauma networks with prehospital major trauma triage in England; the extension of indications for anticoagulation therapy; the establishment of local safeguarding boards in the UK, requiring front-line clinical staff to assess not only the severity of the head injury but also why it occurred; and new evidence on the initial assessment and early management of head injury.

This article summarises the most recent recommendations from the National Institute for Health and Care Excellence (NICE).

**Recommendations**

NICE recommendations are based on systematic reviews of best available evidence and explicit consideration of cost effectiveness. When minimal evidence is available, recommendations are based on the Guideline Development Group’s experience and opinion of what constitutes good practice. Evidence levels for the recommendations are in the full version of this article on bmj.com.

**Transport to hospital**

- Transport patients who have sustained a head injury directly to a hospital that has the resources to further resuscitate them and to investigate and initially manage multiple injuries.
  - All acute hospitals receiving patients with head injury directly from an incident should have these resources, which should be appropriate for a patient’s age.
  - In NHS England these hospitals would be trauma units or major trauma centres. In NHS Wales this should be a hospital with equivalent capabilities.

**Fig 1 | Algorithm 1: selection of adults for CT head scan**

GCS=Glasgow coma scale. CT=computed tomography. GDG=Guideline Development Group

* Based on very low to high quality observational studies, on published cost effectiveness with potentially serious limitations and direct applicability, and on experience and opinion of GDG

† Based on very low to low quality observational studies and on experience and opinion of GDG
Assessment in the emergency department

- A clinician with training in safeguarding should be involved in the initial assessment of any patient 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 patient’s age. (Updated recommendation.) Figures 1–4 summarise selection criteria for CT head scans in adults (algorithm 1), CT head scan in children (algorithm 2), imaging of the cervical spine in adults (algorithm 3), and imaging of the cervical spine in children (algorithm 4).

Assessing range of movement in the neck

- In adults and children who have sustained a head injury and in whom there is clinical suspicion of cervical spine injury, range of movement in the neck can only be assessed safely before imaging if there are no high risk factors requiring cervical spine CT scanning within an hour (see algorithms 3 and 4) and if at least one of the following low risk features applies:
  - Patient was involved in a simple, rear end, motor vehicle collision
  - Patient is comfortable in a sitting position in the emergency department
  - Patient has been ambulatory at any time since injury
  - Prostate cancer: Details of risk factors that mean the patient should be assessed for cervical spine injury
  - For children <1 year old, presence of bruise, swelling, or laceration of >5 cm on head
  - Focal neurological deficit

### Fig 2: Algorithm 2: selection of children for CT head scan

<table>
<thead>
<tr>
<th>Are any of the following risk factors present?*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspicion of non-accidental injury</td>
</tr>
<tr>
<td>Post-traumatic seizure, but no history of epilepsy</td>
</tr>
<tr>
<td>GCS≤14 on initial assessment, or for children &lt;1 year old GCS (paediatric) ≤15</td>
</tr>
<tr>
<td>GCS&lt;15 at 2 hours after injury</td>
</tr>
<tr>
<td>Suspected open or depressed skull injury or tense fontanelle</td>
</tr>
<tr>
<td>Any sign of basal skull fracture (haemotympanum “panda” eyes, cerebrospinal fluid leakage from ear or nose, Battle’s sign†)</td>
</tr>
<tr>
<td>Focal neurological deficit</td>
</tr>
</tbody>
</table>

If true, proceed to Perform CT head scan within 1 hour of risk factor being identified. Provisional written radiology report should be available within 1 hour of CT taking place.

### Yes, >1 factor

- Perform CT head scan within 1 hour of risk factor being identified
- Provisional written radiology report should be available within 1 hour of CT taking place

### Yes, 1 factor

- Observe for a minimum of 4 hours after head injury
- Are any of the following risk factors present?‡
  - GCS ≤15
  - Further vomiting
  - Further episodes of abnormal drowsiness

If true, proceed to Perform CT head scan within 8 hours of injury. Provisional written radiology report should be available within 1 hour of CT taking place.

### Yes

- Perform CT head scan within 8 hours of injury
- Provisional written radiology report should be available within 1 hour of CT taking place

### No

- No imaging required
- Use clinical judgment to determine when further observation is required

### Current warfarin treatment?§

- Yes
- No

### Are any of the following risk factors present?‡

- GCS ≤15
- Further vomiting
- Further episodes of abnormal drowsiness

If true, proceed to Perform CT head scan within 8 hours of injury. Provisional written radiology report should be available within 1 hour of CT taking place.

### Yes

- Perform CT head scan within 8 hours of injury
- Provisional written radiology report should be available within 1 hour of CT taking place

### No

- No imaging required
- Use clinical judgment to determine when further observation is required

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GCS=Glasgow coma scale. CT=computed tomography. GDG=Guideline Development Group.

* Based on moderate quality observational studies, on published cost effectiveness with potentially serious limitations and direct applicability, and on experience and opinion of GDG.

† Bruising which sometimes occurs behind ears in cases of fracture of base of skull (basal skull fracture).

‡ Based on very low to low quality observational studies and on experience and opinion of GDG.

§ Based on very low to low quality observational studies and on experience and opinion of GDG.
return to the emergency department, such as seizure, vomiting or drowsiness
– A specification that a responsible adult should stay with the patient for the first 24 hours after the injury
– Details of the recovery process, including that some patients seem to make a quick initial recovery but later experience 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.
(New recommendation.)

• Inform patients and their families and carers about the possibility of persistent or delayed symptoms after head injury and who to contact if they experience ongoing problems. (New recommendation.)

• For all patients who have attended the emergency department with a head injury, write to their GP within 48 hours of discharge, giving details of the clinical history and examination. This letter should also be shared with health visitors (for preschool children) and school nurses (for school age children). If appropriate, provide a copy of the letter for the patient and their family or carer. (New recommendation.)

**Overcoming barriers**

Over the past decade the NHS has greatly increased the use of CT scanning to investigate head and other injuries, with associated improvements in outcomes. A further “stretch” during this period of relative austerity is required by this 2014 guideline, with more indications for CT scans of the head (for all patients treated with anti-coagulant drugs) and cervical spine, although there are fewer indications for CT head scanning in children. This will increase time and resource use during an emergency department assessment and for radiology departments, which also need to provide written provisional reports within an hour of performing a CT scan. The clinical and cost effectiveness evidence on which these imaging recommendations are based suggest that they will save NHS resources through delayed or missed diagnoses.

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**Fig 3: Algorithm 3: selection of adults for imaging of the cervical spine**

[Diagram of the algorithm showing the decision points and outcomes for imaging of the cervical spine.]
Children presenting to emergency department who have sustained a head injury

Are any of the following risk factors present?*
GCS ≤ 3 on initial assessment
Intubation
Definitive diagnosis of cervical spine injury is required urgently (such as before surgery)
Other body areas are being scanned for head injury or multi-region trauma
Focal peripheral neurological signs
Paresthesia in upper or lower limbs

Yes
No

Perform CT head scan within 1 hour of risk factor being identified
Provisional written radiology report should be available within 1 hour of CT taking place

Is there neck pain or tenderness?†
Yes
No

Was there a dangerous mechanism of injury (fall from >1 metre or >5 stairs, axial load to head (such as diving), high speed motor vehicle collision, rollover motor accident, ejection from motor vehicle, bicycle collision)?†

Are any of the following risk factors present?‡
Involved in simple rear-end motor vehicle collision
Is comfortable in sitting position in emergency department
Has been ambulatory at any time since injury
Absence of midline cervical tenderness
Presents with delayed onset of neck pain

Perform three-view cervical spine x rays of cervical spine within 1 hour of risk factor being identified

Is there strong clinical suspicion of injury despite normal x rays, x rays were technically difficult or inadequate, or x ray identifies significant bony injury?*

Yes
No

On assessment can patient actively rotate neck to 45° to left and right?*

Yes
No

No imaging or further imaging required

GCS = Glasgow coma scale. CT = computed tomography. GDG = Guideline Development Group
* Based on low to moderate quality observational studies and on experience and opinion of GDG
† Based on low to moderate quality observational studies in adults, health economic modelling, and on experience and opinion of GDG
‡ Based on low to high quality observational studies and on experience and opinion of GDG

Fig 4 | Algorithm 4: selection of children for imaging of the cervical spine

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ANSWERS TO ENDGAMES, p 38
For long answers go to the Education channel on bmj.com

STATISTICAL QUESTION
Prognostic scores
Statements b, c, and d are true, whereas a is false.

ANATOMY QUIZ
Axial T1 weighted magnetic resonance imaging of the sacrum
A: Left psoas muscle
B: Left iliacus muscle
C: Right obturator nerve
D: Right L5 nerve trunk
E: Thecal sac
F: Left S2 nerve root
G: Left S1 nerve root