

## **Western Trauma Association Critical Decisions in Trauma: Cervical Spine Clearance in Trauma Patients**

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## Introduction

This is a recommended evaluation and management algorithm from the Western Trauma Association (WTA) Algorithms Committee addressing the management of adult trauma patients with potential for cervical spine injury. Because there is a paucity of published prospective randomized clinical trials that have generated class I data, these recommendations are based primarily on published prospective and retrospective cohort studies, and expert opinion of the WTA members. The final algorithm is the result of an iterative process including an initial internal review and revision by the WTA Algorithm Committee members, and then final revisions based on input during and after presentation of the algorithm to the full WTA membership.

Although cervical spine injuries are uncommon among trauma patients presenting to emergency departments, cervical spine fractures and associated spinal cord injuries are potentially devastating. (1) Spine motion restriction (SMR) is practiced as a means to protect the cervical spine and spinal cord from further damage until a definitive evaluation confirms or rules out injury. The clinical approach to patients at risk for cervical spine injuries has evolved substantially with a better appreciation of the epidemiology and improved diagnostic imaging capabilities. The rare occult presentation and potentially devastating consequences of spinal cord injury often leads to unnecessary imaging in examinable patients and the perceived unreliability of diagnostic imaging and belief that SMR prevents further spinal cord damage results in prolonged use of cervical collars.

The algorithm (Figure 1) and accompanying comments represent a safe and sensible approach to the evaluation of the cervical spine in the injured patient presenting to the hospital with SMR measures in place. The aim is to minimize the unnecessary use of imaging studies

without unduly increasing the risk of missing a clinically significant injury and to discontinue SMR to avoid prolonged use of rigid cervical collars where appropriate. It is intended to apply to most patients most of the time and to aid in the diagnosis of traumatic cervical spine fractures, not to guide treatment of fractures once identified. We recognize that there will be multiple factors that may warrant or require deviation from any single recommended algorithm, and that no algorithm can completely replace expert bedside clinical judgment. We encourage institutions to use this as a general framework in the approach to these patients, and to customize and adapt the algorithm to better suit the specifics of that program or location.

### **Annotated text for the Algorithm**

- A. The indications for pre-hospital spine motion restriction (SMR) using a rigid cervical collar are generally governed by local protocols and may vary considerably. Although clinical judgment applies, there is consensus that SMR has no role for penetrating mechanisms.(2) A recent Joint position statement among Trauma and EM professional societies list indications for prehospital SMR as all blunt mechanism patients unless all of the following are met:(3)
  - i. Reliable history and exam - mental status normal, no intoxicants/language barrier.
  - ii. No neurologic deficits, midline spine pain/tenderness, spine deformity.
  - iii. Active ROM normal.
- B. The first major decision differentiates patients into examinable and unexaminable categories. Cervical spine clearance by physical exam requires that the patient is examinable, i.e. has a normal mental status, no intoxicants, language barrier, or other injury that prevents participation in a reliable history and physical examination.(4)

Unexaminable patients are recommended to undergo screening neck CT. A brief period (less than 24 hour) of observation with SMR in place to allow the patient to become examinable may be practical in select cases such as the intoxicated patient with low a risk mechanism and no other indication for imaging. Prior guidelines recommended imaging for patients with distracting injuries however, such injuries were ill defined. A practical approach is to consider a patient unexaminable if the mental state prohibits communication or cooperation with the examiner, and associated injuries ‘distracting’ if they prevent the participation in a thorough and reliable physical exam.(4, 5) In the judgement of an experienced examiner, A distracting injury that prevents participation in a thorough and reliable physical exam should disqualify a patient from clinical discontinuation of SMR and prompt a screening neck CT.

- C. A normal physical exam is a normal active range of motion and the absence of midline cervical pain/tenderness, focal neurologic deficit, or spine deformity. (6, 7) A normal physical exam is sufficient to exclude significant cervical spine injury without the expense and radiation exposure of a screening CT. In other words, examinable asymptomatic patients do not need imaging to discontinue SMR. (6, 7) A more cautious approach with liberal screening CT scan for examinable asymptomatic patients with higher energy transfer mechanisms, concurrent medical conditions, or patients at the extremes of age is advocated by some. In particular, the liberal use of screening neck CT scans in older patients is recommended by some due to a reported higher incidence of asymptomatic fractures. (8) Symptoms such as neck pain, tenderness, immobility, or focal neurologic deficit warrant a diagnostic neck CT. A

- diagnostic CT scan in a symptomatic patient has a higher likelihood of a significant finding than a screening CT scan in an asymptomatic or unexaminable patient. The optimal disposition of the symptomatic patient with a normal diagnostic neck CT scan is not clear. It can be argued that a high quality diagnostic CT scan identifies all clinically significant injuries and that MRI and SMR provide no added benefit. (9) However, a persistent neurologic defect in a patient with a normal diagnostic neck CT may signal a spinal cord injury and should prompt a diagnostic neck MRI. (10)
- D. The high resolution (64Slice, <3mm thickness) CT scan with multi-planar reconstructions has replaced plain X-ray as the standard of radiographic evaluation of the cervical spine. (11) A Screening neck CT scan is recommended in all patients that cannot participate in a thorough and reliable physical exam. Some institutions have advocated C Spine imaging as part of whole-body CT screening or in those undergoing head CT scan for other reasons. (12) (13) (14) A period of observation prior to screening neck CT can be used in select patients with low risk mechanisms whose clinical condition is expected to improve sufficiently to allow participating in clinical examination if practical.
- E. Fractures identified on CT scan should be referred for spine consult. Although isolated transverse process fractures are managed using comfort measures without spine consultation in some institutions, it is recommended that each institution assess its ability to implement this practice. (15, 16) Some cervical spine fractures are associated with increased risk of Blunt Cerebrovascular Injury (BCVI) and should be investigated with a neck CT angiogram.(17) Risk factors for BCVI are high energy transfer mechanism associated with:

- a. Displaced mid-face fracture (LeForte II or III).
  - b. Basilar skull fracture involving the carotid canal.
  - c. Closed head injury consistent with diffuse axonal injury and GCS <6.
  - d. Cervical body fracture or transverse foramen fracture, subluxation, or ligamentous injury at any level.
  - e. Any C1 –C2 fracture
  - f. Near hanging with cerebral anoxia
  - g. Clothesline type injury or seatbelt abrasion with significant swelling, pain or altered mental status.
- F. Abnormal screening neck CT with significant findings other than bony fractures such as soft tissue swelling or skeletal malalignment should be further investigated with a diagnostic MRI.
- G. Perhaps the most contested point in management is the disposition of the obtunded patient with a normal screening neck CT with normal age appropriate findings. A recent review and practice management guideline developed by the Eastern Association of Surgery of Trauma recommended discontinuation of SMR in obtunded patients with a normal screening neck CT. (18) In this setting, the negative predictive value of a high quality screening neck CT scan in excluding an unstable injury approaches 100%. In such instances SMR provides no added benefit and can be discontinued. A normal screening neck CT is also sufficient to discontinue SMR in intoxicated patients. (19)
- H. Discontinue cervical SMR. Option comfort collar for neck strain/sprain.

1. Maintain SMR, Spine consultation. An option is to provide a comfort collar to patients with isolated transverse process fractures without spine consult.(15, 16, 20) It is recommended that each institution assess its own ability to implement this practice.

## **Discussion**

The end points of this algorithm are discontinuation of SMR or spine consultation which are directed by physical exam and screening and diagnostic imaging. A spine consult is obtained to develop a definitive care plan on patients diagnosed with cervical spine fractures, ligamentous injuries, or spinal cord injuries. The spine service, typically orthopedic or neurosurgical subspecialists, varies by institution but should integrate its care plan with the overall care coordinated by the trauma service for multisystem injured patients as necessary.

## **Author Contributions**

Conception and design – All authors. Data acquisition – DJC; Data interpretation – All authors; Manuscript preparation –DJC; Critical revisions – all authors.

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ACCEPTED

**Figure Legend**

**An Algorithm for cervical spine clearance in trauma patients**

C-Collar = Rigid cervical collar, SMR = Spine motion restriction, CT = computed tomography,

MRI = magnetic resonance imaging, SC = Spinal Cord

ACCEPTED

Figure 1

