

## **Evaluation for spinal injuries among unconscious victims of blunt polytrauma: a management guideline for intensive care**

### **Background**

1.0 There is lack of consistency among clinicians when managing critically ill and head injured patients with possible spinal injury [1,2]. Equally, practice regarding the use and retention of cervical collars and spinal precautions is inconsistent and not evidence-based [3]. Clinicians in nearly every unit remember a missed spinal cord injury and recent surveys suggest that unconscious patients may have their cervical spines cleared of injury on the basis of plain radiographs alone; this form of evaluation alone is not sufficiently sensitive. However, most units have also experienced the morbidity and mortality of prolonged and unnecessary immobilisation, such as ventilator associated pneumonia, ulceration and sepsis from skin breakdown, etc.

1.1 The following guidelines have been derived from consideration of available evidence and guidelines [4-8], and expert, multidisciplinary consensus from three major trauma centres in the United Kingdom; Belfast, Liverpool and Nottingham. The guideline is written in the hope that all hospitals will have the resources to accommodate them and we hope that they will be a useful addition to practice. We hope this guideline will develop over time and welcome comments and suggestions.

### **Management of unconscious patients with suspected spinal injury: implementation and notes**

2.0 These guidelines are intended to clarify the evaluation of the integrity of the spine and subsequent management of patients admitted after traumatic injury. All such patients should be treated as having an unstable spine until 'cleared' using the guidelines that are summarised in the attached flowchart.

**2.1 It is strongly recommended that the cervical and thoracolumbar spine of a trauma victim who remains unconscious be cleared within 48-72 hours.** Beyond this time the morbidity and mortality of spinal precautions (secondary to skin ulceration, pneumonia, thromboembolism, and venous access and airway complications) probably exceed the risk of missed spinal injury.

2.2 A lateral cervical radiograph, especially in the emergency setting, may miss 15% of cervical injuries and the 3 view cervical series 5-10%: in unconscious patients, plain radiographs **alone** lack sensitivity to clear the cervical spine. If the middle of C7 cannot be seen on the lateral plain radiograph, under 8% of cases will have the cervicothoracic junction revealed

by arm traction. Repeated attempts to obtain further (inadequate) lateral radiographs waste time and are to be avoided; CT is ideal to visualise the cervicothoracic junction.

2.3 Obtunded patients who have suffered polytrauma, high velocity injury, or fall from a height >6 feet, and who cannot be assessed clinically must have an AP and lateral plain radiographs of the thoracolumbar spine, preferably before ICU admission (to avoid further transfers of critically ill patients). The incidence of isolated ligamentous injury of the thoracolumbar spine is extremely low and in the absence of fracture or malalignment the thoracolumbar spine may be “cleared”. As discussed below, if a chest or abdominal helical CT is performed as part of the trauma assessment reconstructions may allow visualisation of the thoracolumbar spine and replace conventional radiographs.

### **Clinical exclusion of spinal injury**

3.0 This may be achieved with confidence provided patients meet all 4 conditions outlined in the flowchart. It is uncommon for any trauma victim to be admitted to an ICU and not fail on at least one pre-condition. While such criteria may allow large numbers of patients to be screened in emergency departments and radiographs kept to a minimum, they have not been validated for use in the critically ill, head injured **or patients emerging from sedation**. Therefore, among group 3 patients it is essential that imaging as described is undertaken regardless of whether a clinical evaluation is intended or not.

### **Imaging**

#### **The recommended standard**

4.0 Lateral and anteroposterior radiographs of the cervical spine are performed in conjunction with entire helical CT scanning of the cervical spine (ie from the craniocervical junction to C7). Odontoid radiographs are not recommended for intubated patients with a cervical collar applied and CT images this region.

4.2 Inadequate radiographs of the upper thoracic spine are common due to the presence of the arms and postural factors. It is strongly recommended that the whole cervical spine is imaged **AND** that the scan is extended to include the upper thoracic spine down to the T4/T5 disk.

4.1 The thoracolumbar spine should also be imaged in unconscious trauma victims and this is most commonly with plain radiographs (AP and lateral). If a helical scanner is used to image the chest and abdomen it may be appropriate to use reconstructions of these images to screen the thoracolumbar spine i.e. omit radiographs of these regions.

### **The minimum standard**

4.2 It is recognised that many UK units do not have access to helical multiplane CT scanners. It is essential that the minimum standard of cervical spine imaging comprises *at least* a lateral cervical spine and an anteroposterior (AP) plain radiograph with routine directed CT scanning of the craniocervical junction. This should include the C2/C3 disk space and be at high resolution (1-2mm pitch and collimation) and supported by sagittal and coronal reconstructions. Any inadequately visualised (typically C7/T1) or suspicious areas on plain radiographs should also be CT scanned. It is stressed that using directed CT scanning like this may miss more mid cervical spine injuries (than whole c-spine scanning) if the screening radiographs appear normal; this is a reported problem.

4.3 Imaging investigations should be reported by a radiologist of suitable seniority and experience in conjunction with a knowledge of clinical features i.e. the radiology and trauma services should liaise directly. Interpretation of modern helical CT is best achieved on a computerised “workstation” and not on static printed copies. Such images cannot be easily transferred on an image link.

**4.4** Some units now employ helical CT alone to image the cervical spine ie omit plain radiographs. While this is intuitively reasonable and modern scanners generate excellent images, it should be stressed plain radiographs may have a higher rate of detecting ligamentous disruption and malalignment, CT a better performance in detecting fractures.

4.5 Flexion/ extension radiographs and dynamic fluoroscopy should not be routinely used unless part of a clinical study.

### **MRI**

#### **5.0 Urgent MRI should be considered for any patient with a neurological deficit potentially referable to a spinal injury.**

5.1 It is not considered essential or recommended to routinely perform MRI of the cervical spine to exclude ligamentous instability. MRI is sensitive but does not appear to detect *significant* injuries better than radiographs and CT. MRI typically involves transfer and material risk, is expensive and has limited availability.

### **Spinal precautions and immobilisation**

6.0 Spinal boards were intended as an extrication device and their use should be discouraged following the primary survey.

6.1 Patients with potential cervical spine injury should be immobilised in a semi-rigid collar such as the Aspen or Philadelphia collar. Extrication collars e.g. Stif-Nek should not be used for this purpose due to high rates of skin ulceration. (See below re immobilisation). Patients should be log rolled. Patients who are heavily sedated or receiving neuromuscular blocking drugs (NMBD's) e.g. significant head injuries, are at low risk of spontaneous

movement and may be nursed with sandbags and tape to stabilize the head. Application of a semi-rigid cervical collar during turns and transfers may be considered.

6.2 Individual units must decide whether they feel the relative risks of “clearing” the cervical spine outweigh the morbidity and mortality associated with prolonged use of cervical collars and spinal precautions. In brief, the risk of missing an unstable cervical injury following plain radiographs and directed CT is probably less than 0.5% (ie 5 per 1,000 patients evaluated) and even lower using modern high resolution helical CT. While MRI has a high sensitivity for occult soft tissue and ligamentous injury, the poor specificity often ensures patients without spinal instability remain immobilised for prolonged periods.

6.4 As long as the cervical spine is immobilised patients can be nursed on a standard “firm” hospital mattress but these mattresses are associated with cutaneous necrosis if used for a prolonged period for supine and immobile patients. Early consideration should be given to patient pressure areas and pressure relieving mattresses.♦ If there is an unstable fracture the patient can be treated on a normal hospital bed after application of halo traction or surgical fixation.

6.5 If the thoracolumbar spine is cleared before the cervical spine, it may be appropriate that the cervical spine is maintained immobilised with a collar but the trunk is flexed and the patient nursed at 45 degrees e.g. if there is elevated intracranial pressure or risk of pulmonary aspiration.

### **Cessation of spinal precautions**

7.0 Who “clears” the spine will be decided by individual institutions and the staff and facilities available. It is hoped that an appropriately experienced trauma surgeon and radiologist will liaise regarding the exclusion of spinal injury. It is to be encouraged that details are recorded clearly in the notes with management suggestions. An example of such documentation is provided and it is hoped that such a document will also promote the detailed audit of the care of such patients. Patients with signs or symptoms clearly suggestive of spinal cord injury should NOT have spinal precautions stopped regardless of normal X-ray and CT imaging.

### **Missed injuries**

**8.0 Once the spine is “cleared” the patient can be moved cautiously and under supervision. Any subsequent development of signs or symptoms attributable to spinal injury should prompt the reinstatement of immobilisation and further investigation.**

---

♦ Pressure relieving mattresses air mattresses may, in theory deflate without warning with the risk of producing injury in a patient with an unstable spinal injury. Some manufacturers specifically state that their beds should not be used for such patients. Clinicians should therefore balance the benefits of such beds against this risk.

- 9.0 A flowchart of the proposed evaluation of unconscious trauma victims is included and attention drawn to **group 3 patients** i.e. those requiring intensive care or intubated. Units without helical CT scanners may have to adopt the minimum standard but it is hoped that as increasing numbers of units acquire such scanners “directed” CT will be replaced with helical CT of the entire cervical spine (to include the upper thoracic spine down to the T4/5 disc space).

**Detected spinal injuries**

- 10.0 This flowchart describes the screening process for spinal injuries and if the recommended imaging appears normal then spinal stability can be reasonably assured. If an abnormality is detected its significance should be determined by an experienced spinal expert (neuro- or orthopaedic surgeon). Further imaging may be required and this may include any of repeat radiographs, CT, MRI, dynamic testing or flexion or extension radiographs.

## **References**

1. Guha A and Mahalingham G. Survey of Management of Unconscious Patients with suspected Cspine injuries in Cheshire & Mersey and North Wales, 2004.
2. Morris CG, Mullan B. Clearing the cervical spine after polytrauma: implementing unified management for unconscious victims in the intensive care unit. *Anaesthesia* 2004;59:755-761
3. Kwan I, Bunn F, Roberts I on behalf of the WHO Pre-Hospital Trauma Care Steering Committee. Spinal immobilisation for trauma patients. *The Cochrane Database of systematic reviews* 2001, Issue 2.
4. Morris CGT and McCoy E. Clearing the Cervical Spine in Unconscious polytrauma victims, balancing risks and effective screening. *Anaesthesia* 2004; 59: 464 – 482.
5. Morris CG, McCoy E, Lavery GG. Spinal Immobilisation among unconscious multiply injured patients in the ICU. *British Medical Journal* 2004; IN PRESS
6. EAST Practice Parameter Group for Cervical Spine Clearance. Practice Management Guidelines for Identifying Cervical Spine Injuries following Trauma. 1998, updated 2000 (available at [www.east.org/tpg/chap3u.pdf](http://www.east.org/tpg/chap3u.pdf))
7. American College of Surgeons Committee on Trauma. Advanced trauma life support for doctors student course manual. Chicago, Illinois: American College Of Surgeons, 1997
8. [www.trauma.org.uk](http://www.trauma.org.uk)

## Evaluation for spinal injuries among victims of blunt polytrauma

### GROUP 1 PATIENTS

Defined as those patients who fulfil all the **4 clinical pre-conditions** below

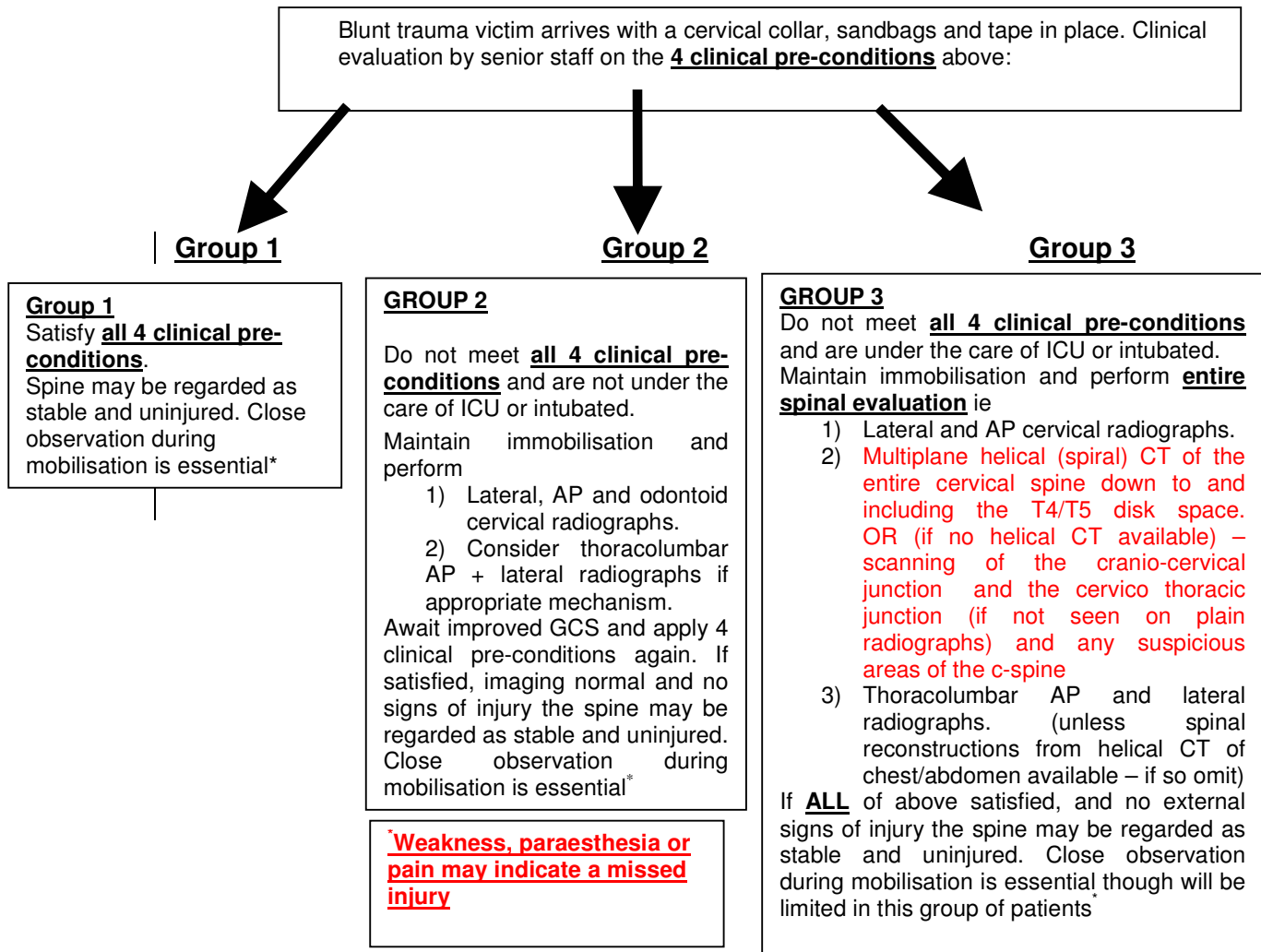
- 1) Glasgow Coma Scale (GCS) score 15 and appropriate responses
- 2) Absence of intoxicants, alcohol or sedation/opioid analgesics
- 3) No midline spinal tenderness, no deformity or steps and no neurological deficit referable to a spinal injury (e.g. abnormal tone, power or reflexes)
- 4) No significant distracting injury e.g. extremity fracture

### GROUP 2 PATIENTS

Defined as patients who do NOT meet the **4 clinical pre-conditions** are not under the care of ICU or intubated

### GROUP 3 PATIENTS

Defined as patients who do NOT meet the **4 clinical pre-conditions** above and are under the care of ICU and/or intubated e.g. traumatic brain injury



### Neurological deficit referable to the spine requires urgent consideration of MRI

Management of a *detected* injury must involve a senior neuro, spinal or orthopaedic surgeon. Units unable to provide helical CT may utilise directed CT scanning and radiographs: please refer to text. Helical CT of the chest and abdomen may generate reconstructions sufficient to replace radiographs of the thoracolumbar spine.

(Morris C, Guha A, Farquhar I 2004)

**Sample Documentation for Spinal Evaluation and Management**

The overall risk of a spinal injury is approximately 5-10% following blunt polytrauma for adults. This risk is increased if patients are admitted to intensive care or any of the following 4 are present:

- |  |
|--|
| <p><b>1) High Energy Mechanism:</b> eg fall &gt; 10 feet, pedestrian or unrestrained road traffic accident</p> <p><b>2) Admission GCS if &lt;15:</b></p> <p><b>3) Abnormalities on Brain Scan</b> (If required):</p> <p><b>4) Associated Injuries:</b></p> |
|--|

Please record the following details (tick)

| <b>Immobilisation instituted</b> | <b>Tick if present</b> |
|----------------------------------|------------------------|
| Firm mattress                    |                        |
| Spinal board                     |                        |
| Cervical collar                  |                        |
| Sandbags and tape                |                        |
| Log-roll                         |                        |

| <b>Clinical features at admission</b>             | <b>Tick if present</b> |
|---|------------------------|
| Neck pain/ tenderness                             |                        |
| Reduced GCS                                       | Record value           |
| Shock (SBP < 90mmHg)                              |                        |
| Weakness  | Specify                |
| Abnormal reflexes                                 | Specify                |
| Spinal signs (priapism, loss anal tone/sensation) |                        |

Imaging Undertaken (document who and grade reported by):

Lateral Cervical Radiograph

|                               |         |
|-------------------------------|---------|
| Technically adequate          |         |
| Technically inadequate        |         |
| Normal                        |         |
| Suspicious but non-diagnostic |         |
| Identified injuries           | Specify |

Cervical Anteroposterior Radiograph

|                               |         |
|-------------------------------|---------|
| Technically adequate          |         |
| Technically inadequate        |         |
| Normal                        |         |
| Suspicious but non-diagnostic |         |
| Identified injuries           | Specify |

Odontoid (“peg”) View

|                               |         |
|-------------------------------|---------|
| Technically adequate          |         |
| Technically inadequate        |         |
| Normal                        |         |
| Suspicious but non-diagnostic |         |
| Identified injuries           | Specify |

Thoracolumbar Lateral and AP Radiographs

|                               |         |
|-------------------------------|---------|
| Technically adequate          |         |
| Technically inadequate        |         |
| Normal                        |         |
| Suspicious but non-diagnostic |         |
| Identified injuries           | Specify |

CT Scans

Areas Scanned (tick)

For each area scanned please record result as either technically adequate/ inadequate, normal, suspicious but non-diagnostic, injury identified (details).

|   |  |
|---|--|
| Craniocervical junction (occiput to include C3 disk)                      |  |
| Cervicothoracic junction (lower cervical vertebrae to see C7/T1 junction) |  |
| Other suspicious/ non visualised areas on plain radiographs               |  |
| Entire helical CT of cervical spine to T4/5                               |  |
| Other areas eg thoracolumbar spine  |  |

Summary of identified injuries

| Region   | Injured (yes/no) | Details if yes* |
|--|------------------|-----------------|
| Cervical   |                  |                 |
| Thoracic   |                  |                 |
| Lumbar   |                  |                 |
| Non-vertebral associated eg nerve root or vertebral artery |                  |                 |

(\*Detail: Fracture, ligament complex (anterior/ posterior), subluxation, stable/unstable/not classified)

Spine cleared?

|          |      |    |
|----------|------|----|
| Cervical | YES* | NO |
| Thoracic | YES* | NO |
| Lumbar   | YES* | NO |

\*If YES, please record time from admission to clearance

Complications Associated With Spinal Precautions

Cutaneous

Pressure sore:

Record location, full/partial thickness (include collar and bed sores), interventions (eg surgery, skin grafting) other details eg litigation

Cerebral

Was raised ICP attributed to a collar or supine positioning?

Respiratory

Airway, delayed tracheostomy, pneumonia (pyrexia, purulent sputum and leukocytosis with antibiotic started)

Cardiovascular

Sepsis (specify), thromboembolic (documented DVT or PE)

Other: Please detail and if required explain how related to spinal precautions

Stabilisation required

|                                   |           |
|-----------------------------------|-----------|
| Cervical collar alone             |           |
| Tongs and traction                |           |
| Halo vest                         |           |
| Open reduction, internal fixation | Anterior  |
|                                   | Posterior |
|                                   | Combined  |

Was an injury missed at any stage ie the spine declared stable and instability subsequently apparent?

|   |  |
|---|--|
| Level of injury and details               |  |
| Neurological deficit?                     |  |
| Deficit present before injury identified? |  |
| GCS when discovered                       |  |
| Subsequent management eg surgical, collar |  |

**Morris C, Guha A, Farquhar I. Feb 2005**