

Cervical Spine Clearance in Critical Care

Aim To provide guidance on the management of proven or suspected cervical spine (c-spine) injuries in Critical Care

Scope All adult patients in Critical Care with proven or suspected c-spine injury following trauma

Unconscious patient with suspected traumatic spinal injury

Begin with full spinal precautions: hard collar, blocks, tape, unbroken bed (may be tilted) and full log rolls

Get CT imaging of spine

CT Head & C-Spine: as minimum investigation

Thoracolumbar Imaging: if age over 50 yrs, high energy impact, fall greater than own height, unknown mechanism, or injuries found on c-spine CT. Discuss plain films vs CT with radiology.

Full Trauma CT: if otherwise indicated

Is there any CT evidence of spinal injury?

Requires written report from consultant radiologist with adequate coverage and no CT evidence of spinal injury.

No CT evidence of c-spine injury

ICU Consultant decision on continued immobilisation (see p2)

If clinical clearance is **unlikely** within 48 hours (eg due to low GCS, or distracting injuries) it is usually safer to remove cervical immobilisation now - to reduce risks of pressure sores & respiratory compromise.

If clinical clearance is **likely** within 48 hours, follow Spinal Plan C below, with reassessment at 48 hours.

Evidence of spinal injury

- Urgent referral to QAH Orthopaedics registrar and Wessex Neurosciences.
- Confirm and document recommended Spinal Plan (Plan B, C or D below)

Agree spinal plan with ICU Consultant & record in CIS

Stable C-Spine
Stable T&L Spine

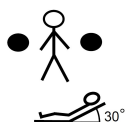
Stable C-Spine
Unstable T&L Spine

C-Spine stable if in collar
Stable T&L Spine

Unstable C-Spine
+/- Unstable T&L Spine

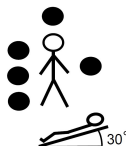
Spinal Plan A

No hard collar
Patient sat up
Normal turns (2 staff)



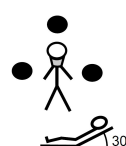
Spinal Plan B

No hard collar
Bed tilted head-up
Full spinal turns (5 staff)



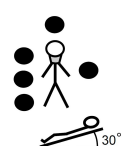
Spinal Plan C

Hard collar (Miami J)
Patient sat up
Normal turns with head hold (3 staff)



Spinal Plan D

Hard collar (Miami J)
Bed tilted head-up
Full spinal turns (5 staff)



Balance of risks in unconscious patient without CT evidence of spinal injury

Risks of removing cervical collar while unconscious or sedated

| Risk | Evidence | References |
|---|---|--|
| Small risk of unidentified unstable spinal injury | Registry-based review of 319 trauma patients found that CT had a 100% sensitivity for detecting spinal fractures. | Antevil JL <i>et al.</i> J Trauma 2006;61:382-87 |
| | Retrospective review of 14577 blunt trauma patients found that ligamentous injuries without C-spine fracture are very rare (<0.6%) | Chiu WC <i>et al.</i> J Trauma 2001; 50:457-63. |
| | A study was carried out in 1400 patients suffering blunt trauma to the head and neck. 366 patients were obtunded and unable to be cleared clinically despite a normal CT c spine. All scanned with MRI. 4 ligamentous injuries were found, none of which were unstable. | Hogan G <i>et al.</i> Radiology 2005; 237: 106-113. |
| | Case series of over 14,000 patients without a single missed injury on CT showing sensitivity and specificity of greater than 99.9% in detecting an unstable cervical spine. | Panczykowski D <i>et al.</i> Journal of Neurosurgery 2011; 115: 541-549. |

Risks of leaving cervical collar on until awake and cleared clinically

| Risk | Evidence | References |
|--|--|--|
| Pressure sores from cervical collar | The risk of cervical collar-related decubitus ulceration increases by 66% for every 1 day increase in time to cervical spine clearance. | Ackland HM <i>et al</i> Spine 2007; 32: 423-428. |
| Increased risk of aspiration and ventilator-associated pneumonia | Supine position due to immobilisation with collar and blocks. | Hunt JD <i>et al</i> BMJ 2012; 344 e3325. |
| Difficult mouth and airway intervention | Restricted mouth opening due to collar position | Criswell JC <i>et al.</i> Anaesthesia 1994; 49: 900-903. |
| Impaired venous drainage and raised ICP | A study of 30 patients found a mean increase of 4.6 mmHg in ICP following application of a cervical collar which resolved after its removal. | Hunt, K <i>et al.</i> Anaesthesia 2001; 56: 511-513. |
| Infection prevention difficult due to staffing requirements | Increased staffing requirements for logroll and moving patient | Harrison P <i>et al</i> Contin Educ Anaesth Crit Care Pain 2008; 8 (4): 117-120. |

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1. INTRODUCTION

The cervical spine (“c-spine”) is the most common site for spinal fractures. 2-12% of blunt polytrauma victims suffer c-spine injury with the presence of head injury the strongest independent risk factor for c-spine injury. C-spine injuries can have serious consequences including death or permanent tetraplegia¹.

Despite this, spinal injury is frequently missed in blunt polytrauma when inappropriate examinations or imaging are performed.

Cervical collars were introduced to prevent the secondary injury to spinal cord by immobilizing a potential unstable spine¹. However, the most recent Cochrane review² could not identify a single randomized controlled trial on spinal immobilisation strategies. The current protocol for pre-hospital spinal immobilisation has a strong historical rather than scientific precedent, based on the concern that a patient with an injured spine may deteriorate neurologically without immobilisation. Furthermore, neurological deterioration can occur or indeed worsen with their use^{3,4}.

Prompt exclusion of spinal injury is important: prolonged use of spinal protection including rigid collar is associated with significant morbidity from pressure ulcers, venous thromboembolism, raised intracranial pressure, difficulty in intubation, poor oral care and failed enteral feeding⁵. These problems increase with the duration of c-spine immobilisation.

This guidance is specifically relevant to Critical Care as imaging modalities play a more important role than on general wards where clinical examination can exclude c-spine injury in many patients. With the advent of trauma networks, unconscious patients with potential spinal injury may become less common in DCCQ. A clinical guideline is now arguably even more important to provide guidance to staff managing these rare but potentially devastating injuries.

2. PURPOSE

To provide guidance on the management of actual or potential c-spine injuries in Critical Care.

3. SCOPE

This guideline is for use in the Department of Critical Care. This guideline is subject to professional judgement and accountability.

4. DEFINITIONS

ATLS = Advanced Trauma Life Support

C-spine = cervical spine

CT = Computed tomography

5. DUTIES AND RESPONSIBILITIES

The decision to implement this guideline is at the discretion of the on-call critical care consultant. Implementation of this guideline is the joint responsibility of appropriate critical care medical/nursing staff. This guideline is subject to professional judgment and accountability.

6. PROCESS (Recommendations & Justification)

A: Indications for initial C-Spine Protection

| Recommendation (Action) | Justification (Rationale) |
|---|---|
| <p>All trauma patients where c-spine cannot be cleared clinically should assume fracture present until proven otherwise.</p> | <p>Spinal injury is potentially devastating and life changing. Ensuring adequate protection of the spine during the initial management of trauma patients is a well accepted part of trauma management as per Advanced Trauma Life Support (ATLS) guidelines. Approximately 5% of patients with brain injury will also have an associated spinal injury¹ therefore vigilance is paramount.</p> |
| <p>Patients with suspected fractured c-spine should have full spinal precautions which include;</p> <ul style="list-style-type: none"> a) Hard collar and supports either side of head b) Trolley or bed unbroken with up to 30 degree head up tilt c) In-line stabilisation for turns (“log roll”) d) Transfer using scoop stretcher (or long board if scoop unavailable) | <p>In line with ATLS guidelines¹ .</p> |
| <p>Conscious patients can only have the c-spine cleared clinically if all the following criteria are met:</p> <ul style="list-style-type: none"> a) GCS = 15 b) No central neck tenderness c) No neurological deficit d) No distracting injuries e) No confounding issue such as drugs masking symptoms f) No pain on active movement turning 45 degrees left and right | <p>Clearing the c-spine clinically is useful in the emergency department setting. The EAST criteria⁶ opposite have been well validated against plain radiographs in ruling out spinal injury^{7,8} . However, in the critical care setting, the criteria required make it unlikely that the spine can be cleared without the need for radiological imaging.</p> <p>However, it is useful to be aware of the criteria for c-spine clearance as this helps to make decisions regarding the likelihood of the clinical situation improving quickly to the extent that clinical clearance is likely in the next 48-72 hours. For example, where alcohol might be clouding initial consciousness.</p> |

B: Radiological imaging

| Recommendation (Action) | Justification (Rationale) |
|---|--|
| All trauma patients with head injury and depressed conscious level should have CT of head and c-spine. | In blunt polytrauma, c-spinal injury is present in 2-12% of patients. Head injury is the most important risk factor for injury of the c-spine (RR 8.5) ⁵ . Depressed consciousness is a risk factor for severity of head injury and also prevents the clearance of spinal injury clinically. Scanning head and c-spine simultaneously reduces the need for repeated transfers of critically unwell patients to the radiology department and has a high sensitivity in ruling out spinal injury in unconscious patients >99% ⁵ . Plain radiographs of the c-spine confer no additional advantage over CT alone ⁶ . |
| In patients deemed high risk, spinal imaging should include thoracic and lumbar. High risk patients include when: a) Mechanism of injury unknown b) Fall greater than patients own height c) High energy impact d) Age > 50 years | There are multiple mechanisms of injury that have been identified as being highly correlative with thoraco-lumbar fractures. These include falls greater than 10 feet, ejection from a motor vehicle, motorcycle crashes, high-velocity injuries, and pedestrians struck by motor vehicles ⁹ . Osteoporosis increases the likelihood of bony spinal injury and its prevalence increases with age. Wessex neurological ICU guidelines recommend trauma patients with head injury over the age of 50 receive imaging to the thoracic and lumbar spine in addition to the c-spine ¹⁰ . |
| In patients with radiologically demonstrated fracture of the c-spine, further imaging of the thoracolumbar spine is required. | Patients with radiologically demonstrated c-spine fracture have a higher incidence of further fracture of the spine ¹¹ . |

C: Consultant radiologist to interpret imaging

| Recommendation (Action) | Justification (Rationale) |
|--|---|
| Only consultant radiologist can exclude bony c-spine injury. | C-spine fractures can be overlooked by inexperienced interpreters ¹² . Due the devastating consequences of a missed fracture, only radiologists experienced at interpreting CT of c-spine should exclude bony c-spine injury ¹³ . |

D: Case discussion with spinal surgeon

| Recommendation (Action) | Justification (Rationale) |
|--|---|
| All abnormal CT scans of spine should be discussed with on-call orthopaedic team at Queen Alexandra Portsmouth. They will usually then discuss with Southampton University Hospital Trust Spinal injury team for expert opinion in regards to on-going management. | This is in keeping with regional guidelines on the management of spinal trauma. Spinal surgeons are the most experienced members of the team in regards to evaluating the stability of the injury and management. Further management might include surgical stabilisation therefore spinal surgical involvement early is important. Early management of c-spine injury improves outcome ¹² . |

E: Spinal precautions after imaging and discussion with spinal surgeon (if required)

| Recommendation (Action) | Justification (Rationale) |
|---|---|
| Where CT is reported as showing no spinal injury and no occipital condyle fracture, in sedated patients, hard collar can be removed. This should be a consultant-level decision, based partly on the risks of continued spinal immobilisation for the patient in question. | The risk of serious ligamentous injury resulting in an unstable spine in patients with a normal CT scan is extremely low (<0.1%) ^{14,15} . The risks of prolonged spinal precautions in patients without evidence of injury is significant and usually outweighs the potential benefits ⁵ . Potential complications from continuing spinal precautions include: <ul style="list-style-type: none"> • Pressure injury to soft tissues. • Increased risk of respiratory failure and lower respiratory tract infections. • Increased intracranial pressure • Difficult laryngoscopy and intubation¹⁶ • Difficult central venous cannulae insertion • Increased risk of pulmonary thromboembolism, especially in context of other injuries, e.g. long bone fractures • Increased rates of central venous cannulae associated blood stream infections • Prevention of cross-infection difficult due to staffing requirements¹³ • Increased intracranial pressure¹⁷ |
| When a c-collar has been removed in a sedated patient based on a negative CT scan, it may need to be reapplied on stopping sedation if: <ol style="list-style-type: none"> a) There is a particularly strong suspicion of spinal injury due to the mechanism of injury b) There is evidence of spinal fusion, either due to surgery or disease c) Patient develops neck pain or neurological symptoms on waking. | CT of the c-spine, particularly with less than 3mm slices and 3-D reconstruction is extremely sensitive at detecting spinal injury. However, CT should not exclude the use of clinical judgment. If the mechanism of injury, other injuries or other factors are present which mean there is a high suspicion of spinal injury, further evaluation is necessary with the help of the radiologist and orthopaedic surgeons. |

| | |
|--|---|
| <p>Unstable c-spine injury should be placed in Miami J collar - only removed routinely during washing and pressure area care.</p> <p>Temporary extrication collars should be exchanged for a Miami J collar at the earliest opportunity to reduce the risk of pressure injury.</p> | <p>Miami J is the most widely used semi-rigid collar in use¹⁸ and provides a reasonable level of stability in flexion and extension stress tests in addition to reducing pressure sores compared to rigid collars. Other orthosis might be necessary depending on the type of injury. This should be guided by the consultant orthopaedic surgeon.</p> |
| <p>Stable c-spine injury patients may have the front of their hard collar removed whilst they are sedated, paralysed and not being turned or undergoing physiotherapy - this should first be confirmed with a consultant orthopaedic surgeon.</p> | <p>This is in keeping with the regional major trauma centre and Wessex neurological critical care guidelines.</p> |
| <p>Stable thoracic and lumbar spinal injury may be sat up with normal turns - this should first be confirmed with a consultant orthopaedic surgeon.</p> | <p>This is in keeping with the regional major trauma centre and Wessex neurological critical care guidelines.</p> |
| <p>Unstable thoracic and lumbar spinal injury should have bed tilted head up with full spinal turns.</p> | <p>This is in keeping with the regional major trauma centre and Wessex neurological critical care guidelines.</p> |

7. TRAINING REQUIREMENTS

All Critical Care staff will be informed of the content of this guideline and how to access it via the Critical Care Guidelines and SOPs intranet page. All staff involved in ensuring c-spine protection will be given appropriate training, managed by the Critical Care Education Team.

8. MONITORING COMPLIANCE WITH, AND THE EFFECTIVENESS OF, PROCEDURAL DOCUMENTS

This guideline will be reviewed initially at 6 months and thereafter 2 yearly by the Critical Care Governance Group. Measurement of compliance will be achieved by unit-based audit. Results reviewed will be fed back to members of the senior medical /nursing team and the Critical Care Governance Group.

9. REFERENCES AND ASSOCIATED DOCUMENTATION

1. Advanced Trauma Life Support for Doctors Student Course Manual. Chicago, IL: American College of Surgeons, 2012
2. Kwan I, Bunn F, Roberts IG. Spinal immobilisation for trauma patients. Cochrane Database of Systematic Reviews 2001 (updated 2007), Issue 2. Art. No.: CD002803. DOI: 10.1002/14651858.CD002803
3. Huang, Y.H., Yang, T.M., Lin, W.C., Ho, J.T., Lee, T.C., Chen, W.F., Rau, C.S., and Wang, H.C. (2009). The prognosis of acute blunt cervical spinal cord injury. J Trauma 66, 1441–1445.
4. Horodyski, M., DiPaola, C.P., Conrad, B.P., and Rehtine, G.R. Cervical collars are insufficient for immobilizing an unstable cervical spine injury. J Emerg Med. 2011; 41: 513–519
5. Morris C G, McCoy W, Lavery G G. Spinal immobilisation for unconscious patients with multiple injuries. British Medical Journal 2004; 329(7464):495-499.
6. EAST Determination of Cervical Spine Stability in Trauma Patients. Update 2000. Available from www.east.org
7. Velhams GC, Theodorou D, Tatevossian R et. al. Radiographic cervical evaluation in the alert, asymptomatic blunt trauma victim: much ado about nothing? J Trauma 1996;40:768-774.
8. Gonzales RP, Fried PO, Bukhalo M, Holevar MR, Falimirski ME. Role of clinical examination in screening for blunt cervical spine injury. J Am Coll Surg. 1999;189:152-157.
9. Sixta S, Moore FO, Ditillo MF, et al. Screening for Thoracolumbar Spinal Injuries in Blunt Trauma. J Trauma 2012; 73(5): 326-332.
10. Wessex Neurological ICU guidelines. Cordingly M, Hell J. <http://www.neuroicu.org.uk>. Last accessed on November 30th 2013.
11. Hsu JM, Joseph T, Ellis AM. Thoracolumbar fracture in blunt trauma patients: guidelines for diagnosis and imaging. Injury 2003;34(6):426-433.
12. Reid DC, Henderson R, Saboe L, Miller JD. Etiology and clinical course of missed spine fractures. J Trauma 1987; 27: 980 – 6.
13. Harrison P, Cairns, C. Clearing the cervical spine in the unconscious patient. Contin Educ Anaesth Crit Care Pain 2008; 8 (4): 117-120.
14. Stassen NA, Williams VA, Gestring ML, Cheng JD, Bankey PE. Magnetic resonance imaging in combination with helical computer tomography provides a

- safe and efficient method of cervical spine clearance in the obtunded patient. *J Trauma* 2006; 60: 171–7.
15. Diaz JJ, Aulino JM, Collier B et al. The early work-up for isolated ligamentous injury of the cervical spine: does computer tomography scan have a role? *J Trauma* 2005; 59: 897–904.
 16. Cook TM, Woodall N, Harper J, Benger J; Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 2: intensive care and emergency departments. *Br J Anaesth* 2011;106:632-642.
 17. Hunt, K., Hallworth, S., and Smith, M. (2001). The effects of rigid collar placement on intracranial and cerebral perfusion pressures. *Anaesthesia* 56, 511–513.
 18. Gavin T, Carandang G, Havey R, et al. Biomechanical analysis of cervical orthoses in flexion and extension: A comparison of cervical collars and cervical thoracic orthoses. *Journal of Rehabilitation Research and Development* 2003; 40(6): 527–538.

Appendix A

Checklist for the Review and Ratification of Procedural Documents and Consultation and Proposed Implementation Plan

To be completed by the author of the document and attached when the document is submitted for ratification: a blank template can be found on the [Trust Intranet. Home page -> Policies -> Templates](#)

| CHECKLIST FOR REVIEW AND RATIFICATION | | | |
|---------------------------------------|---|---------------|----------|
| TITLE OF DOCUMENT BEING REVIEWED: | | YES/NO N/A | COMMENTS |
| 1 | Title | | |
| | Is the title clear and unambiguous? | Yes | |
| | Will it enable easy searching/access/retrieval?? | Yes | |
| | Is it clear whether the document is a policy, guideline, procedure, protocol or ICP? | Yes | |
| 2 | Introduction | | |
| | Are reasons for the development of the document clearly stated? | Yes | |
| 3 | Content | | |
| | Is there a standard front cover? | Yes | |
| | Is the document in the correct format? | Yes | |
| | Is the purpose of the document clear? | Yes | |
| | Is the scope clearly stated? | Yes | |
| | Does the scope include the paragraph relating to ability to comply, in the event of a infection outbreak, flu pandemic or any major incident? | Yes | |
| | Are the definitions clearly explained? | Yes | |
| | Are the roles and responsibilities clearly explained? | Yes | |
| | Does it fulfill the requirements of the relevant Risk Management Standard? (see attached compliance statement) | Yes | |
| | Is it written in clear, unambiguous language? | Yes | |
| 4 | Evidence Base | | |
| | Is the type of evidence to support the document explicitly identified? | Yes | |
| | Are key references cited? | Yes | |
| | Are the references cited in full? | Yes | |

| | | | |
|----------|--|-----|--------------------------------|
| | Are associated documents referenced? | Yes | |
| 5 | Approval Route | | |
| | Does the document identify which committee/group will approve it? | Yes | Critical Care Governance Group |
| 6 | Process to Monitor Compliance and Effectiveness | | |
| | Are there measurable standards or KPIs to support the monitoring of compliance with the effectiveness of the document? | Yes | |
| 7 | Review Date | | |
| | Is the review date identified? | Yes | |
| 6 | Dissemination and Implementation | | |
| | Is a completed proposed implementation plan attached? | Yes | |
| 7 | Equality and Diversity | | |
| | Is a completed Equality Impact Assessment attached? | Yes | |

Appendix A
continued

| CONSULTATION AND PROPOSED IMPLEMENTATION PLAN | | | |
|---|--|---|-----------|
| Date to ratification committee | | 22 Jan 16 | |
| Groups /committees / individuals involved in the development and consultation process | | Critical Care Governance Group Multidisciplinary staff working in DCCQ | |
| Is training required to support implementation? | | Yes | |
| If yes, outline plan to deliver training | | 1. Distribution of revised guideline via email, and uploading to intranet site. 2. Coverage at identified Friday multidisciplinary teaching session. 3. Targeted training via Renal Team and Education Team where appropriate | |
| Outline any additional activities to support implementation | | As above | |
| Individual Approval | | | |
| If, as the author, you are happy that the document complies with Trust policy, please sign below and send the document, with this paper, the Equality Impact Assessment and NHSLA checklist (if required) to the chair of the committee/group where it will be ratified. To aid distribution all documentation should be sent electronically wherever possible. | | | |
| Name | Dr G Craig, Consultant in Critical Care | Date | 08 Jan 16 |
| Signature | <i>signed electronically</i> | | |
| Committee / Group Approval | | | |
| If the committee/group is happy to ratify this document, would the chair please sign below and send the policy together with this document, the Equality Impact Assessment, and NHSLA checklist (if required) and the relevant section of the minutes to the Trust Policies Officer. To aid distribution all documentation should be sent electronically wherever possible. | | | |
| Name | Dr N Tarmey, Critical Care Governance Group | Date | 22 Jan 16 |
| Signature | <i>signed electronically</i> | | |

If answers to any of the above questions is 'no', then please do not send it for ratification.

Appendix B

Equality Impact Assessment

To be completed by the author of the document and attached when the document is submitted for ratification: a blank template can be found on the [Trust Intranet. Home page -> Policies -> Templates](#)

| | |
|---|--|
| Title of document for assessment | Management of spinal injury in the unconscious patient |
| Date of assessment | 08 Jan 16 |
| Job title of person responsible for assessment | Dr N Tarmey |
| Division/Service | DCCQ / CHAT CSC |

| | Yes/No | Comments |
|---|--------|----------|
| Does the document affect one group less or more favorably than another on the basis of: | | |
| Race | No | |
| Gender (including transgender) | No | |
| Religion or belief | No | |
| Sexual orientation, including lesbian, gay and bisexual people | No | |
| Age (for HR policies only) | No | |
| Disability – learning disabilities, physical disabilities, sensory impairment and mental health problems | No | |
| Does this document affect an individual's human rights? | No | |
| If you have identified potential discrimination, are the exceptions valid, legal and/or justified? | | |

If the answers to any of the above questions is 'yes' you will need to complete a full Equality Impact Assessment (available from the Equality and Diversity website) or amend the policy such that only an disadvantage than can be justified is included. If you require any general advice please contact staff in the Equality and Diversity Department on 02392 288511