

## Management of patients with head injury

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Over the past 25 years, many guidelines have been developed for the management of head injury, most of which have been aimed at the treatment of patients with severe head injury and in a coma.<sup>1-3</sup> This Viewpoint aims to establish an accurate method of identifying patients who have sustained a head injury (often apparently minor) and who need further inpatient observation and treatment compared with those who can be safely discharged, but it does not address the issue of guidelines for the treatment of severely injured patients. Patients with potentially severe injury who will need specialist treatment in tertiary neurosurgical units also need to be identified, including those with diffuse injury who do not necessarily need neurosurgery.<sup>1</sup> Where these patients are treated initially is therefore critically important. Revised UK guidelines from the National Institute for Health and Clinical Excellence (NICE) for the management of acute head injury address the initial management and triage.<sup>4</sup> Evidence has also shown that even patients who have sustained a minor head injury have difficulty reintegrating into society.<sup>5</sup> Thus, management of head injury is an important topic.

We hope to guide clinicians who treat patients with acute head injuries, by providing a consistent triage algorithm to identify patients who are at high risk of deterioration and might therefore need neurosurgical intervention. Our recommendations are based on the revised 2007 NICE guidelines and take into account the present service structure and resource limitations in the UK and have been agreed by the Council of the Society of British Neurological Surgeons (SBNS) and the executive committee of the Trauma Audit and Research Network (TARN). Although designed for the UK, they can be applied safely to any health-care system in which 24-h CT scanning is available. When CT scanning is not permanently available, the previous system in the UK of reliance on the skull radiograph is a reasonable alternative.<sup>6</sup> Other triage guidelines for the management of patients with head injuries also exist.<sup>3,7-10</sup>

Many factors need to be taken into account when developing triage guidelines that are practical and safe. The neurosurgical referral pattern in the UK and throughout much of Europe means that most patients with head injuries arrive from emergency departments in district general hospitals that are equipped with CT. In many parts of the world, CT scanning is readily available in urban areas but not in rural and remote areas—eg, Australia, Africa, and India have substantial variability in the distance to CT facilities. Historically, less than 5% of patients with head injury are treated by neurosurgeons in the UK. Furthermore, less than 0.5% of all patients with head injuries need a craniotomy for intracranial haematoma.

In countries with high ratios of trained neurosurgeons to population, such as Japan and the USA, direct admission

to neurosurgery units is possible. However, such facilities are by no means universally available, and sustaining the management of patients who cannot be discharged and need observation, treatment, and rehabilitation for more than 48 h is a challenge. In other countries, patients with apparently minor head injuries are observed in wards under the supervision of consultants in emergency medicine, paediatrics, orthopaedics, and general surgery as recommended in the Royal College of Surgeons' report.<sup>11</sup> However, with increasing subspecialisation, these groups are uncomfortable managing such patients.

If neurosurgery units are to take over responsibility for these patients, which would seem to be the most sensible option, we have calculated increased resource requirements of between 84 000 and 105 000 extra bed-days per year in England (ie, seven to ten beds with attending staff per neurosurgery unit on the basis of average length of stay of 7 days<sup>12</sup>).

Major difficulties also remain in terms of the continued management of patients who have head injuries and restricted and variable access to services for neurological rehabilitation (eg, physiotherapy, speech therapy, occupational therapy, neuropsychology, and social work).<sup>13,14</sup> If access to these services could be expanded, patients with mild or moderate brain injury could be managed in less acute environments or even in the community.

The other major logistical issue is that many head injuries take place outside regular office hours, and units accepting trauma patients do not all have on-call radiographers. Therefore, delays can arise in obtaining a scan. The demand on CT resources was further increased by the NICE recommendation in 2003 that patients older than 65 years, with any loss of consciousness or amnesia since injury, should have a CT scan within 1 h of presentation. This recommendation did not apply to patients younger than 65 years since they have a lower risk of haematoma. However, the 2007 recommendations from NICE suggest that patients older than 65 years presenting out of hours can be safely admitted for effective overnight observation instead of having an immediate CT scan unless the Glasgow coma scale (GCS) score is less than 15.<sup>4</sup> The CT scan would then be done within 8 h of the injury unless there was previous deterioration (figure).

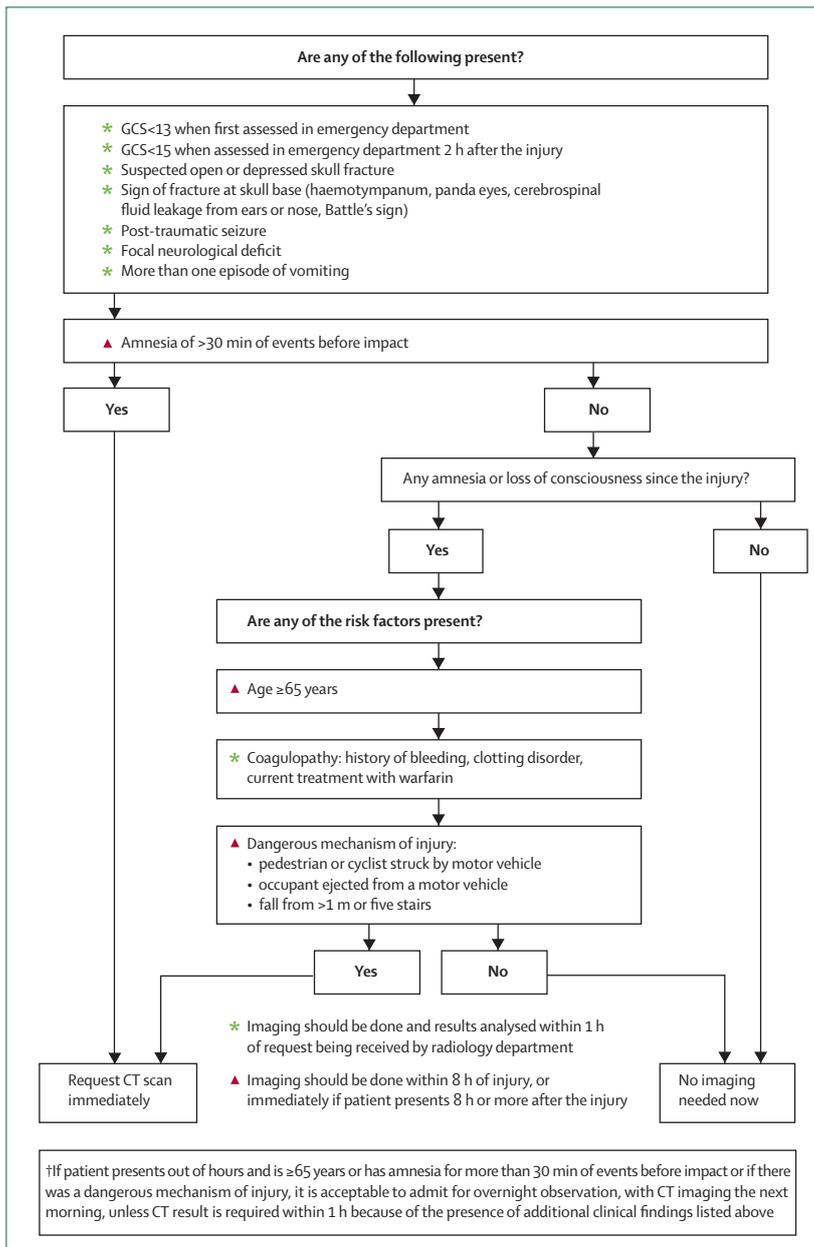
Although resource limitations are acknowledged to be a difficulty in some parts of the UK and many other parts of the world, resources are abundant in some parts of western Europe and the USA. Therefore, different countries have to tailor their management of neurological trauma to the available resources.

The principles for the triage of patients with head injuries were set out in the Royal College of Surgeons' report in 2005.<sup>11</sup> This report and the Scottish Intercollegiate Guidelines Network<sup>6</sup> were largely based on clinical risk

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**Figure: Selection of adults for CT scanning of head**

CT imaging of the head is the primary investigation of choice. GCS=Glasgow coma scale. Reproduced with permission from the National Institute for Health and Clinical Excellence.<sup>4</sup> NICE clinical guideline number 56.

factors and the presence of a skull fracture radiograph.<sup>15</sup> This approach resulted in about 5% of patients (about 50 000 patients per year in the UK) with head injury proceeding to a CT scan. The major disadvantage was that a skull radiograph does not have 100% sensitivity and specificity to detect a haematoma. By contrast, CT scanning accurately identifies all surgically significant haematomas.

The 2007 NICE guidelines<sup>4</sup> use additional evidence for minor head injuries from the Canadian Emergency Medicine Group.<sup>16</sup> This study identified two tiers of indication for CT scanning based on a 5-point or 7-point

scale. The 5-point scale (high risk) has 100% sensitivity for patients who need neurosurgical intervention and would require 32% of head injuries to be scanned. The 7-point assessment (medium risk) identifies all important injuries (98% sensitivity), such as cerebral contusions, that are relevant to prognosis and rehabilitation but do not necessarily need neurosurgical interventions. Therefore, 54% of such patients with head injuries would need scanning.

The Canadian CT Head Rule<sup>7</sup> has now been explicitly and prospectively re-evaluated in a separate cohort of patients with head injuries, thus adding to its strength as class I evidence. Guidelines from the Advanced Trauma Life Support (ATLS),<sup>18</sup> produced by the American College of Surgeons, recommend CT scanning of all patients with head injuries except those with the most minor. These recommendations have tended to be overimplemented in Canada and the USA, but underimplemented in the UK and many developing countries (especially in rural and remote areas).

If the ATLS guidelines<sup>18</sup>—which are used worldwide—are to be rigorously implemented, 95% of head injuries would need to be scanned; however, there is no reference to evidence-based decision rules in ATLS documents. CT of the head is recommended if there is a focal neurological deficit, a GCS of less than 15, amnesia, loss of consciousness for more than 5 min, or severe headache. Thus, in many western European and North American health-care systems, CT scanning for patients with head injuries is used excessively, which is the opposite situation to that in the UK.

After a systematic review of published work, the NICE guidelines have adopted the Canadian CT Head Rule and provided recommendations for both CT head scanning and screening of the cervical spine, with clear management algorithms. However, implementation of these guidelines is a challenge in the UK because of the additional demand on CT scans, resulting from a rise between two-fold and eight-fold depending on which guidelines had been in place previously.<sup>19–23</sup> This rise poses difficulties with implementation of NICE guidelines in view of present radiography and radiology staffing levels, especially out of hours.

The other challenge is one of resource for neurosurgery units. It relates to the referral of all severe head injuries (GCS < 8) to a hospital with a neurosurgical unit,<sup>24</sup> which is a difficulty because there are only 35 neurosurgery units in the UK, whereas there are 298 district general hospitals with emergency departments. Thus, neurosurgical units would need extra staff and specially equipped beds. The revised NICE guidelines<sup>4</sup> include a detailed economic evaluation suggesting that an additional £18 000 per 100 000 population needs to be allocated every year.

The figure summarises the new NICE head injury guidelines for CT in adults.<sup>4</sup> CT should be immediately requested in patients with any of the risk factors (figure). The new NICE guidelines for CT of the head in children use the Chalice rule.<sup>4</sup>

**Panel: Recommendations for emergency departments**

- Train medical and nursing staff to assess head injury, especially with knowledge of Glasgow coma scale
- Provision of necessary equipment and personnel for resuscitation of the patient with severe head injuries
- 24-h CT scanning and imaging facility, which is electronically linked to the regional neurosurgical unit
- Agree a protocol with the regional neurosurgical unit for transfer of patients between hospitals and a move to provide additional neurosurgical resources as recommended in the Royal College of Surgeons' report and suggested in the new NICE guidelines<sup>24</sup>
- Audit head injuries, using TARN method in all hospitals and neurosurgery units
- Expand the provision of neurological rehabilitation services
- Designate a lead consultant to be responsible for the strategy of head-injury management

NICE=National Institute for Health and Clinical Excellence. TARN=Trauma Audit and Research Network.

On the basis of present evidence, the working party of SBNS for the management of patients with head injury and the executive committee of TARN recommend that the NICE guidelines be complied with as far as possible. However, they recognise the practical and resource difficulties with implementation. NICE has calculated this cost at £15·3 million per year, which we think is inadequate in view of the increased demands on critical care. These acute neurosurgical and neurorehabilitation beds need to be commissioned for every neurosurgery unit in the UK, and would need appropriate rehabilitation staff including neuropsychologists, speech therapist, physiotherapists, and occupational therapists.

The panel outlines our recommendations for hospitals with emergency departments accepting patients with head injuries. We believe these principles, although designed for the UK, would be equally safe in most other countries. However, where patients with head injuries are cared for in rural and remote areas, reliance will still have to be placed on skull radiography as recommended in earlier versions of the UK triage guidelines and in Scotland.

**Conflict of interest statement**

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