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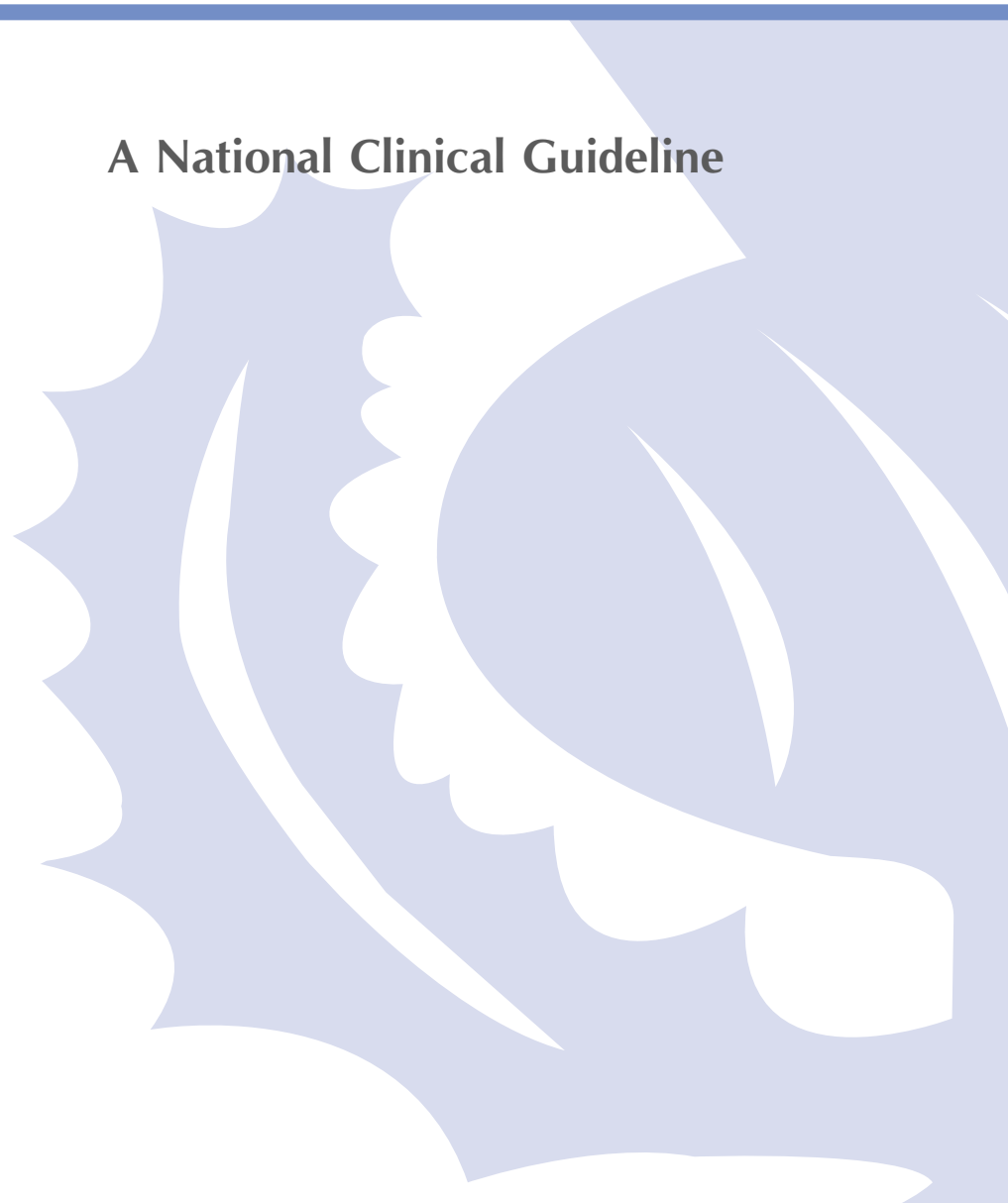
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Network

Early Management of Patients with a Head Injury

A National Clinical Guideline



August 2000

KEY TO EVIDENCE STATEMENTS AND GRADES OF RECOMMENDATIONS

The definitions of the types of evidence and the grading of recommendations used in this guideline originate from the US Agency for Health Care Policy and Research¹ and are set out in the following tables.


STATEMENTS OF EVIDENCE

<i>Ia</i>	Evidence obtained from meta-analysis of randomised controlled trials.
<i>Ib</i>	Evidence obtained from at least one randomised controlled trial.
<i>IIa</i>	Evidence obtained from at least one well-designed controlled study without randomisation.
<i>IIb</i>	Evidence obtained from at least one other type of well-designed quasi-experimental study.
<i>III</i>	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.
<i>IV</i>	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

GRADES OF RECOMMENDATIONS

A	Requires at least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation. <i>(Evidence levels Ia, Ib)</i>
B	Requires the availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation. <i>(Evidence levels IIa, IIb, III)</i>
C	Requires evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates an absence of directly applicable clinical studies of good quality. <i>(Evidence level IV)</i>

GOOD PRACTICE POINTS

<input checked="" type="checkbox"/>	Recommended best practice based on the clinical experience of the guideline development group.
	Paediatric practice point (see page 2 for further information).

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Notes for users of the guideline

LOCAL IMPLEMENTATION OF THE GUIDELINE

It is intended that this guideline will be adopted after local discussion involving clinical staff and management. The Area Clinical Effectiveness Committee should be fully involved. Local arrangements may then be made for the derivation of specific local guidelines to implement the national guideline in individual hospitals, units and practices and for securing compliance with them. This may be done by a variety of means including patient-specific reminders, continuing education and training, and clinical audit.

SIGN consents to the copying of this guideline for the purpose of implementation in the National Health Service in Scotland. For details of how to order additional copies of this or other SIGN publications, see inside back cover.

STATEMENT OF INTENT

This report is not intended to be construed or to serve as a standard of medical care. Standards of medical care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve.

These parameters of practice should be considered guidelines only. Adherence to them will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the doctor in light of the clinical data presented by the patient and the diagnostic and treatment options available.

Significant departures from the national guideline as expressed in the local guideline should be fully documented and the reasons for the differences explained. Significant departures from the local guideline should be fully documented in the patient's case notes at the time the relevant decision is taken.

A background paper on the legal implications of guidelines is available from the SIGN secretariat.

REVIEW OF THE GUIDELINE

This guideline was issued in August 2000 and will be reviewed in 2002 or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the SIGN web site. Comments are invited to assist the review process. All correspondence and requests for background information regarding the guideline should be sent to:

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Abbreviations

A&E	Accident and Emergency
ATLS	Advanced trauma life support
APLS	Advanced paediatric life support
CSF	Cerebrospinal fluid
CT	Computed tomographic
GCS	Glasgow Coma Scale and Score
GP	General Practitioner
PTA	Post-traumatic amnesia
SASM	Scottish Audit of Surgical Mortality
SIGN	Scottish Intercollegiate Guidelines Network
STAG	Scottish Trauma Audit Group

Summary of recommendations

ASSESSMENT AND CLASSIFICATION

- B** The management of head injured patients should be guided by clinical assessments and protocols based on the Glasgow Coma Scale and Glasgow Coma Score.

INDICATIONS FOR REFERRAL TO HOSPITAL

- B** **A head injured patient should be referred to hospital if any of the following is present:**
- **Impaired consciousness (GCS <15/15) at any time since injury**
 - **Amnesia for the incident or subsequent events**
 - **Neurological symptoms**, e.g.
 - severe and persistent headache
 - nausea and vomiting
 - irritability or altered behaviour
 - seizure
 - **Clinical evidence of a skull fracture** (e.g. CSF leak, periorbital haematoma)
 - **Significant extracranial injuries**
 - **A mechanism of injury suggesting:**
 - a high energy injury (e.g. road traffic accident, fall from height)
 - possible penetrating brain injury
 - possible non-accidental injury (in a child)
 - **Continuing uncertainty about the diagnosis after first assessment**
 - **Medical co-morbidity** (e.g. anticoagulant use, alcohol abuse)
 - **Adverse social factors** (e.g. no-one able to supervise the patient at home).

PRINCIPLES OF MANAGEMENT

- C** A head injured patient should initially be assessed and managed according to clear principles and standard practice as embodied in the Advanced Trauma Life Support (ATLS) system and for children the Advanced Paediatric Life Support (APLS) system.

IMAGING

- B** Selection for imaging should be based on known 'risk' factors for the presence of a skull fracture or an intracranial lesion.
- C** CT scanning should be readily available, on a 24 hour basis, to A&E Departments responsible for assessing head injured patients.
- B** Doctors who interpret and make clinical decisions based upon skull films or scans should be trained to do so. All imaging should be reviewed by an experienced radiologist as soon as possible.
- B** Transport or transmission of images should be used to communicate about patients in whom the appropriate management is not otherwise clear.

- B** **CT scanning** should be done in a patient who has any of the following features:
- (1) **The patient is eye opening only to pain or does not converse** (CGS 12/15 or less)
 - (2) **A deteriorating level of consciousness or progressive focal neurological signs**
 - (3) **Confusion or drowsiness** (CGS 13 or 14/15) **followed by failure to improve within at most four hours of clinical observation**
 - (4) **Radiological/clinical evidence of a fracture**, whatever the level of consciousness
 - (5) **New focal neurological signs which are not getting worse**
 - (6) **Full consciousness** (GCS 15/15) **with no fracture but other features**, e.g.:
 - severe and persistent headache
 - nausea and vomiting
 - irritability or altered behaviour
 - a seizure.

- B** **Skull films** should be carried out if any of the following apply and if CT is not being performed:
- (a) **If the patient is alert and orientated and obeying commands** (GCS 15/15) but:
 - the mechanism of injury has not been trivial; or
 - consciousness has been lost; or
 - the patient has loss of memory or has vomited; or
 - the scalp has a full thickness laceration or a boggy haematoma; or
 - the history is inadequate.
 - or
 - (b) **If the level of consciousness is impaired** (GCS \leq 14/15).

- B** **Imaging of the cervical spine**, including the cervico-thoracic junction should be carried out:
- in a fully conscious patient (GCS 15/15) if clinical symptoms or signs or the mechanism of injury indicate the possibility of injury
 - in a patient with persisting impaired consciousness (GCS 14/15 or less)
 - in an unconscious patient, not localising pain (GCS 6/15 or less) CT scanning of the cervical spine down to C2 should be undertaken routinely, at the time of head scanning.

ADMISSION OR DISCHARGE?

- B** A patient should be **admitted to hospital** if:
- **the level of consciousness is impaired** (GCS $<$ 15/15)
 - **the patient is fully consciousness** (GCS 15/15) **but any of the following risk factors are present**:
 - continuing amnesia (for at least five minutes after injury)
 - continuing nausea and/or vomiting
 - a seizure at any time after injury
 - focal neurological signs
 - irritability or abnormal behaviour
 - clinical or radiological evidence of a recent skull fracture or suspected penetrating injury
 - an abnormal CT scan
 - severe headache or other neurological symptoms
 - **the patient has significant medical problems**, e.g. anticoagulant use
 - **the patient has social problems or cannot be supervised by a responsible adult.**

- B** A patient can be discharged from A&E for observation at home if fully conscious (GCS 15/15) with none of the additional risk factors above or other relevant adverse medical and social factors.

INPATIENT OBSERVATION

- B** Any of the following examples of **neurological deterioration** should prompt urgent reappraisal by a doctor:
- the development of agitation or abnormal behaviour
 - a sustained decrease in conscious level of at least one point in the motor or verbal response or two points in the eye opening response of the GCS
 - the development of severe or increasing headache or persisting vomiting
 - new or evolving neurological symptoms or signs, such as pupil inequality or asymmetry of limb or facial movement.

INDICATIONS FOR REFERRAL TO A NEUROSURGICAL UNIT

- B** A head injured patient should be **discussed with a neurosurgeon:**
- when a CT scan in a general hospital shows a recent intracranial lesion
 - when a patient fulfils the criteria for CT scanning but this cannot be done within an appropriate period
 - irrespective of the result of any CT scan, when the patient has clinical features that suggest that neurosurgical assessment, monitoring, or management are appropriate.

- B** Features suggesting that **neurosurgical assessment, monitoring, or management** are appropriate include:

- (1) persisting coma (GCS score 8/15 or less) after initial resuscitation
- (2) confusion which persists for more than four hours
- (3) deterioration in level of consciousness after admission (a sustained drop of one point on the motor or verbal subscales, or two points on the eye opening subscale of the GCS)
- (4) progressive focal neurological signs
- (5) a seizure without full recovery
- (6) compound depressed skull fracture
- (7) definite or suspected penetrating injury
- (8) a CSF leak or other sign of a basal fracture.

- B** Transfer of the patient should follow the principles set out by the Association of Anaesthetists of Great Britain and Ireland and the Neuro-anaesthesia Society of Great Britain and Ireland.

FOLLOW UP

- B** A **discharge letter** should be sent to the general practitioner about every patient, whether or not admitted to hospital.

SUMMARY OF PAEDIATRIC PRACTICE POINTS

ASSESSMENT AND CLASSIFICATION



The Glasgow Coma Scale is difficult to apply to the young (under 5 years) child. Although modifications exist, great care needs to be taken with its interpretation and this should be done by those with experience in the management of the young child.

IMAGING



Skull fractures in children, though significantly associated with an increased risk of intracranial injury, are not as discriminating as in adults. In children with a head injury, significant intracranial injury occurs more frequently in the absence of a skull fracture than is the case in adults. Clinical features (e.g. tense fontanelle) are an equally important factor in determining the need for a CT scan to rule out intracranial injury.



In the absence of clinical signs of intracranial injury, observation by experienced paediatric medical and nursing staff in an appropriate unit/ward is an alternative to urgent CT scan.

ADMISSION OR DISCHARGE?



Children should be admitted if any of the following risk factors apply:

- history of loss of consciousness
- neurological abnormality or persisting headache or vomiting
- clinical or radiological evidence of skull fracture or penetrating injury
- difficulty in making a full assessment
- suspicion of non-accidental injury
- other significant medical problem
- not accompanied by responsible adult or social circumstances considered unsatisfactory.



In injured children, especially the very young, the possibility of non-accidental injury must be considered when findings are not consistent with the explanation given, if the history changes, or if the family is known to be on the 'At Risk' register. In such a case a medical practitioner with experience in the care of children should be involved and should contact the duty social worker to allow early investigation. Locally agreed guidelines and protocols should be followed.



Children can be discharged from A&E if none of the risk factors noted above apply. Clear written instruction should be given to and discussed with parents or carers before a child is discharged.

INPATIENT OBSERVATION



Children <3 years old who have sustained a head injury are particularly difficult to evaluate and clinicians should have a low threshold of suspicion for early consultation with a Specialist Paediatric Surgical Unit. Children requiring admission should be admitted under the care of a paediatrician or paediatric surgeon with experience in the care of children with a head injury and should be observed in a children's ward.

REFERRAL TO A NEUROSURGICAL UNIT



Transfer of a child to a specialist neurosurgical unit should be undertaken by staff experienced in the transfer of critically ill children – i.e. a (Regional) Paediatric Transfer Team.

FOLLOW UP



Children suffering significant head injury should be followed up by a specialist multidisciplinary team to assess the need for rehabilitation and should include notification to the school medical service and the primary health care team.

1 Introduction

1.1 BACKGROUND

About 100,000 people attend hospital every year in Scotland with a head injury, and around 20% are admitted, a rate of 330 per 100,000 population.² Although case fatality is low (3.2% of admissions, 10 per 100,000 per annum), trauma is the leading cause of death under the age of 45 and up to a half are due to a head injury. Furthermore, sequelae are common in survivors: a recent study in Scotland estimated an annual incidence of between 100 and 150 per 100,000 adults disabled a year after a head injury.³

1.2 THE NEED FOR A GUIDELINE

Outcome after head injury depends upon the initial severity of injury, the extent of any subsequent complications and how these are managed. Much of the early hospital management of head injuries falls upon Accident and Emergency Departments (A&E), with primary care and ambulance services involved before hospital. Most of the large number of patients who attend hospital after a head injury do not develop life threatening or disabling complications in the acute stage. However, in a small but important group of patients, outcome is made worse by a failure to detect promptly or to deal adequately with complications.⁴⁻⁹

There is no debate about the efficacy or effectiveness of the interventions required to remove a space-occupying intracranial haematoma or to treat complications such as the correction of hypoxia and hypotension. Instead, much of the debate about the early management of head injuries is focused on the methods used to identify the patients at risk and to provide appropriate care, in terms of investigations utilised, observations performed and where these should be carried out.

The use of guidelines in the early management of head injuries was endorsed by a Department of Health Seminar,¹⁰ based on recommendations from neurosurgeons that were published subsequently in 1984¹¹ and incorporated in the Report of a Working Party of the Royal College of Surgeons of England in 1986.¹² Since then, services for the management of trauma have changed substantially, with much greater availability of computed tomographic (CT) scanning in general hospitals. This has led to proposals for revisions from sources that include the Society of British Neurological Surgeons,¹³ the Royal College of Radiologists,¹⁴ the Royal College of Surgeons of England,¹⁵ and the British Paediatric Association / British Association of Paediatric Surgeons.¹⁶ The need to assimilate evidence obtained from a fresh, systematic review with these earlier recommendations, into a coherent, consistent approach, provided the remit for the SIGN Head Injury Guideline Development Group.

1.3 REMIT OF THE GUIDELINE

The purpose of this guideline is to make recommendations which will inform the initial management of head injuries, focusing on topics of importance to the management of patients throughout the National Health Service in Scotland.

The questions the guideline deals with are:

- How should head injured patients be assessed and classified?
- What are the indications for referral to hospital of a patient with a recent head injury?
- What are the principles of care during transport and during assessment in A&E?
- What are the relative merits of skull radiography (x-ray) and CT scanning in the recently head injured patient?
- Who should undergo radiological investigations, and what technique is appropriate?
- Who should be admitted to hospital for observation?
- Who can be discharged from A&E?
- How should observation be continued in hospital or after discharge?
- Who should be discussed with the regional neurosurgical unit?

The guideline does not discuss the detailed management of more severe injuries, either pre- or in-hospital, which are already incorporated in publications from the American College of Surgeons,¹⁷ the American Association of Neurosurgeons/Brain Trauma Foundation,¹⁸ the European Brain Injury Consortium,¹⁹ and the Association of Anaesthetists/British Neuroanaesthesia Society.²⁰

The guideline is based on a thorough review of available evidence (*see Annex 1*). A particular problem in conducting rigorous prospective studies of diagnostic investigations and triage policies in head injury is that the absolute risk of serious or catastrophic complications is actually relatively low, so that very large numbers of patients are required. Many decisions in head injury management are designed to minimise risks that are rare. The factors relevant to these risks have been identified and quantified rigorously, but prospectively collected evidence from randomised studies of the consequences of different decisions is lacking. Many recommendations therefore reflect an appraisal of what is rational, authoritatively advocated, and apparently widely accepted.

The guideline development group considers that its recommendations are appropriate to most head injured patients in Scotland, and as relevant to primary care clinicians as to the staff of acute hospitals, but will require interpretation in the light of local facilities and geography.

A number of 'paediatric practice points' have been included to highlight specific aspects of management which may differ in children (age < 16 years unless specified otherwise). These are indicated with the following symbol:



Paediatric practice point.

2 Assessment and classification

How should head injured patients be assessed and classified?

2.1 ASSESSING THE PATIENT

The approach to management of head injuries which depended on taking urgent action following the detection of deterioration has been superseded by one based on utilisation of pre-emptive investigation to detect lesions before they lead to neurological deterioration. The management of individual head injured patients, and the formulation and application of guidelines depends upon the use of a widely accepted and applicable method of assessment and classification of the so-called 'level of consciousness'. This provides the most useful indication of the initial severity of brain damage and its subsequent changes over time.

The Glasgow Coma Scale²¹ and its derivative, the Glasgow Coma Score,²² are used widely for assessing patients both before and after arrival at hospital.²³⁻²⁵ Extensive studies have supported their repeatability,²⁶⁻²⁹ validity,^{22, 30-34} and other clinimetric properties.

Evidence level III

B The management of head injured patients should be guided by clinical assessments and protocols based on the Glasgow Coma Scale and Glasgow Coma Score.



The Glasgow Coma Scale is difficult to apply to the young (under 5 years) child. Although modifications exist,³⁶ great care needs to be taken with its interpretation and this should be done by those with experience in the management of the young child.

The AVPU (Alert, Verbal, Painful, Unresponsive) system can provide a rough guide to whether patients need airway protection, but full assessment will still be required.^{37, 38}

2.2 THE GLASGOW COMA SCALE AND COMA SCORE

The **Glasgow Coma Scale** provides a framework for describing the state of a patient in terms of three aspects of responsiveness: eye opening, verbal response, and best motor response, each stratified according to increasing impairment. In the first description of the Scale for general use, the motor response had only five options, with no demarcation between 'normal' and 'abnormal' flexion. The distinction between these movements can be difficult to make consistently^{26, 27} and is rarely useful in monitoring an individual patient but is relevant to prognosis and is therefore part of an extended six option scale used to classify severity in groups of patients.^{30, 32, 39}

The **Glasgow Coma Score** is an artificial index; obtained by adding scores for the three responses.²² The notation for the score was derived from the extended scale, incorporating the distinction between normal and abnormal flexion movements, producing a total score of 15 (see *Table 1*). This score can provide a useful single figure summary and a basis for systems of classification, but contains less information than a description separately of the three responses.

The three responses of the original (1974) scale, not the total score, should therefore be of use in describing, monitoring and exchanging information about individual patients. The guideline development group recommends that the progress of the patient should be recorded on a chart, incorporating the Glasgow Coma Scale and other features. An example chart which is widely used is included at Annex 2.

Examination of the cranial nerves, in particular pupil reactivity, and neurological examination of the limbs, in particular the pattern and power of movement, provide supplementary information about the site and severity of local brain damage. Information about mechanisms of injury, other injuries and complications should be also recorded.

Classification of head injured patients can be made using information from the Glasgow Coma Scale or Score. In view of the widespread use of both systems, the recommendations in this guideline are framed in both terms where appropriate.

- Monitoring and exchange of information about individual patients should be based on three separate responses of the Glasgow Coma Scale.
- If a total score is recorded or communicated, it should be based on a sum of 15, and to avoid confusion this denominator should be specified.
- A standard chart should be used to record and display assessments, including the Glasgow Coma Scale, pupil size and reaction and movements of right and left limbs.

Table 1

THE GLASGOW COMA SCALE AND SCORE

Feature	Scale Responses	Score Notation
Eye opening	Spontaneous	4
	To speech	3
	To pain	2
	None	1
Verbal response	Orientated	5
	Confused conversation	4
	Words (inappropriate)	3
	Sounds (incomprehensible)	2
	None	1
Best motor response	Obey commands	6
	Localise pain	5
	Flexion – Normal	4
	– Abnormal	3
	Extend	2
	None	1
TOTAL COMA 'SCORE'		3/15 - 15/15

3 Indications for referral to hospital

What are the indications for referral to hospital of a patient with a recent head injury?

An apparently minor blow to the head is a common event in every day life and many patients do not require hospital referral. The principal reasons for hospital referral are the existence or potential for brain damage or the presence of a wound that may require surgical repair.

Impairment of conscious level may indicate brain injury and is an indication for referral to hospital. Impairment may be transient, shown by a loss of awareness to onlookers and/or by a period for which the patient has no recall (amnesia). Although there is acceptance that the increasing duration of such a period relates to increased likelihood of intracranial injury there is insufficient evidence to establish a minimum duration, below which hospital referral is unnecessary. Persisting impaired consciousness (GCS total score less than 15/15) has been correlated with an increased risk of brain injury and so is always an indication for hospital referral.^{40, 41}

Patients with a recent head injury who have *not* had impaired consciousness or have recovered and are alert, with eyes spontaneously open, orientated and obeying commands (GCS 15/15) are not a homogeneous group. In addition to a loss of consciousness or amnesia, other features that may indicate a risk of intracranial damage include nausea and vomiting, headache, irritability or altered behaviour, a seizure, pupil changes, focal neurological deficits, a suspected penetrating scalp wound, intoxication⁴² or clinical evidence of a skull fracture and in particular a basal skull fracture.⁴¹⁻⁴⁸

Evidence level III

A lack of an adequate history, uncertainty about diagnosis, or co-morbidity (medical or social e.g. warfarin therapy, alcohol abuse, extracranial injuries, lack of supervision or non-accidental injury) also provide reasons for referral to hospital.⁴⁹⁻⁵²

B A head injured patient should be referred to hospital if any of the following is present:

- Impaired consciousness (GCS < 15/15) at any time since injury
- Amnesia for the incident or subsequent events
- Neurological symptoms, e.g.
 - severe and persistent headache
 - nausea and vomiting
 - irritability or altered behaviour
 - seizure
- Clinical evidence of a skull fracture (e.g. CSF leak, periorbital haematoma)
- Significant extracranial injuries
- A mechanism of injury suggesting:
 - a high energy injury (e.g. road traffic accident, fall from height)
 - possible penetrating brain injury
 - possible non-accidental injury (in a child)
- Continuing uncertainty about the diagnosis after first assessment
- Medical co-morbidity (e.g. anticoagulant use, alcohol abuse)
- Adverse social factors (e.g. no-one able to supervise the patient at home).

For many of the 1,000 GPs in Scotland who work in rural or remote settings, arranging the transfer of a head injured patient to an acute hospital is a major undertaking because of the distance involved. If reference to the guideline suggests that transfer is necessary then there should be no hesitation in doing so, but some GPs have the option of admitting the patient to a community hospital *when the risk of intracranial complications is low*. This allows a patient who is not causing clinical concern but who cannot for practical reasons be supervised at home to be observed locally. Such hospitals rarely have imaging facilities, so care must be taken when deciding whether to refer or to keep the patient in a community hospital.

A decision to refer might be determined by:

- GCS < 15/15
 - loss of consciousness at the time of the incident
 - post-traumatic amnesia
 - signs to suggest a skull fracture
 - inadequate history
 - complex medical history, e.g. anticoagulant use.
- Geographical factors, for example where hospital attendance requires a prolonged journey, or special transport (by helicopter or fixed wing aircraft), should not influence the referral of a patient with persisting impairment of consciousness, but in a patient who has not had impaired consciousness they may justify a higher threshold for referral.

4 Principles of management

What general principles apply in the management of the recently head injured patient during transport and in A&E?

A detailed review of all aspects of care of head injured patients before arrival and in the A&E Department is not within the scope of this guideline. A systematic approach to the assessment and treatment of the injured patient, to identify and to treat first the greatest threat to life, to do no further harm and to arrange safe transfer to the most appropriate definitive care facility are widely accepted principles. These have their clearest application initially but continue to be relevant at all subsequent stages.

4.1 PRINCIPLES OF ADVANCED TRAUMA LIFE SUPPORT

The guideline development group endorses the principles of Advanced Trauma Life Support, the systematic, internationally accepted approach for assessment and resuscitation developed by the American College of Surgeons Committee on Trauma.¹⁷ For children, the Advanced Paediatric Life Support system is recommended.⁵³

Evidence level IV

C A head injured patient should initially be assessed and managed according to clear principles and standard practice as embodied in the Advanced Trauma Life Support (ATLS) system and for children the Advanced Paediatric Life Support (APLS) system.

4.2 FEATURES OF HEAD INJURED PATIENTS ATTENDING SCOTTISH HOSPITALS

About half of patients attending Accident and Emergency Departments in Scotland with a head injury are children under the age of 14 years. The very great majority are fully conscious (see Table 2), without even a history of loss of consciousness or amnesia or other signs of brain damage.⁵⁴⁻⁵⁶

Evidence level III

Table 2

LEVEL OF RESPONSIVENESS IN 7,656 HEAD INJURED PATIENTS ATTENDING A&E DEPARTMENTS IN SCOTLAND^{41, 54-56}

GCS (/15)	Adults	Children
15	93%	96%
9-14	6%	3.5%
≤ 8	1%	0.5%

5 Imaging

What are the relative merits of skull radiography and CT scanning in the recently head injured patient?

5.1 DETECTION OF TRAUMATIC INTRACRANIAL LESIONS BY IMAGING

Intracranial lesions can be detected radiologically before they produce clinical changes.^{57, 58} Early imaging, rather than awaiting neurological deterioration, reduces the delay in the detection and treatment of acute traumatic intracranial injury. This is reflected in better outcomes.⁵⁹⁻⁶² Exclusion or demonstration of intracranial injury can also guide decisions about the intensity and duration of observation in apparently less severe injuries.⁴⁶

Evidence level III

CT scans can directly answer the key question: *is there structural intracranial damage?* There is a progressive shift away from skull radiography as a source of circumstantial evidence of intracranial damage, towards CT scanning to provide a definitive answer.⁶³⁻⁶⁷ Disadvantages of performing early CT include the possible hazards and inconvenience of transfer to a scanner,^{68, 69} the occasional need for general anaesthesia to obtain clinically useful images, and the development later of a new significant lesion but this is rare after a 'negative' early scan.⁷⁰⁻⁷² There is also a need to avoid over-use of this investigation and there is a general duty to reduce radiation dosage when possible. The estimated dose for brain CT (2.0 mSv) is equivalent to one year's background radiation but is considerably more than the dose for three skull films (0.14 mSv).⁷³

Evidence levels III and IV

CT scanning is increasingly readily available to patients in General Hospitals.^{64, 65, 74} Authoritative sources recommend 24 hour access in all Accident and Emergency Departments.^{14, 15, 75} Nevertheless, the criteria for the use of skull x-ray and CT scan in patients with less severe injuries provoked most controversy in the development of this guideline. The SIGN guideline development group's conclusions about the indications for the selective use of skull x-ray and CT scan accord with the recommendations of the Royal College of Radiologists,¹⁴ the Society of British Neurological Surgeons,¹³ and the Royal College of Surgeons of England.¹⁵

Evidence level IV

C CT scanning should be readily available, on a 24 hour basis, to A&E Departments responsible for assessing head injured patients.

5.2 SELECTION OF PATIENTS FOR IMAGING

In the absence of evidence from randomised comparisons of the results of different imaging modalities, indications depend upon an assessment of the likely return in different categories of patient. The return can be considered either in terms of the radiological lesions demonstrated or the yield of clinically significant abnormalities, which are typically 10-20% of the former.^{48, 76-81}

5.2.1 RISK FACTORS FOR AN INTRACRANIAL LESION

The most firmly established factors that correlate with the occurrence of a surgically significant intracranial haematoma are the level of consciousness and the presence or absence of a skull fracture.^{40-43, 47, 48, 70, 78, 79, 81-92} The risks of an intracranial haematoma requiring operative evacuation in head injured patients based on findings on arrival at A&E in one large study are summarised in Table 3.⁴¹

Evidence level III

Table 3

RISK OF AN OPERABLE INTRACRANIAL HAEMATOMA* IN HEAD INJURED PATIENTS (adapted from Teasdale et al, 1990⁴¹)

GCS (/15)	Risk	Other features	Risk
15	1 in 3,615	None	1 in 31,300
		Post-traumatic amnesia (PTA)	1 in 6,700
		Skull fracture	1 in 81
		Skull fracture and PTA	1 in 29
9-14	1 in 51	No fracture	1 in 180
		Skull fracture	1 in 5
3-8	1 in 7	No fracture	1 in 27
		Skull fracture	1 in 4

*Data from haematomas that were surgically evacuated

Additional factors modify these risks, but to an extent that has not been quantified. Features include, age over 60,^{50, 79, 80, 93} injured in an assault or being struck by a vehicle,^{50, 80} headache and vomiting,⁹³ the presence of focal neurological signs,^{47, 78} and a history of intake of alcohol,^{42, 51, 94} or anticoagulant treatment.^{95, 96} The Royal College of Radiologists has used these features to categorise head injured patients as at low, medium, high or very high risk of intracranial injury.¹⁴ These correspond broadly to combinations of clinical and skull fracture findings:

- low: GCS 15/15, no fracture
- medium: GCS 15/15, no fracture but history of loss of consciousness
- high: GCS 13 or 14/15, or GCS 15/15 with skull fracture
- very high: GCS 12/15 or less, or clinical deterioration.

Evidence levels III and IV

Patients whose expectation of having radiography is not fulfilled are reported to be less satisfied about their management in A&E and to have longer lasting symptoms. Nevertheless, this should not interfere with a selective approach.

Evidence level III

B Selection for imaging should be based on known 'risk' factors for the presence of a skull fracture or an intracranial lesion.

5.3 INDICATIONS FOR SKULL X-RAY

The indications for skull films need to be considered in the context of the criteria for CT scanning. If an emergency CT scan is planned, there is no reason to carry out skull radiography. If CT scanning is not planned, the need for skull radiographs must be considered.

In the large majority of patients who are conscious (spontaneous eye opening, talking and fully orientated, GCS 15/15) CT scanning is not recommended as a routine unless there is evidence of a skull fracture (*see below*). In these patients, therefore, it is necessary to decide between a non-selective policy for skull x-ray or an attempt to focus investigation on subgroups likely to have a 'high yield' of fractures. If the patient has persisting impaired consciousness and CT is not planned, skull radiographs are considered to be appropriate in all cases.¹³⁻¹⁵

Evidence level IV

Features in the history that increase the prospect of x-ray showing a fracture include:

- persisting impairment of consciousness or neurological signs
- in those who have recovered, a history of loss of consciousness or amnesia, nausea or vomiting
- inadequate history to establish the conscious state.

Clinical signs that correlate with the likelihood of a fracture include:

- a 'full thickness' scalp laceration
- boggy haematoma
- leak of CSF or blood from the nose or ear
- periorbital bruising.^{41, 44, 48, 98-103}

Evidence level III

Information about the violence of impact is also relevant, for example a skull fracture is more likely if there has been a fall of more than 60 cm onto a broad hard surface or impact against a small object.⁹⁹ Unfortunately, in features where 'grading' is possible, e.g. length of amnesia or severity of impact, there is not sufficient evidence of robust, distinct 'break points' to establish precise 'thresholds' to define when a skull x-ray is or is not appropriate.

B Skull films should be carried out if any of the following apply and if CT is not being performed:

(a) If the patient is alert and orientated and obeying commands (GCS 15/15)

but:

- the mechanism of injury has not been trivial; or
- consciousness has been lost; or
- the patient has loss of memory or has vomited; or
- the scalp has a full thickness laceration or a boggy haematoma; or
- the history is inadequate.

or

(b) If the level of consciousness is impaired (GCS \leq 14/15).

5.4 INDICATIONS FOR HEAD CT

There is a view in some countries that a CT scan should be done in every head injured patient in whom there is any concern whatsoever about an intracranial lesion.^{46, 50, 104, 105} However, over-use of CT scanning has disadvantages that include the time and effort expended in providing emergency immediate 24 hour access, and the possible hazards of transfer and the occasional need for general anaesthesia to obtain satisfactory images. Appropriate use of resources is also a consideration and a realistic balance has to be found.^{14, 82, 84}

*Evidence levels
III and IV*

The pragmatic view taken by the guideline development group is that CT scanning is appropriate, either as a primary investigation or after a skull x-ray, if the likelihood of yielding an abnormality is 10% or more. This corresponds to the likelihood of identifying a lesion for which surgery is required of at least 1-2%.

The data summarised in Table 3 (see page 9) and data obtained from other studies (see section 5.2) show that this condition is fulfilled either if the patient is conscious but has a skull fracture or has impaired consciousness (GCS 14/15 or less, e.g. confusion or failure to obey commands).

5.4.1 FULLY CONSCIOUS PATIENTS

In the large number of patients who are fully conscious (GCS 15/15), the risk of an intracranial haematoma is less than 1%. CT scanning is appropriate only if a higher risk is indicated by the presence of other features. The additional feature most clearly justifying CT scanning is the presence of a skull fracture. In the absence of evidence of a skull fracture, other features that may make CT scanning appropriate include persisting severe headache, vomiting or developing neurological signs, and treatment with anticoagulants (see section 5.2). There is some evidence that the features that indicate that a skull x-ray is appropriate can also be used to justify a CT scan without a skull x-ray.^{90, 92, 108} However, the guideline development group considers that this has not to date been established as appropriate in Scottish practice.

Evidence level III

5.4.2 PATIENTS WITH IMPAIRED CONSCIOUSNESS (GCS 3-14/15)

CT scanning shows an abnormality in at least 20% of cases of patients with impairment of consciousness. Some recommend performing CT in all these patients^{13, 77, 88, 104} (see section 5.2). However, the 'positive' yield is increased by selecting those with more profoundly impaired consciousness. The debate is about the speed of obtaining a CT scan in patients with a lesser degree of impaired consciousness.

Patients who are confused and/or open their eyes only after a sound stimulus (GCS 13 or 14/15) show an abnormality on CT scanning in about 20-30% of cases. If there is a skull fracture, the yield is even higher. It is therefore widely accepted that if a patient has any impaired consciousness and clinical or radiological evidence of a skull fracture, CT is indicated as an emergency.^{11, 13-15} When the patient does not have a fracture and especially if there is strong suspicion that consciousness is impaired as a result of alcohol or other drugs, rather than injury, the yield is less and scanning may be more difficult. An option is to decide after assessing the patient's progress during a short period (no more than four hours) of clinical observation. CT scanning is then carried out urgently if the patient fails to improve or there is neurological deterioration.

Evidence level III

When the patient's consciousness is markedly depressed (GCS 12/15 or less), there is a sufficiently high likelihood of finding an abnormality that CT scanning is appropriate in all cases.

In considering the rapidity with which CT scanning should be performed, it can be useful to make a broad distinction between scanning as *an emergency* and *urgent* scanning. By analogy with use of these terms in surgery, emergency indicates that arrangements for scanning should be initiated immediately and performed as soon as possible after completion of appropriate resuscitation/stabilisation – which will always take priority. Patients who fulfil the criteria for urgent scanning should, if needed, be investigated ‘out of hours’, and at the most within four hours from the first observation. The investigation should not be delayed until ‘normal working hours’ because this may detract from the potential benefit resulting from the wider availability of CT.

The above criteria for scanning as an emergency correspond closely with those of the Royal College of Radiologists; likewise, the criteria for scanning urgently correspond with the circumstances in which the Royal College of Radiologists states that CT scanning should be carried out within four hours of admission.¹⁴

Evidence level IV

B CT scanning should be done in a patient who has any of the following features:

- (1) **The patient is eye opening only to pain or does not converse (GCS 12/15 or less)**
- (2) **A deteriorating level of consciousness or progressive focal neurological signs**
- (3) **Confusion or drowsiness (GCS 13/15 or 14/15) followed by failure to improve within at most four hours of clinical observation**
- (4) **Radiological/clinical evidence of a fracture, whatever the level of consciousness**
- (5) **New focal neurological signs which are not getting worse**
- (6) **Full consciousness (GCS 15/15) with no fracture but other features, e.g.**
 - severe and persistent headache
 - nausea and vomiting
 - irritability or altered behaviour
 - a seizure.

Patients in categories (1) and (2) should be scanned as an emergency.

Patients in categories (3) - (6) should be scanned urgently.

When clinical features point strongly to an intracranial haematoma (e.g. the emergence of focal signs, or a deterioration in consciousness level), there should be discussion with a neurosurgeon about the benefits of transfer promptly to a location which has both CT scanning facilities and an emergency neurosurgical service.



Skull fractures in children, though significantly associated with an increased risk of intracranial injury, are not as discriminating as in adults. In children with a head injury, significant intracranial injury occurs more frequently in the absence of a skull fracture than is the case in adults. Clinical features (e.g. tense fontanelle) are an equally important factor in determining the need for a CT scan to rule out intracranial injury.



In the absence of clinical signs of intracranial injury, observation by experienced paediatric medical and nursing staff in an appropriate unit/ward is an alternative to urgent CT scan.

5.4.3 REMOTE COMMUNITIES

In remote communities other factors must be taken into account when considering the usefulness of skull films as a triage tool. Where CT is not available locally the finding of a skull fracture (carrying increased risk) may influence the decision to evacuate a patient. However, if a helicopter or plane is needed even to obtain skull films then it is more appropriate to arrange transfer directly to a centre with a CT scanner and neurosurgical facilities.

Evidence level III

Recommendations for use of radiographic investigations in patients (> 5 years old) with a head injury are illustrated in Figure 1 overleaf.

5.5 INTERPRETATION OF IMAGES

Casualty officers have been found to miss 10% of skull fractures in x-rays reviewed by radiologists.⁵⁶

Evidence level III

B Doctors who interpret and make clinical decisions based upon skull films or scans should be trained to do so. All imaging should be reviewed by an experienced radiologist as soon as possible.

The growth in CT scanning of head injured patients at general hospitals has been accompanied by consultation about patients whose scans are sent to a tertiary centre for a second opinion. This may be by physical transport of the films or transmission by teleradiology. There is evidence that image transfer influences decision-making and may reduce unnecessary transfers of head injured patients and promote more rapid transfer in appropriate cases.¹⁰⁷⁻¹⁰⁹

Evidence level III

B Transport or transmission of images should be used to communicate about patients in whom the appropriate management is not otherwise clear.

5.6 IMAGING THE CERVICAL SPINE

A head injury may be accompanied by a cervical injury. Even though this is an infrequent event, the need to consider the possibility of spinal injury and to take measures to 'clear the cervical spine' are well-established components of assessment of a head injured patient. The approach depends upon whether or not the patient is conscious and talking and hence able to report any symptoms and co-operate in clinical examination.

Cervical spine films are not considered necessary in conscious patients who are not complaining of pain in the cervical spine, have no neck tenderness, have no clinical evidence of cervical injury or neurological deficit, have not had a 'distracting injury', (an injury to another part of the body which draws attention away from the neck injury) and who have a full range of pain-free neck movement.¹¹⁰⁻¹¹³

Evidence level III

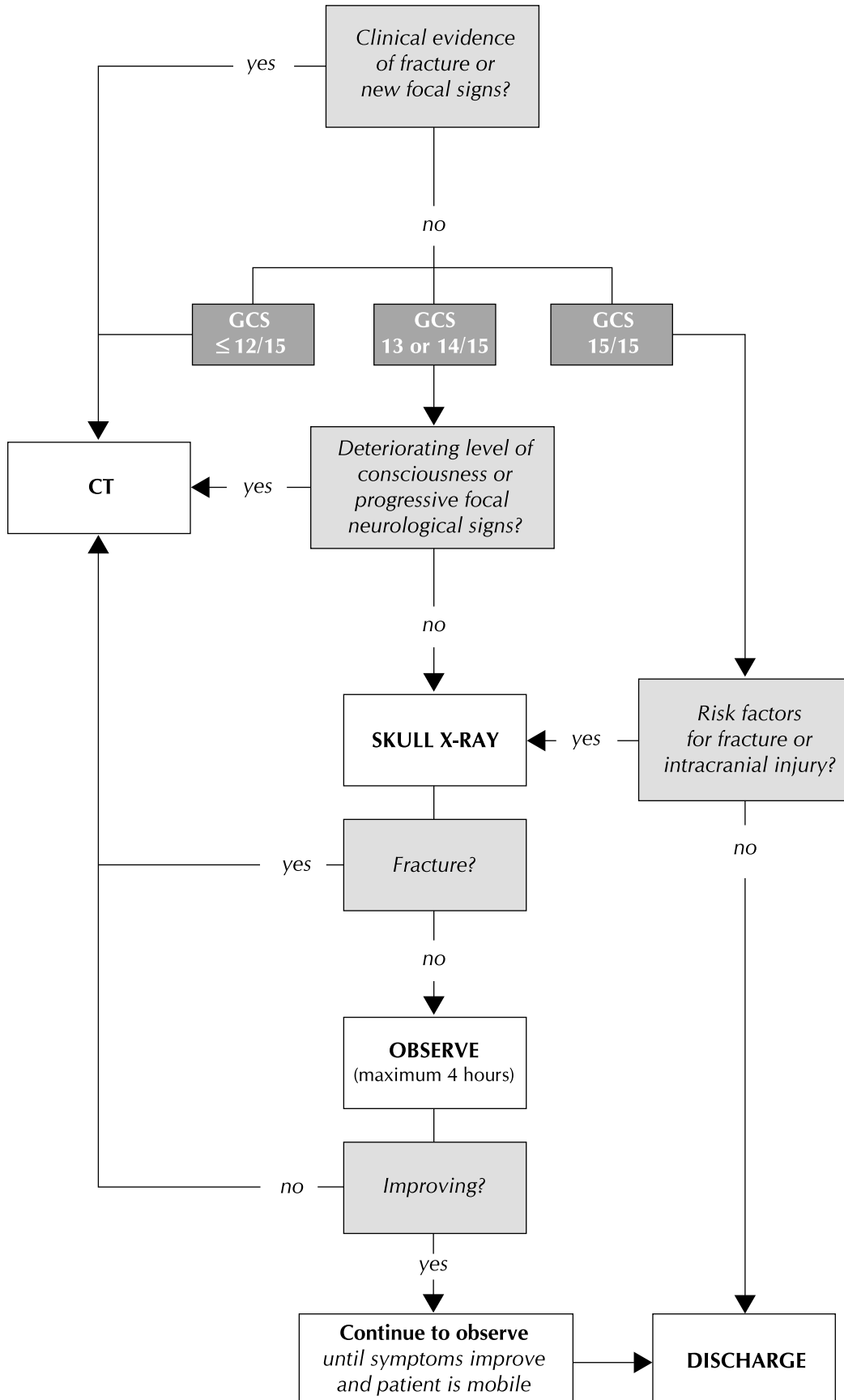
Immobilisation and imaging of the cervical spine is recommended:¹⁷

- if the patient is conscious, but describes the relevant symptoms
- if the mechanism of injury suggests a high risk of cervical injury
- if the patient has neurological signs suggesting spinal injury
- if the patient has impaired consciousness.

Evidence level IV

Figure 1

USE OF RADIOGRAPHIC INVESTIGATIONS IN PATIENTS (> 5 YEARS OF AGE) WITH A HEAD INJURY



The risk of spinal injury is reported to be increased in patients injured as a result of a fall from a height, in a road traffic accident or in other circumstances associated with high velocity, severe violence or multiple injuries.¹¹⁰ In patients injured in this way, the frequency of spinal injury in those with a head injury (3.5%) may not be greater than in those without a head injury and may not be influenced by severity of the head injury.¹¹⁴

Evidence level III

Plain radiographs of the cervical spine can detect most, but not all cervical spinal injuries and exclusion of injury can be complex, sometimes requiring additional CT of the spine. Detection of unstable ligamentous injuries may depend upon additional flexion and extension radiographs and/or magnetic resonance imaging. In current practice, a balance is usually made between the perceived likelihood of a spinal injury and the extent of investigation employed.

Plain cervical spinal radiographs should be taken (lateral, anteroposterior and transoral) as a single lateral cervical spine radiograph is not sufficient to exclude spinal injury.^{110, 113, 115} It is important to visualise the C7-T1 region and if this is not demonstrated on the plain radiographs the need for computed tomography should be considered.^{110, 113, 116} This may be conveniently performed at the same time as CT head scanning. In patients in deep coma, it is reported that fractures of the upper cervical spine are commonly detected by CT scanning more often than expected from the plain films and therefore the occipito cervical region should be imaged along with the head in patients with GCS <6/15.¹¹⁷

Evidence level III

Lateral radiographs in flexion/extension can be useful in selected circumstances, when an unstable ligamentous injury is suspected, for example, when there are minor degrees of misalignment and/or apparently detached osteophytes. Static flexion/extension views, under medical supervision, expose the patient and staff to a significantly lower radiation dose than dynamic fluoroscopy, which has no additional advantages.^{113, 118}

B Imaging of the cervical spine, including the cervico-thoracic junction should be carried out:

- in a fully conscious patient (GCS 15/15) if clinical symptoms or signs or the mechanism of injury indicate the possibility of injury
- in a patient with persisting impaired consciousness (GCS 14/15 or less)
- in an unconscious patient, not localising pain (GCS 6/15 or less) CT scanning of the cervical spine down to C2 should be undertaken routinely, at the time of head scanning.

6 Admission or discharge?

Who should be admitted to hospital for observation and who can be discharged home from A&E?

6.1 INDICATIONS FOR ADMISSION TO HOSPITAL

Surveys show that only some 20% of the patients who attend hospital with a head injury are admitted.^{54, 119} The reasons for admission include evidence that the patient has not recovered from the effects of the injury and/or any brain damage already sustained or that there are features that indicate the risk that further complications are likely. Some patients have a head injury that in itself would not require admission but this is necessary because they have serious injuries elsewhere, medical problems, or social factors that indicate that discharge is inappropriate.¹²⁰

Evidence level III

If a patient has persisting impaired consciousness, there is a clear need for continuing observation and care. Debate, about where and how care should be provided, can arise if it is suspected that the patient's condition is not due to a head injury but to another factor such as the effects of the intake of alcohol or drugs.¹²¹ If there is doubt, the appropriate course usually is to regard the patient's condition as due to a head injury.^{121, 122}

If a patient has apparently recovered from the effects of a head injury, so that concern is only about the possibility of a delayed complication, the benefits of admission to hospital are less clear.^{93, 101, 123} The potential advantage lies in the possibility of carrying out repeated observation by trained staff, so that neurological deterioration due to delayed complication could be detected and appropriate action taken promptly. Against this has to be set the reality that this event is rare (frequency of development of an intracranial haematoma in a patient with a Glasgow Coma Score of 15 has been estimated as 1 in 3,615⁴¹ (see section 5.2.1)). In addition to the cost, in terms of resources, being disproportionately high,¹²³ it has been argued that observation in hospital is more likely to be effective if it is focused on patients selected to be at higher risk, whereas well conducted home observation can be appropriate in low risk cases.¹²⁴⁻¹²⁶

Evidence levels III and IV

In a patient who is fully conscious after an injury, the guideline development group consider that clear indications for admission include persistence of symptoms or signs that develop as a consequence of the injury or the finding of abnormalities on a skull x-ray or CT scan.

The necessity to admit a patient who has recovered, but who has a clear history of having lost consciousness or who has amnesia for the circumstances of the injury, remains controversial. There is evidence that such patients are at very low risk of an intracranial complication but also a view that extended periods of unconsciousness or amnesia in themselves may merit admission. The precise duration of amnesia or unconsciousness that enables the distinction to be made has not been established; the guideline development group's view was that a period of more than five minutes should be considered an indication for admission. The concept that admission for 24 hours of those with a brief period of amnesia might reduce the occurrence of post-concussional syndrome has not been confirmed.¹²⁷

- B** A patient should be admitted to hospital if:
- the level of consciousness is impaired (GCS < 15/15)
 - the patient is fully conscious (GCS 15/15) but any of the following risk factors are present:
 - continuing amnesia (for at least five minutes after injury)
 - continuing nausea and/or vomiting
 - a seizure at any time after injury
 - focal neurological signs
 - irritability or abnormal behaviour
 - clinical or radiological evidence of a recent skull fracture or suspected penetrating injury
 - an abnormal CT scan
 - severe headache or other neurological symptoms
 - the patient has significant medical problems, e.g. anticoagulant use
 - the patient has social problems or cannot be supervised by a responsible adult.



Children should be admitted if any of the following risk factors apply:

- history of loss of consciousness
- neurological abnormality or persisting headache or vomiting
- clinical or radiological evidence of skull fracture or penetrating injury
- difficulty in making a full assessment
- suspicion of non-accidental injury
- other significant medical problem
- not accompanied by responsible adult or social circumstances considered unsatisfactory.



In injured children, especially the very young, the possibility of non-accidental injury must be considered when findings are not consistent with the explanation given, if the history changes, or if the family is known to be on the 'At Risk' register. In such a case a medical practitioner with experience in the care of children should be involved and should contact the duty social worker to allow early investigation. Locally agreed guidelines and protocols should be followed.

6.2 INDICATIONS FOR DISCHARGE FROM A&E

It is neither feasible nor desirable to admit to hospital the majority of patients attending A&E with a head injury who have recovered and who are at low risk of an intracranial complication. The circumstances in which discharge home is appropriate are therefore the converse of the criteria for admission.

Observation at home is especially appropriate for most patients who are fully conscious and orientated and who have recovered from any brief period of post traumatic amnesia.^{125, 127} Any adverse social factors should be taken into account.

*Evidence levels
Ib and III*

B A patient can be discharged from A&E for observation at home if fully conscious (GCS 15/15) with none of the additional risk factors noted in section 6.1 above or other relevant adverse medical and social factors.

- The following social criteria must be met prior to discharge:
 - a responsible adult is available and willing to observe the patient for at least 24 hours
 - verbal and written instructions about observations to be made and action to be taken are given to and discussed with that adult
 - there is easy access to a telephone
 - the home is within reasonable distance of medical advice
 - transport home is available.



Children can be discharged from A&E if none of the risk factors noted in section 6.1 apply.

6.3 INFORMATION AND INSTRUCTION ON DISCHARGE FROM A&E

If a patient is to be observed at home, compliance with observations and awakening advice is best if the verbal and written instructions are given directly to a responsible adult who can understand them.^{125, 128} Several different versions of instruction sheets have been described and many hospitals have locally devised versions.¹²⁸ The development of a standard uniform approach has been advocated.¹²⁶ Example advice sheets for the person taking responsibility for the patient and for the patient are provided as Annexes 3 and 4.

- Patients and carers should be given verbal and written advice and encouraged to seek prompt advice from their general practitioner or hospital emergency department by phone about any worrying symptoms or other concerns.



Clear written head injury observation instructions should be given to and discussed with parents or carers before a child is discharged (*see Annex 5*).

7 Inpatient observation

What practices are appropriate during inpatient observation and at subsequent discharge of head injured patients not admitted to specialist neurosurgical or intensive care?

7.1 CLINICAL OBSERVATION AND RECORDING

Careful, repeated observation forms a major part of the care of patients admitted to a general (i.e. non neurosurgical) ward according to the criteria described in section 6.1. The aim is to detect promptly patients who deteriorate neurologically who may need referral to a neurosurgical unit, and to confirm satisfactory recovery and to enable discharge in the majority of patients. The process of admission to a hospital ward requires good verbal and written communication and record-keeping.

- Accident and Emergency medical and nursing staff should communicate details of the mechanism and type of injury and maintain a chart of the neurological progress since arrival in A&E.
- Nursing staff should carry out a neurological assessment on arrival in the ward and compare it with that obtained in A&E. Any discrepancy between these assessments, suggesting deterioration, or other concerns about the patient's condition should be discussed immediately with the relevant medical staff.



Children <3 years old who have sustained a head injury are particularly difficult to evaluate and clinicians should have a low threshold of suspicion for early consultation with a Specialist Paediatric Surgical Unit.



Children requiring admission should be admitted under the care of a paediatrician or paediatric surgeon with experience in the care of children with a head injury and should be observed in a children's ward.

The Glasgow Coma Scale (GCS) is used widely to make neurological observations, and in trained hands is a good discriminative measure of conscious level (see section 2.1). It works best as a monitoring tool if each subscale (eye opening, verbal, and best motor response) rather than a total score is used as a separate predictor. Using only one type of flexor response in the motor component improves the consistency of recording the best motor response. Despite the apparent simplicity and clarity of the GCS, it is open to misinterpretation and misapplication leading to confusion,¹²⁹ especially when only the total score is reported.¹³⁰ High levels of consistency can be achieved if training in the use of the scale is provided and reinforced.²⁸

*Evidence levels
III and IV*

Wards for the observations of head injured patients should be suitably staffed by experienced doctors and nurses to provide the necessary close observation and prompt action if deterioration occurs.^{119, 131, 132}

- All medical and nursing staff involved in the care of head injured patients should be trained in the use and recording of the Glasgow Coma Scale.

- ☑ Other features monitored should be pupil size and reactivity, limb movements, respiratory rate, heart rate, blood pressure and temperature.
- ☑ Observations should be recorded on a chart of a design common to Scottish hospitals, a copy of which must go with the patient throughout the different departments during the patient's hospital stay.

An example observation recording chart is included as Annex 2.

7.2 FREQUENCY OF OBSERVATIONS

How often observations should be made has not been rigorously studied, but should relate to the estimated risk of clinically influential findings. The risk of rapid deterioration is higher during the first six hours and diminishes as the time since injury increases.^{57, 96, 95, 133}

Evidence level III

The guideline development group recommends that the factors to be considered include:

- the history of post traumatic amnesia
 - the time lapse since injury
 - the pattern of previous findings in GCS
 - the findings on skull x-ray or CT scan
 - other risk factors, e.g. warfarin therapy.
- ☑ Head injured patients, who warrant admission, should have neurological observations carried out at least in the following frequency starting after initial assessment in A&E:
 - ½ hourly for 2 hours
 - 1 hourly for 4 hours
 - 2 hourly for 6 hours
 - 4 hourly thereafter until fit for discharge.
 - ☑ It is necessary for medical staff to know the patient's condition on admission and to review progress. Medical staff should assess the patient on admission to the ward and should re-assess the patient at least once within the next 24 hours. Assessment should include examination for the GCS, neck movement, limb power, pupil reactions, other cranial nerves and signs of basal skull fracture.

7.3 FREQUENCY OF REAPPRAISAL

Head injured patients can develop a wide range of secondary complications, both intracranial and extracranial.¹³⁴ The occurrence of such complications may be indicated clinically either if a patient fails to improve at the expected rate or if there is evidence of clinical worsening. In either circumstance the patient should be reappraised by a member of the medical staff in order to confirm the clinical features, to consider how they may be explained and to arrange for appropriate investigations and intervention.¹⁰¹

Evidence levels III and IV

Although neurological changes direct attention to the possibility of intracranial complication, more often the cause is an extracranial complication and the priority is to ensure that the airway is clear, oxygenation adequate, etc.¹⁷ The effects of alcohol or other drugs may be a factor in persisting impairment of consciousness^{119, 122} but these effects are usually short-lasting (less than four hours) and the role of estimation of alcohol level is controversial.⁹⁴ Sequelae of alcohol withdrawal can also contribute to neurological impairment.

*Evidence levels
III and IV*

B Any of the following examples of neurological deterioration should prompt urgent reappraisal by a doctor:

- the development of agitation or abnormal behaviour
- a sustained decrease in conscious level of at least one point in the motor or verbal response or two points in the eye opening response of the GCS
- the development of severe or increasing headache or persisting vomiting
- new or evolving neurological symptoms or signs, such as pupil inequality or asymmetry of limb or facial movement.

If reappraisal confirms a neurological deterioration, many factors need to be evaluated but the first step is to ensure the airway is clear, and that oxygenation and circulation are adequate.

- Clinical signs of shock in a head injured patient should be assumed, until proven otherwise, to be due to hypovolaemia caused by associated injuries.
- Whilst an intoxicating agent may confuse the clinical picture, the assumption that deterioration or failure to improve is due to drugs or alcohol must be resisted.
- If systemic causes of deterioration such as hypoxia, fluid and electrolyte imbalance, or hypoglycaemia can be excluded, then resuscitation should continue according to ATLS principles while anaesthetic help and neurosurgical advice are sought (see section 8).

7.4 DISCHARGE AFTER OBSERVATION

Every patient needs a discharge plan. After inpatient observation, the need for home observation is less, and asking the family to wake the patient at intervals is usually not appropriate.^{125, 135}

Evidence level IV

Whenever possible, relatives should be involved in the patient's ongoing care and written advice should be given, modified from that given when a patient is discharged from A&E without admission (see section 6.2.1 and Annex 6). A careful assessment should be made of previous health and home circumstances, particularly in the elderly, who may have an associated illness or be taking medication which may have contributed to a fall, and a referral to the care for the elderly service may reduce the future risk of injury.¹²⁰

Evidence level III

- Written discharge information should be given to the patient or a relative prior to leaving the ward and they should demonstrate an understanding of the information given.

- Before discharge from the ward a patient with a head injury must be assessed by an experienced doctor, who must establish that all the following criteria have been met:
 - (a) Consciousness has recovered fully and is sustained at the pre-injury state.
 - (b) The patient is eating normally and not vomiting.
 - (c) Neurological symptoms/signs have either resolved, or are minor and resolving or are amenable to simple advice/treatment, (e.g. headache relieved by simple analgesia, or momentary positional vertigo due to vestibular disturbance).
 - (d) The patient is either mobile and self caring or returning to a safe environment with suitable social support.
 - (e) The results of imaging and other investigations have been reviewed and no further investigation is required.
 - (f) Extracranial injury has been excluded or treated.
- An immediate discharge document should be sent to the patient's general practitioner, in advance of the more detailed discharge letter (see section 9).

(See the SIGN report on the immediate discharge document,¹³⁶ which is under review in 2000.)

8 Indications for referral to a neurosurgical unit

Only a minority of head injured patients need assessment and treatment at a neurosurgical unit. The proportion transferred varies in different regions. These patients have the most serious injuries and highest risk of complications and of death. The speed with which patients who need neurosurgical care are identified, referred and transferred may critically influence their outcome.^{9, 45, 46, 48-51, 59, 82, 87, 137, 138} A survey after the introduction in 1978 of guidelines for transfer to neurosurgery showed few deaths in general hospitals occurred in patients who would clearly have benefited from neurosurgical care.¹³⁹ However, there is evidence that delays and other errors in the early management still occur.¹⁴⁰

Evidence level III

In the past, the main reason for transfer to a neurosurgical unit was deteriorating consciousness. If this happens, this is an important reason for transfer. However, the main aim is to take pre-emptive action.

8.1 REASONS FOR CONSULTATION

The circumstances when consultation about referral is appropriate include when a CT scan has been done and shows an intracranial lesion potentially appropriate for neurosurgical management, or when a CT scan has not been done but there are features indicating a high likelihood of an intracranial lesion requiring urgent attention. Occasionally, consultation may be needed if the patient's condition is causing clinical concern and this has not been resolved by the findings of a CT scan.¹³ The benefits of neurosurgical care, in addition to the skills and facilities for intracranial surgery, include expertise and facilities for patient assessment and investigation, as well as the sophisticated monitoring and management of intracranial conditions that constitute specialised neuro-intensive care. There are also benefits in the access to enhanced knowledge and experience resulting from the concentration of experience.¹³⁷

Evidence level IV

The potential disadvantages of secondary transfer include the possible exposure to secondary insults or added delay in action. These factors are of most concern to patients with serious multiple injuries¹⁴¹ whose continuing care requires ready access to a range of expertise.

Evidence level III

In Scotland, each neurosurgical centre is in the campus of a general hospital. In only one is cardiac surgery co-located with neurosurgery, but patients who require both forms of surgical intervention are extremely rare in Scottish practice.

8.2 INDICATIONS FOR REFERRAL

- B** A head injured patient should be discussed with a neurosurgeon:
- when a CT scan in a general hospital shows a recent intracranial lesion
 - when a patient fulfils the criteria for CT scanning but this cannot be done within an appropriate period
 - irrespective of the result of any CT scan, when the patient has clinical features that suggest that neurosurgical assessment, monitoring, or management are appropriate.

B Features suggesting that neurosurgical assessment, monitoring, or management are appropriate include:

- (1) **persisting coma** (GCS score 8/15 or less) **after initial resuscitation**
- (2) **confusion which persists for more than 4 hours**
- (3) **deterioration in level of consciousness after admission** (a sustained drop of one point on the motor or verbal subscales, or two points on the eye opening subscale of the GCS)
- (4) **progressive focal neurological signs**
- (5) **a seizure without full recovery**
- (6) **depressed skull fracture**
- (7) **definite or suspected penetrating injury**
- (8) **a CSF leak or other sign of a basal fracture.**

8.3 TRANSFER BETWEEN A GENERAL HOSPITAL AND A NEUROSURGICAL UNIT

Patients with impaired consciousness are at risk of physiological instability that can result in secondary insults during transport and a worse outcome.^{68, 142} These adverse events can be minimised by resuscitation before transport and high level monitoring and care in transport.^{20, 69}

Evidence level III

B Transfer of the patient should follow the principles set out by the Association of Anaesthetists of Great Britain and Ireland and the Neuro-anaesthesia Society of Great Britain and Ireland.



Transfer of a child to a specialist neurosurgical unit should be undertaken by staff experienced in the transfer of critically ill children – i.e. a (Regional) Paediatric Transfer Team.

A standard method of verbal or written communication between referring doctors and neurosurgeons facilitates patient care. Good communication between nursing teams is also important. The guideline development group endorse the proforma developed by the Scottish Trauma Audit Group (see Annex 7).

- To facilitate communication between general hospitals and neurosurgical unit staff, a proforma containing the Glasgow Coma Scale and other relevant features should be used.

The details of neurosurgical care are beyond the scope of this guideline, but require an integrated approach which includes operative neurosurgery, neuro-intensive care (including care of potential organ donors), and neuro-rehabilitation. The care of severely head injured patients should follow the guidelines described by a group supported by the Brain Trauma Foundation and recommended by the American Association of Neurosurgeons,¹⁸ and the guidelines of the European Brain Injury Consortium.¹⁹

9 Follow up

A head injury can be followed by a wide variety of problems, and advice on the detailed management of these is beyond the scope of this guideline. The value of specialist multidisciplinary follow up and rehabilitation services for head injured patients may be a subject for future guidelines; at present, the availability of these services is fragmentary and varies widely in different localities.

Information on the common physical and neuro-psychological sequelae of head injury (e.g. memory problems, dizziness, anosmia, epilepsy), and advice on return to driving, work, or sport should be available and offered at the time of discharge. It may be helpful (either then or later) to make a referral to a multidisciplinary health/social services team or an appropriate community support agency. Advice on alcohol and drug use and contact numbers for victim support groups should be offered where appropriate. It may be appropriate to provide this information both to the family and to the patient.

Follow up arrangements may be co-ordinated by the primary care team or the hospital. Patients who have post traumatic amnesia of over an hour, a fractured skull, or neuropsychological or neurological symptoms at discharge from hospital are more likely to have residual problems.¹⁴³ Simple structured advice can help them and their families to cope with these sequelae.

Evidence level Ib

Head injured patients may benefit from advice and treatment given by a variety of experts, often working as a team: neuro-rehabilitation physician, clinical neuro-psychologist, rehabilitation nurse, physiotherapist, occupational therapist, speech and language therapist, and medical social worker/care manager.¹⁴³⁻¹⁴⁶ Continuity of care and information about the ability of the patient and family to cope in the community can be obtained by home visits from liaison social workers, occupational therapists, or other head injury workers. The more severe the head injury the more useful an interdisciplinary and goal-orientated approach to the patient's problems is likely to be, but even moderately and mildly head injured patients may benefit. Further evaluation of this approach is needed.

Evidence levels Ib, III and IV

B A discharge letter should be sent to the general practitioner about every patient, whether or not admitted to hospital. At this time an offer should be made to review the patient in an appropriate clinic if progress is not as expected or if unforeseen problems develop.



Children suffering significant head injury should be followed-up by a specialist multidisciplinary team to assess the need for rehabilitation and should include notification to the school medical service and the primary health care team.

10 Implications for service delivery

The following good practice and paediatric practice points relating to service delivery, training, and organisation of care from the earlier sections of the guideline are grouped together here to provide a basis for local discussion of implementation of the guideline.

- Each neurosurgical department should take a lead in establishing local implementation of the guidelines, ensuring that they are widely known and regularly reviewed with staff in referring hospitals.
- Staff caring for head injuries should be given training to ensure ability to carry out reliable assessments, and their proficiency documented.

The increased use of investigations may reduce hospital admissions, but there is no evidence yet of a substantial change of practice. This area is an important target for research and audit (see section 11).

- All A&E Departments which receive head injured patients should have rapid access, round the clock, to facilities for skull films and CT scanning. Staff trained to interpret the results of these investigations should be available.
- Patients admitted to a general hospital for observation should be cared for in wards where observation and care of head injury patients is a regular part of the workload, and where staff have sufficient training and time to provide appropriate care during admission and to arrange for appropriate aftercare following discharge.



Children requiring admission should be admitted under the care of a paediatric surgeon or paediatrician with experience in the care of children with a head injury and those children should be observed in a children's ward.

Decision-making about patients who need transfer to a second hospital with a neurosurgical unit can be difficult, particularly in the context of multiple injuries or where prognosis appears poor.

- General hospitals in Scotland should have facilities for electronic transmission of images and consultation with the regional neurosurgical unit.



Children <3 years old who have sustained a head injury are particularly difficult to evaluate and clinicians should have a low threshold of suspicion for early consultation with a Specialist Paediatric Surgical Unit.

- The need for severely head injured patients to be transported between hospitals should be minimised and, when required, carried out to standards recommended by the Association of Anaesthetists/British Society of Neuro-Anaesthesia.



Transfer of a child to a specialist neurosurgical unit should be undertaken by staff experienced in the transfer of critically ill children – i.e. a (Regional) Paediatric Transfer Team.

11 Recommendations for audit and research

11.1 AUDIT

The SIGN guideline development group's deliberations have been given focus by information provided by the Scottish Trauma Audit Group (STAG) on all patients with head injury admitted to participating hospitals who either die or remain in hospital for three or more days. Analysis of the information on these patients was underway at the time of development of the guideline. Preliminary information confirms that problems in assessment, diagnosis, triage and transfer continue to be important potential adverse factors. Audit of these guidelines and their impact on clinical and radiological practice should continue.

11.2 KEY INDICATORS OF QUALITY OF MANAGEMENT

1. Has a comprehensive assessment been documented?
 - (a) *Have guidelines been followed in decision-making about investigation?*
 - (b) *Have guidelines been followed in decisions about admission or discharge for home observation?*
 - (c) *Have guidelines for neurosurgical consultation been appropriately used?*
 - (d) *Have decisions about neurosurgical consultation or transfer been carried out appropriately?*
 2. Have clear and appropriate instructions been given about management?
 3. Have appropriate instructions been given to patients discharged?
 4. Has progress in hospital been appropriately documented?
 5. Is there evidence of untoward incidents in patient management?
-

The above indicators concentrate on process rather than outcome because death after a head injury is a relatively rare occurrence and information about disability, although common in survivors, is not routinely collected. Nevertheless, patients who die after a head injury are an important and readily identifiable group, and form an appropriate target for a Scotland-wide audit in every instance. STAG is currently developing a robust peer review process for such patients, and this work should be actively encouraged.

Deaths may also be included in the Scottish Audit of Surgical Mortality (SASM), but the focus of the latter has, so far, been on the role of operative and perioperative factors and the value of the data from this source in auditing other aspects of management should be expanded.

11.3 RECOMMENDATIONS FOR FURTHER RESEARCH

Rigorous, prospective studies are needed to increase the quality of evidence upon which to base future revisions of these guidelines.

Important topics include:

- the merits of the use of skull x-ray or CT scanning in the triage of less severe injuries
- the 'trade-off' between CT scanning in the A&E Department with discharge after normal findings, against routine admission for observation in patients with apparently minor head injury
- the 'trade-off' between early CT scanning in patients admitted to hospital against scanning selected patients after a period of observation
- triage of head injured patients by paramedical crews to select patients for transport to different levels of hospital
- the extent to which recommendations based on data from adults can apply safely to children, and how this is influenced by the age of the child
- the efficacy and effectiveness of different arrangements for follow up.

Annex 1

DETAILS OF THE SYSTEMATIC REVIEW UNDERTAKEN FOR THIS GUIDELINE

The evidence base for this guideline was synthesised in accordance with SIGN methodology. An initial systematic review of the literature was carried out using an explicit search strategy devised by the SIGN Information Officer in collaboration with members of the guideline development group.

Searches were mostly restricted to meta analyses, systematic reviews, and randomised controlled trials, but were extended to cover observational studies in areas where other types of study were weak or non-existent. Inclusion criteria were the management, diagnosis and treatment of injuries to the head or neck from accident site through to discharge or transfer from the Accident and Emergency Department. Intensive care of head injured patients, or maxillofacial injuries, were specifically excluded.

Initial searches were carried out on the Cochrane Library, Embase, Healthstar, and Medline from 1985 through to September 1997. The main searches were supplemented by material identified by individual members of the development group and the evidence base for the guideline was updated during the course of development.

All selected papers were evaluated using standard methodological checklists before conclusions were considered as evidence.

Annex 2

EXAMPLE HEAD INJURY OBSERVATION CHART

See next page for chart

NAME		SOUTHERN GENERAL HOSPITAL NHS TRUST INSTITUTE OF NEUROLOGICAL SCIENCES, GLASGOW OBSERVATION CHART												DATE	
RECORD No.														TIME	
COMA SCALE	Eyes open	Spontaneously To speech To pain None													Eyes closed by swelling = C
	Best verbal response	Orientated Confused Inappropriate words Incomprehensible sounds None													Endotracheal tube or tracheostomy = T
	Best motor response	Obeys commands Localise pain Flexion to pain Extension to pain None													Usually record the best arrival response
Pupil scale (mm)	• 1	240													Temperature °C
	• 2	230													
	• 3	220													
	• 4	210													
	• 5	200													
	• 6	190													
	• 7	180													
	• 8	170													
		160													
		150													
	140														
	130														
	120														
	110														
	100														
	90														
	80														
	70														
	60														
	50														
	40														
	30														
	20														
	10														
PUPILS	Right	Size Reaction													+ reacts - no reaction c eye closed
	Left	Size Reaction													
LIMB MOVEMENT	Arms	Normal power Mild weakness Severe weakness Spastic flexion Extension No response													Record right (R) and left (L) separately if there is a difference between the two sides
	Legs	Normal power Mild weakness Severe weakness Extension No response													

Annex 3

EXAMPLE ADVICE LEAFLET FOR PERSON TAKING A PATIENT HOME FROM A&E

IMPORTANT THINGS TO LOOK FOR AFTER A HEAD INJURY

Advice for the person taking a patient home from the A&E Department

[Name] _____ has suffered a head injury, but does not need to be admitted to a hospital ward. We have examined the patient, and believe that the injury is not serious. Very rarely complications can develop as a result of the injury, so please watch the patient closely over the next day or so and rouse gently every couple of hours, and follow this advice:

1. Do not leave the patient alone in the home.
2. Make sure that there is a nearby telephone, and that the patient stays within easy reach of medical help.
3. Symptoms to look out for:
 - Is it difficult to wake the patient up?
 - Is the patient very confused?
 - Does the patient complain of a very severe headache?
 - Has the patient:
 - vomited?
 - had any fits?
 - lost consciousness?
 - complained of weakness or numbness in an arm or a leg?
 - complained about not seeing normally?
 - had any watery fluid coming out of their ear or nose?

If the answer to any of these questions is 'Yes' or you are worried about anything else, you should telephone the Accident and Emergency Department on:

TEL. NO.:

Or if you are very worried take the patient straight back to the Accident and Emergency Department.

Annex 4

EXAMPLE ADVICE LEAFLET FOR PATIENT ALLOWED HOME FROM A&E

ADVICE FOR A PATIENT ALLOWED HOME FROM A&E FOLLOWING HEAD INJURY

Do you still feel unwell?

Often people can feel unwell after a head injury even when they are back home. Common symptoms are:

- mild headache
- dizziness
- memory problems
- poor concentration
- irritability or being easily annoyed
- tiredness
- poor sleep.

If you have any of these symptoms, **do not worry** because they should clear up in time without any treatment.

But if you still have any of the symptoms after two weeks you should see your own doctor.

Some extra advice to help you get well:

Following this advice will help you to recover from your head injury more quickly, and it may stop some of the symptoms from happening.

- **DO** have plenty of rest and avoid stressful and noisy situations.
- **DO NOT** take any alcohol.
- **DO NOT** take sleeping pills, sedatives or tranquillisers unless they are given by a doctor.
- **DO NOT** play any contact sport (e.g. football or squash) for at least three weeks without talking to your doctor first.

Annex 5

EXAMPLE OBSERVATION INSTRUCTIONS FOR PARENTS AND CARERS

HEAD INJURY OBSERVATION INSTRUCTIONS FOR PARENTS AND CARERS

Following a head injury, your child should be kept under observation for the next 24 hours. If any concern arises that he/she is developing a problem, please seek advice from your GP or this Accident and Emergency Department or, if necessary, make arrangements to bring him/her back to hospital by ambulance, taxi or car.

The signs that you should look out for are:

- increasing drowsiness or confusion
- persisting headache
- vomiting
- weakness of one or more limbs
- difficulty in seeing or breathing
- continuous discharge or bleeding from ear, nose or mouth
- fits
- any other abnormal behaviour.

When your child is sleeping, you should arrange to observe him/her at two-hour intervals to establish:

- Does he/she appear to be breathing normally?
- Is he/she sleeping in a normal posture?
- Does he/she make the expected response when you rouse him/her gently? (e.g. pulling up sheets, cuddling teddy-bear)
- If you cannot satisfy yourself that your child is sleeping normally, he/she should be wakened fully to be checked.

Annex 6

EXAMPLE ADVICE LEAFLET FOR PATIENT DISCHARGED HOME AFTER ADMISSION

Whenever possible, this leaflet should be given to a responsible adult taking the patient home, as well as to the patient.

IMPORTANT ADVICE FOR A PATIENT WITH HEAD INJURY WHEN YOU GET HOME

Ward _____ Ward telephone number: _____

We think that it is OK for you to leave hospital now. We have kept a close eye on you since your head injury, and you seem to be well on the road to recovery. So when you get home you will probably not have any serious symptoms. But if any of the following symptoms do happen, you should return to the hospital or telephone the ward for advice.

Important symptoms to look out for:

- severe headache which is not helped by pain-killers such as paracetamol
- vomiting (being sick)
- confusion (not knowing where you are, getting things muddled up)
- drowsiness (feeling very sleepy all the time)
- fits (collapsing and feeling a bit out of touch afterwards)
- passing out suddenly
- fluid coming out of your ear or nose
- not seeing as well as usual.

Mild Symptoms

People who have had a head injury sometimes have mild symptoms. You may feel a slight headache, dizziness, memory problems, poor concentration, irritability (being easily annoyed), tiredness, or poor sleep. These mild symptoms usually clear up after two weeks or so without any treatment, so **do not worry about them.**

But if these symptoms do not clear up after two weeks, you must go and see your own doctor.

Some extra advice to help you get well:

Following this advice will help you to recover from your head injury more quickly, and it may stop any symptoms from happening.

- DO have plenty of rest and avoid stressful and noisy situations.
- DO NOT take any alcohol.
- DO NOT take sleeping pills, sedatives or tranquillisers unless they are given by a doctor.
- DO NOT play any contact sport (e.g. football or squash) for at least three weeks without talking to your doctor first.

Annex 7

SCOTTISH TRAUMA AUDIT GROUP (STAG) NEUROSURGICAL REFERRAL LETTER¹⁴⁷

See next page for letter

NEUROSURGICAL REFERRAL LETTER

Scottish Trauma Audit Group

Referring Hospital: _____ Consultant: _____ A&E Number:

Name: _____ Sex: Male Female Age:

Address: _____ DOB:

Date of Incident: Time of Incident: : Time of Admission: :

History: _____

Physiological Observations

	Time	HR	BP	RR	O ₂ sat	GCS			RIGHT Pupil		LEFT Pupil	
						eye	motor	verbal	reacts	size	reacts	size
on arrival												
on transfer												

Cranial Injuries: _____

Extra-Cranial Injuries: (proven or suspected) CT Scan at referring hospital: Yes No

C-spine: _____ Chest: _____

Pelvis: _____ Abdomen: _____

Thoracolumbar: _____ Face/Neck: _____

Limbs: _____

Other: (specify) _____

Past Medical History: _____

Current Medication: _____

Interventions

Airway: Guedel ETT Other None

Ventilation: Spontaneous IPPV

Nasogastric tube: Yes No

Urinary catheter: Yes No

Urinalysis: _____

Drugs given	Dose	Time
Tetanus Toxoid		

IV Fluids	Volume
crystalloid	
colloid	
blood	

Time			
pO ₂			
pCO ₂			
H ⁺			
HCO ₃			

Time		Time	
Hb		Na ⁺	
WCC		K ⁺	
Platelets		C ⁻	
Glucose		HCO ₃	
X-match		Urea	
		Creat.	

Next of kin: _____ Tel. No: _____ Notified: yes no

Valuables: patient relatives police none Clothing: patient relatives police none

NB: Have you excluded all possible sites of blood loss?

Transfer with the patient: Observation charts Medical notes X-rays

Signed: _____ Print: _____ Grade: _____

Receiving Neurosurgeon: _____ Grade: _____ Transfer Time: :

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Quick Reference Guide

ASSESSMENT AND CLASSIFICATION

B The management of head injured patients should be guided by clinical assessments and protocols based on the Glasgow Coma Scale and Glasgow Coma score.



The Glasgow Coma Scale is difficult to apply to the young (under 5 years) child. Great care needs to be taken in interpretation and this should be done by those with experience in managing young children.

FEATURE	SCALE RESPONSES	SCORE
Eye opening	Spontaneous	4
	To speech	3
	To pain	2
	None	1
Verbal response	Orientated	5
	Confused conversation	4
	Words (<i>inappropriate</i>)	3
	Sounds (<i>incomprehensible</i>)	2
	None	1
Best motor response	Obey commands	6
	Localise pain	5
	Flexion (<i>normal</i>)	4
	Flexion (<i>abnormal</i>)	3
	Extend	2
	None	1
TOTAL COMA 'SCORE'		3/15 - 15/15

INDICATIONS FOR REFERRAL TO HOSPITAL

B A head injured patient should be referred to hospital if *any* of the following is present:

- **Impaired consciousness (GCS <15/15) at any time since injury**
- **Amnesia for the incident or subsequent events**
- **Neurological symptoms**, e.g.
 - severe and persistent headache
 - nausea and vomiting
 - irritability or altered behaviour
 - seizure
- **Clinical evidence of a skull fracture** (e.g. CSF leak, periorbital haematoma)
- **Significant extracranial injuries**
- **A mechanism of injury suggesting:**
 - a high energy injury (e.g. road traffic accident, fall from height)
 - possible penetrating brain injury
 - possible non-accidental injury (in a child)
- **Continuing uncertainty about the diagnosis after first assessment**
- **Medical co-morbidity** (e.g. anticoagulant use, alcohol abuse)
- **Adverse social factors** (e.g. no-one able to supervise the patient at home).

INDICATIONS FOR NEUROSURGICAL OPINION

- B**
- CT shows a **recent intracranial lesion**
 - Patient fulfils the criteria for CT scan but this cannot be done within an appropriate period
 - **Persisting coma** (GCS score 8/15 or less) after initial resuscitation
 - **Confusion** which persists for more than 4 hours
 - **Deterioration in level of consciousness** after admission
 - **Progressive focal neurological signs**
 - A **seizure** without full recovery
 - **Depressed skull fracture**
 - Definite or suspected **penetrating injury**



A B C

grade of recommendation

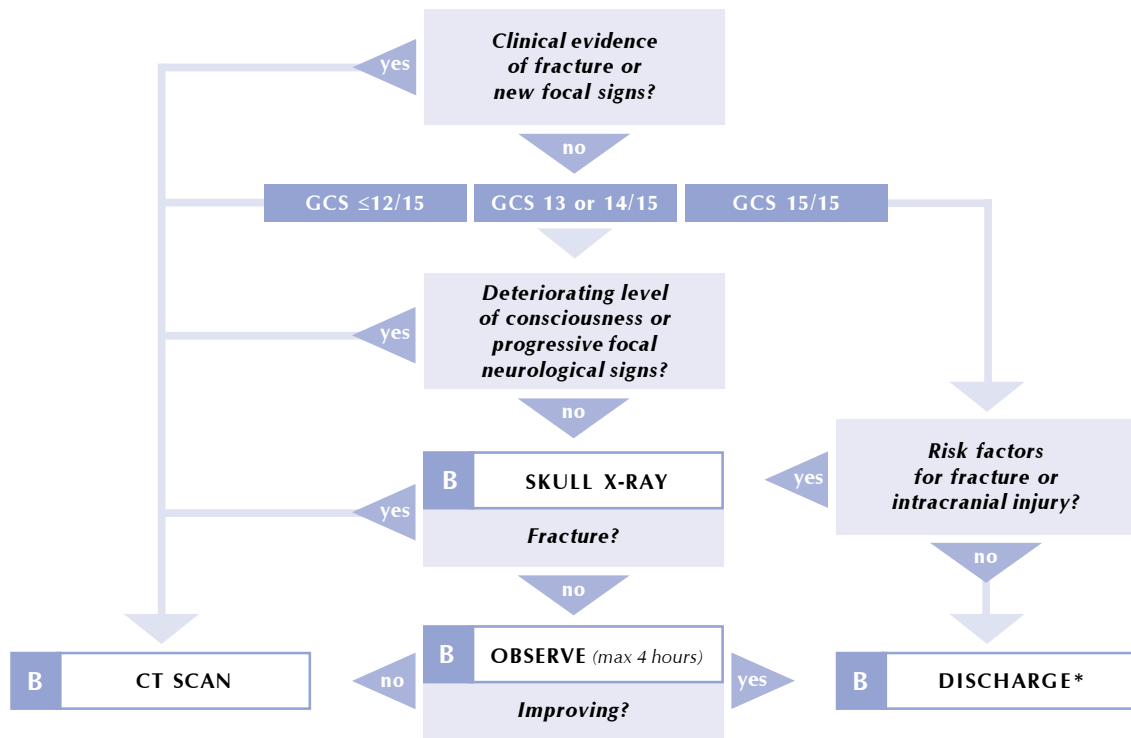


good practice point



paediatric practice point

INDICATIONS FOR IMAGING



* Patients who have had risk factors for intracranial injury should not be discharged until they fulfil the criteria for discharge from a ward. Further observation is needed for some patients even if consciousness has returned to normal.



In children, significant intracranial injury occurs more frequently in the absence of a skull fracture than in adults. Clinical features (e.g. tense fontanelle) are an equally important factor in determining the need for CT scan.

ADMISSION OR DISCHARGE?

- B** A patient should be **admitted to hospital** if:
- **level of consciousness is impaired** (GCS <15/15)
 - **the patient is fully conscious but any of the following risk factors are present:**
 - continuing amnesia (≥ 5 minutes after injury)
 - continuing nausea and/or vomiting
 - a seizure at any time after injury
 - focal neurological signs
 - irritability or abnormal behaviour
 - clinical or radiological evidence of recent skull fracture or suspected penetrating injury
 - an abnormal CT scan
 - severe headache or other neurological symptoms
 - **the patient has significant medical problems** (e.g. anticoagulant use)
 - **the patient has social problems or cannot be supervised by a responsible adult.**

- Patients and carers should be given verbal and written advice and encouraged to seek prompt advice from their GP or A&E department by phone about any worrying symptoms or other concerns.



Children should be admitted if any of the following risk factors apply:

- history of loss of consciousness
- neurological abnormality, persisting headache or vomiting
- clinical or radiological evidence of skull fracture or penetrating injury
- difficulty in making a full assessment
- suspicion of non-accidental injury
- other significant medical problems
- not accompanied by a responsible adult or social circumstances considered unsatisfactory.

INDICATORS OF NEUROLOGICAL DETERIORATION

- Development of agitation or abnormal behaviour
- Sustained decrease in conscious level of at least one point in motor or verbal response or two points in eye opening response of the GCS
- Development of severe or increasing headache or persisting vomiting
- New or evolving neurological symptoms or signs, e.g. pupil inequality or asymmetry of limb or facial movement

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Derived from the national clinical guideline recommended for use in Scotland by the Scottish Intercollegiate Guidelines Network (SIGN) Royal College of Physicians of Edinburgh, 9 Queen Street, Edinburgh EH2 1JQ

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