Guideline for Emergency CT Scanning

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### Meta Data

<table>
<thead>
<tr>
<th>Guideline Title:</th>
<th>Guideline for Emergency CT scanning</th>
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<tbody>
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<td>Guideline Author:</td>
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<tr>
<td>Date of Ratification (CSC):</td>
<td>October 2008</td>
</tr>
<tr>
<td>Review Date:</td>
<td>June annually</td>
</tr>
<tr>
<td>Related Policies/Topic/Driver</td>
<td>Emergency Department guidelines</td>
</tr>
<tr>
<td>Stored Centrally:</td>
<td>To be on the guidelines website.</td>
</tr>
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### Revision History

<table>
<thead>
<tr>
<th>Version No.</th>
<th>Date of Issue</th>
<th>Author</th>
<th>Reason for Issue</th>
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<tr>
<td>Version 1</td>
<td>04 March 2008</td>
<td>Tony Bleetman</td>
<td></td>
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<tr>
<td>Version 2</td>
<td>24th November 09</td>
<td>Tony Bleetman</td>
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1 Overview/Introduction

This guideline serves to ensure a standardised, evidence-based approach to requesting emergency CT scanning to include head injury, clearing the cervical spine, assessment of surgical, medical and paediatric presentations.

2. Reason for Development of The Guideline

To ensure compliance with NICE guidelines on head injury management in children and adults.

To ensure appropriate advanced imaging for patients presenting with medical, surgical and traumatic conditions.

2.1 Methodology

Review of NICE guidelines on head injury management and clearing the cervical spine after trauma. Consensus between directorate representatives in the development of this guideline. (Tony Bleetman, Lowri Morus, Surgical Management Committee).

2.2 Implementation

Circulation to:

- Intranet
- Radiology consultants and registrars
- Radiographers
- Emergency Department clinical staff
- Paediatric clinical staff
- Clinical staff Acute Medicine
- Clinical staff Surgery

Issue to all new medical staff on memory sticks. Introduction into departmental teaching.

2.3 Monitoring

This will be monitored by departmental audit.

3. Application of the Guideline

The purpose of this guideline is to provide optimum access to emergency CT scanning for:

- Head Injury – In Adults (age 16 and over)
• Head Injury – In Children (age up to 15)
• The Multiply Injured patient
• Cervical Spine Clearance
• Headache
• Surgical Emergencies
• Medical Emergencies
• Meningitis

The guideline is of relevance to clinical staff dealing with these patients.

4. Objectives of the Guideline

To ensure appropriate and timely CT scanning for patients presenting with head injuries, multiple injuries, surgical and medical emergencies.

5. Guideline Steps

Identification of patients for whom the guideline is relevant. Integration with clinical pathways for trauma patients and those with head injuries.
5.1 Head injury in Adults (age 16 and over)

Criteria for CT scanning after head injury –
[NICE guidelines compliant]

Immediate scan:
GCS of <13 at any time since the injury (irrespective of alcohol/drugs)
A patient who has had a brief loss of consciousness at the time of injury with full recovery maybe observed and reviewed by a senior ED doctor.
GCS of less than 15 at 2 hours after the injury (irrespective of alcohol/drugs)
Suspected open or depressed skull fracture
Suspected penetrating injury
Suspected base of skull fracture
Any localising sign or neurological deficit
Seizure after head injury (irrespective of previous history of epilepsy)
Any loss of consciousness or amnesia and coagulopathy/anti-coagulant
Any loss of consciousness or amnesia and dangerous mechanism of injury

For CT scan as soon as practicable BUT always within 8 hours of Injury.
[CT at the discretion of senior ED doctor after an appropriate period of observation with neurological observations on CDU]

Amnesia of events >30 before impact
More than one episode of vomiting in adults
[Vomiting alone is not a reliable predictor of intracranial injury in children – careful clinical assessment is required].
Persisting symptoms (to include headache>8 hours, persistent vomiting)
Age >65 providing that some loss of consciousness or amnesia has been experienced
Any patient with a fracture on skull X-ray.
[Children <5 years may need a GA for CT scan]

SKULL X-RAY
Adults (Age 16 and over)
Conscious patients (GCS 15/15) with no indication for CT in whom a possible retained foreign body is suspected.
Others, at the discretion of a senior emergency physician.
Guideline for Emergency CT Scanning

5.2 Head injury in Children (up to age 15)

Criteria for CT scanning after head injury

Are any of the following present?

- Witnessed loss of consciousness lasting > 5 minutes
- Amnesia (antegrade or retrograde) lasting > 5 minutes
- Abnormal drowsiness
- 3 or more discrete episodes of vomiting
- Clinical suspicion of non-accidental injury
- Post-traumatic seizure but no history of epilepsy
- Age > 1 year: GCS < 14 on assessment in the emergency department
- Age < 1 year: GCS (paediatric) < 15 on assessment in the emergency department
- Suspicion of open or depressed skull injury or tense fontanelle
- Any sign of basal skull fracture (haemotympanum, "panda" eyes, cerebrospinal fluid leakage from ears or nose, Battle's sign)
- Focal neurological deficit
- Age < 1 year: presence of bruise, swelling or laceration > 5 cm on the head
- Dangerous mechanism of injury (high-speed road traffic accident either as pedestrian, cyclist or vehicle occupant, fall from > 3 m, high-speed injury from a projectile or an object)

CT requests need to be made by a clinician experienced in assessing children.

There is little, or no role for skull x-rays in children. Consideration of skull X-rays in children should be discussed with a consultant.
Immediate CT imaging of the cervical spine is indicated as follows:

**Selection of adults and children (age 10+) for imaging of the cervical spine**

Are any of the following present?

- Patient cannot actively rotate neck to 45 degrees to left and right (if safe to assess the range of movement in the neck)
- Not safe to assess range of movement in the neck
- Neck pain or midline tenderness plus:
  - age ≥ 65 years, or
  - dangerous mechanism of injury
- Definitive diagnosis of cervical spine injury required urgently (for example, prior to surgery)
- GCS < 13 on initial assessment
- Has been intubated
- Plain film series technically inadequate (for example, desired view unavailable), suspicious or definitely abnormal
- Continued clinical suspicion of injury despite normal X-ray
- Patient is being scanned for multi-region trauma

- Yes
  - Request three-view radiographs immediately

- No
  - No imaging required now

- Yes
  - Request CT scan immediately
Investigation for injuries to the cervical spine

Which Investigations?

- In most circumstances, plain radiographs are the initial investigation of choice to detect cervical spine injuries – three views of sufficient quality for reliable interpretation (two views for children under 10 years of age)

- CT imaging is recommended in some circumstances

- Children under 10 have increased risk from irradiation, so restrict CT imaging of cervical spine to children with indicators of more serious injury, in circumstances such as:
  - severe head injury (GCS <= 8)
  - strong suspicion of injury despite normal plain films
  - plain films are inadequate.

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

Timing of cervical spine imaging

- Imaging indicated: imaging within 1 hour of request being received by the radiology department or when patient sufficiently stable.

- Children under 10 with GCS <= 8: CT imaging of the cervical spine within 1 hour of presentation or when sufficiently stable.

Fits/coma in children

Children who present with acute encephalopathy with an abnormal GCS (with or without localising signs) require an urgent CT scan. Children who fail to consistently improve their conscious level after prolonged fits also require an urgent CT scan. Children who require emergency general anaesthetic for status epilepticus require an urgent CT scan. Most children with febrile convulsions (even if prolonged) do not require a CT scan.

CERVICAL SPINE CT in Adults & Children (10 years of age & over)

For obtunded patients with isolated head injuries (for whom a CT head is indicated) and when the cervical spine needs to be cleared, a CT examination of the cervical spine should be undertaken in preference over plain radiographs of the neck.

In children aged less than 10 the opinion of a senior clinician should be sought on the appropriateness of scanning.
5.3 The multiply-injured patient

For multi-system trauma it may be appropriate to CT scan the head, C-spine, chest, abdomen and pelvic contents (to include the entire spine even in the absence of firm clinical signs, particularly in anaesthetised patients). The presence of significant head and upper body injury together with lower body injury should raise the suspicion of intra-thoracic and intra-abdominal and spinal injuries. A senior Emergency Physician will consider mechanism, vital signs and response to initial resuscitation prior to any CT request. Surgical opinion will not always be mandatory prior to CT request.

CLINICIANS NEED TO HAVE A VERY LOW THRESHOLD FOR IMAGING THE CERVICAL SPINE IN PATIENTS WITH RHEUMATOID ARTHRITIS EVEN WITH A RELATIVELY TRIVIAL MECHANISM OF INJURY.

Plain cervical spine radiographs are no longer routinely conducted as part of the primary trauma survey.
5.4 Cervical Spine Clearance

Patients can be divided into three principal groups and managed according to these guidelines.

**Group 1.**

Awake, alert, not intoxicated, neurologically normal with no midline neck pain or tenderness even with full range of motion of neck and palpation of cervical spine AND do not have significant associated injuries that detract from their general evaluation.

No radiological investigation needed
**Guideline for Emergency CT Scanning**

**Group 2**
Awake, alert, not intoxicated, neurologically normal with no distracting injury
BUT
Has neck pain AND midline tenderness on palpation.

**Give analgesia at early stage**

**Indications:**
- Patient can not actively rotate neck to 45 degrees to left and right (if safe to assess the range of movement of the neck)
- Not safe to assess range of movement of neck
- Neck pain or midline tenderness plus:
  - age 65 years or under
  - dangerous mechanism of injury
- Definitive diagnosis of cervical spine injury required urgently (for example prior to surgery)

3 view cervical spine x-rays with gentle but firm caudal arm traction

**Adequate and normal?**

Abnormal

Inadequate

Inadequate

Must have involved middle grade/consultant by this stage

Remove collar, if residual tenderness
MUST BE REVIEWED PERSONALLY BY SENIOR/MIDDLE GRADE EMERGENCY PHYSICIAN to consider scan if passive lateral movements restricted <45°.

CT scan of abnormal and/or poorly visualised areas.

**After midnight:** If the mechanism is minor or in cases where the clinical suspicion is low, CT scanning can be delayed until the next morning. The patient will require immobilisation in an Aspen or rigid collar at the discretion of the senior Emergency Physician

Normal

Discharge
**Group 3.**
Unconscious or obtunded patient with potential (mechanism) or confirmed cervical spine injury AND has clinical indication for CT scan of any other body area

3 view cervical spine x-rays with gentle but firm caudal arm traction

Inadequate

At radiographers discretion, upto 2 attempts to visualise C7/T1 junction with swimmers views

Still inadequate

Proceed directly to CT of entire C-spine when imaging other body region

**Group 4.**
Unconscious or obtunded patient with potential or confirmed cervical spine injury WITH NO clinical indication for CT scan of any other body area

Abnormal

CT scan of entire C-spine
Unconscious or obtunded pts in whom plain film/CT assessment is normal

Must have involved middle grade/consultant by this stage

Remove semi-rigid collar, sand bags and tape

Fit appropriately sized Aspen collar

Transfer to ITU

Consider MRI to clear cervical spine at 48 hours.
5.5 **Headache:**

Urgent CT scanning should be considered for sudden severe headaches with or without objective neurological signs. The clinical judgement of a senior emergency physician is mandatory who must personally examine and evaluate the patient. Possible subarachnoid haemorrhage with GCS 15/15 and no localising neurology does not require an ‘out of hours’ scan. [Out of hours refers to 12 midnight to 8am]. These patients should be admitted directly under the medical team and monitored closely. Should their condition deteriorate then urgent CT scanning should be reconsidered.

5.6 **Surgical emergencies:**

Urgent CT of the abdomen should be considered for patients with an acute abdomen where there exists uncertainty over the diagnosis and where the examination will influence the decision to operate. The surgical team should be involved in this decision. Urgent CT of the abdomen should be considered in suspected leaking or dissecting aortic aneurysms.

5.7 **Medical emergencies:**

Urgent CT scanning of the head should be undertaken for suspected stroke patients where the result will influence management (eg. entry into the Trust's CVA care pathway – at present during office hours only, or potential for transfer for emergency neurosurgical care). Urgent CT scanning of the head should also be considered in patients presenting with ‘collapse ?cause’ after exclusion of a clear non-neurological diagnosis. Patients who fail to recover full consciousness after epileptic fits, alcohol and drug ingestion should also be considered for urgent CT scanning. These patients must be personally assessed by a senior emergency physician prior to any request for a CT scan.

5.8 **Meningitis:**

For patients with suspected meningitis with no neurological signs, urgent CT scanning (prior to lumbar puncture / antibiotic treatment) is NOT indicated.
5.9 Definitions and notes

Senior Emergency Physician refers to a middle grade or consultant.

Out of hours refers to 12 midnight to 8am.

3 view cervical spine series: lateral, antero-posterior and open-mouth peg.

Adequate - the lateral film should show the base of the occiput and all cervical vertebrae down to the top of the first thoracic vertebrae

The antero-posterior view should demonstrate the spinous processes from C2 to T1.

The open-mouth peg view should allow visualisation of the lateral masses of C1 and C2 as well as the entire odontoid peg.

Analgesia - combination of NSAIDS (if not contraindicated) and co-codamol. If patient is discharged then make sure that the patient understands the importance of regular adequate analgesia and has access to enough.

Following trauma or other significant mechanism of injury, if a vertebral fracture is found at any level then the rest of the spine should be adequately imaged without undue delay. A significant percentage will have an additional fracture. The most appropriate mode of imaging, on a case by case basis, should be determined following discussion with the on call radiologist.

In the elderly osteoporotic patient who may have an occult compression (wedge) fracture of the thoracolumbar spine, who presents with a new injury caused by minimal force or trauma, then there may be no need to further image the spine at all.

Patients in whom the mechanism of injury or clinical picture do not suggest that a cervical spine injury is present but still have a suspicious/equivocal area on adequate plain film examination do not necessarily need to have their CT scans done out of normal working hours.

This small sub group of patients may be fitted with an Aspen collar and imaged (if necessary) the following day after observation on CDU.

A very small sub group of pts, with a potential c-spine injury, who are intubated, but do not have an indication for a CT of another body region (and therefore would not routinely get a CT of their c-spine as well) may exist. Clearly a peg view is not feasible in this group and therefore they too should undergo CT scanning of their entire c-spine.

In patients suffering serious blunt injuries who have reduced conscious level (groups 3 & 4) or other painful injuries, both the clinical history and examination are unreliable. Radiological imaging by CT supported by plain x-ray is required. Even if this imaging is normal, the c-spine cannot be cleared

Examples of high-risk mechanisms include: High speed RTA (>35mph), RTA with a death at the scene, Fall from >10 feet, pelvic fractures, multiple extremity fractures.
6. References

NICE guidelines on head injury.