

Maine Medical Center Trauma Clinical Practice Guideline (MMCT-CPG)		
<p style="text-align: center;">Cervical Spine Clearance</p> <p style="text-align: center;">(MMC-CPG ID: #)</p> <p>Provides guidelines and recommendations for the clearance of the cervical spine, allowing removal of the cervical collar, in trauma patients</p>		
Contributors		
<div> <div></div> <div></div> <div></div> </div>		
<div> <div>Primary Author: Laura Withers, MD</div> <div>Contributors: Forest Sheppard, MD Jeffrey Florman, MD</div> </div>		
First Publication Date July 2013	Publication Date June 2023	Supersedes CPG dated Feb 2019
Guidelines translate best evidence into best practice. A well-crafted guideline promotes quality by reducing healthcare variations, improving diagnostic accuracy, promoting effective therapy, and discouraging ineffective – or potentially harmful – interventions.		
TABLE OF CONTENTS		

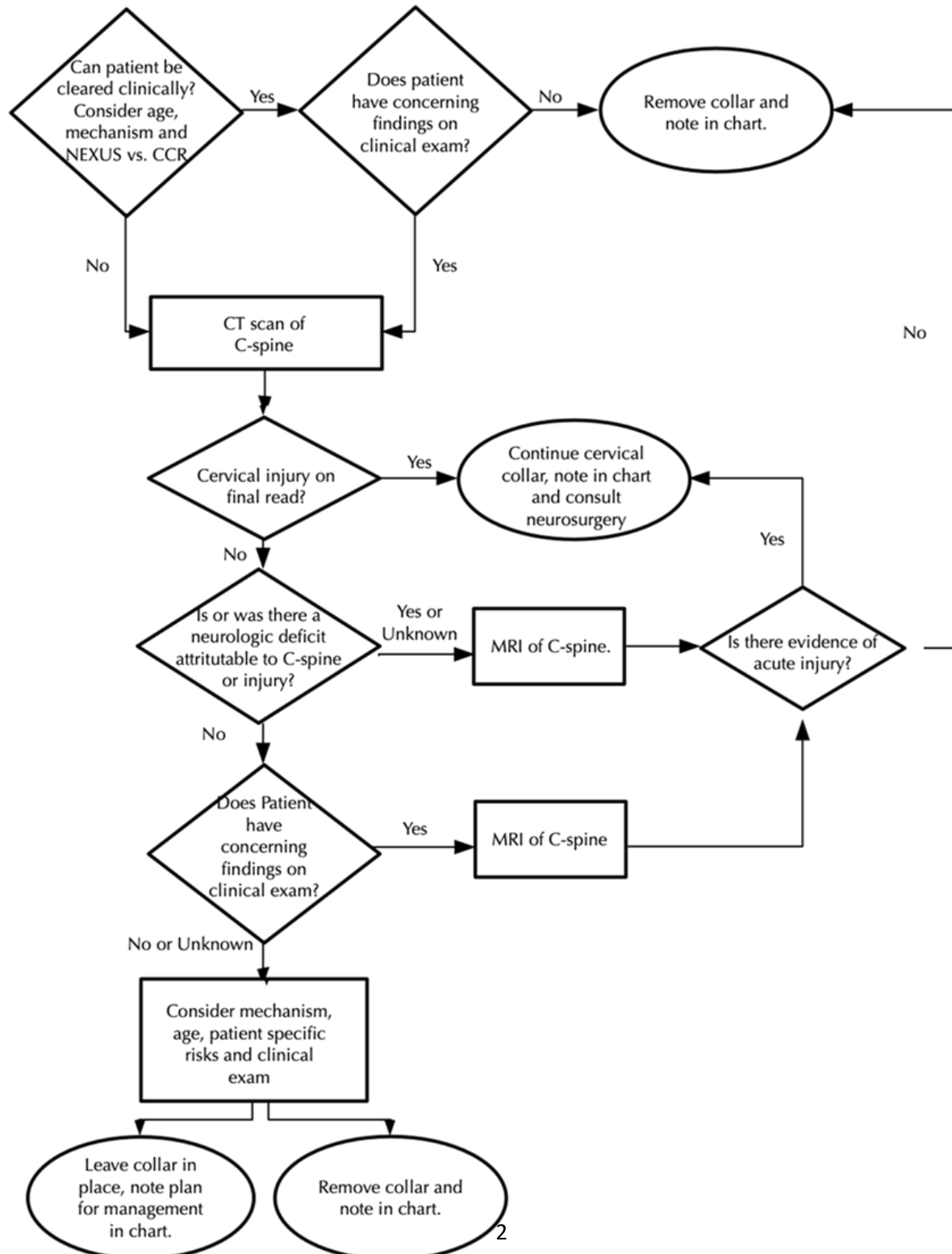
Cervical Spine Clearance Flowsheet.....	02
Summary.....	03
Purpose	03
Background	03
Clearance by Clinical Exam	04
Initial Imaging	05
Adjunctive Imaging in the Alert Patient.....	06
Cervical Spine Clearance in the Obtunded Patient.....	07
Areas of Ongoing Controversy, Special Cases and Comments.....	07
Performance Improvement Monitoring	08
Intent (Expected Outcomes), Performance/Adherence Measures, Data Source.....	08
System Reporting Frequency	08
Responsibilities	08
Appendix A	09
Appendix B	10
References	11

Cervical Spine Clearance Flowsheet

Cervical spine clearance must be documented in the chart.

.TRAUMACSPINECLEARVTWO or .TRAUMACSPINECLEARVONE

Use with Caution in patients >65



SUMMARY

- For penetrating trauma patients, immobilization of the cervical spine is not necessary unless the trajectory suggests direct injury.
- All blunt and mixed mechanism trauma patients should remain in cervical spine precautions until the cervical spine has been positively cleared.
 - Patients who are awake and alert can be clinically cleared unless distracting injury, concerning neurologic deficit or mechanism is high risk. This is done with a confrontational physical exam.
 - For patients who cannot be clinically cleared, CT of the neck is the primary imaging modality. Ideally, patients will have a negative CT, benign neurologic exam and pain-free confrontational exam to be cleared.
 - Obtunded patients with negative CT of the cervical spine ON FINAL READ may be cleared without confrontational exam. Mechanism, age and patient specific risks should be considered before deciding to remove the collar.
 - MRI within 72 hours of injury is the preferred adjunctive study in patients whose CT is equivocal, who have/ or had, at any time since the injury, neurological findings that could be attributed to a cervical cord or spine injury, who have ongoing neck pain or other concerning circumstances.
- Clearance of the small group of patients who cannot be cleared clinically, have an equivocal CT, AND are unable to get an MRI within 72 hours is an area of controversy and no definite recommendation can be made; this requires the judgement of an experienced clinician.
- Clearance of the cervical spine should be documented in the medical record. Use dot phrases .TRAUMACSPINECLEARVTWO or .TRAUMACSPINECLEARVONE
- The cervical collar carries significant morbidity; we should clear the cervical spine and remove the collar as soon as practical.

PURPOSE

Appropriate management of the cervical spine is crucial for preventing further injury in the trauma patient. Though clearance of the cervical spine is common practice some significant questions lack enough evidence to make strong recommendations and clinical judgement remains important. These guidelines attempt to provide a framework to minimize the risk of further injury, from either missing an injury or leaving a cervical collar in place unnecessarily.

BACKGROUND

About 3% of major trauma patients suffer a cervical spine injury. The incidence rises to 10% in patients with a serious head injury.¹ A missed injury can delay treatment and cause or worsen neurologic impairment. The cervical collar, used to immobilize a potentially unstable cervical spine, carries significant downsides including skin breakdown, decubitus ulcers, and increased ICP.² It is imperative that providers be knowledgeable and conscientious in managing potential cervical spine trauma.

CLEARANCE BY CLINICAL EXAM

Does the patient meet NEXUS criteria for clinical clearance? Is the patient under 65?

(See Appendix B)?

[Can use Canadian C-Spine Rule instead and should consider mechanism in all cases.

(See Appendix C)]

If the under 65-year-old patient has **NONE** of the following:

- Focal neurological deficit
 - Posterior midline cervical spine tenderness
 - Altered level of consciousness
 - Intoxication
 - Competing pain from a distracting injury
- then the cervical spine can be cleared with additional clinical exam.

Clinical examination consists of:

1. An evaluation done while maintaining immobilization. The patient is asked about midline, posterior neck pain, paresthesias and weakness.
2. A static exam is then done while continuing cervical immobilization. This is performed by inspecting the cervical spine for ecchymosis or deformity. And palpating for tenderness and deformity.

***Positive findings should lead to further imaging. If the static portion is negative a dynamic exam is done. ***

3. Dynamic or Confrontational exam is done with the patient supine or without moving their position if they are seated. They are asked to voluntarily flex and extend the neck, rotate left and right, and bend laterally. Normal range of motion (ROM) of the neck varies with age, gender, size and pre-existing conditions. Communication with the patient is important to obtain a good exam. If this is done without pain or onset of neurological symptoms the examiner applies an axial load by pressing down on the skull.
- If the **patient has midline** pain with motion, neurologic symptoms that occur with motion or too much pain to complete the exam, or the exam is not normal a CT is warranted.
 - If the **clinical exam is normal** the cervical spine is considered “cleared,” the collar may be removed and a notation made in the medical record.
 - If the exam is not normal but the patient states that “it is normal for me” (e.g. limited ROM due to prior injury) the patient may be cleared or imaged at the discretion of the physician.

The National Emergency X-Radiography Utilization Study (NEXUS) is a prospective, observational, multi-institutional study that enrolled 34,069 adult, stable, blunt trauma patients who were at risk for cervical spine injury³. The authors recommended that in an awake alert patient with no focal neurologic deficit, no altered level of consciousness, not intoxicated, no midline spinal tenderness, no distracting injury the risk of cervical spine injury is low and the

patient be cleared. The presence of any one criteria indicates increased risk for cervical spine injury and is an indication for radiographic evaluation. See the rule in Appendix A.

The Canadian C-Spine Rule was developed from a prospective, observational multi-institutional study that enrolled 8,924 alert (GCS of 15), stable, adult, blunt trauma patients who were at risk for cervical spine injury.⁴ It uses a combination of high-risk criteria, that if present indicate a need for imaging, and low-risk criteria, that if absent indicate a need for imaging. See Appendix B. Of note, age > 65 is a high-risk factor and these patients automatically move on to further imaging.

The Canadian C-spine Rule and Nexus Criteria were compared in a prospective, cohort, multi-institutional study.⁵ The Canadian C-spine Rule was found to have 99.4% sensitivity, 100% negative predictive value and specificity of 45.1%. NEXUS had a 90.7% sensitivity, 99.4% negative predictive value and 36.8% specificity. There is concern that NEXUS may miss some cervical spine injuries. Recently, a literature review by The Cervical Assessment and Diagnosis Research Evaluation (CADRE) Collaboration echoes these findings.⁶ From 2005 – 2015 they identified 5 low bias studies using the Canadian C-spine Rule and/or Nexus criteria. “The sensitivity of the Canadian C-spine rule ranged from 0.90 to 1.00 with negative predictive values ranging from 99 to 100%. They also evaluated inter-rater reliability; for the Canadian C-spine Rule it varied from $k = 0.60$ between nurses and physicians to $k = 0.93$ among paramedics. Only one included study utilized NEXUS criteria. The inter-rater reliability of the Nexus Low-Risk Criteria was $k = 0.53$ between resident physicians and faculty physicians.”⁷ However, at this time EAST Guidelines continue to utilize NEXUS criteria.⁷

INITIAL IMAGING

For patients who cannot be clinically cleared, CT of the neck is the primary imaging modality. If the patient has **ANY ONE** of the NEXUS criteria or fails the clinical exam, imaging of the cervical spine is required. CT of the cervical spine is the imaging modality for all trauma patients.

- If the CT shows evidence of fracture, ligamentous injury or other abnormality related to acute trauma, maintain cervical spine precautions and consult neurosurgery.
- If the CT shows no evidence of acute injury assess the reasons the patient failed.
 - If the patient is likely to be able to meet the NEXUS criteria within 48 hours, keep the cervical spine precautions and wait to clear the cervical spine by clinical exam.
 - If the patient is not likely to meet NEXUS criteria within 48 hours, the cervical spine may be cleared without exam if the CT of the cervical spine is negative for acute injury on final attending read the collar may be removed. If there are concerning findings consult neurosurgery.
 - In some older or high risk patients it may be decided not to clear the collar and move on to adjunctive imaging.

In their 2009 guideline for Cervical Spine Injuries Following Trauma the EAST authors reviewed multiple studies comparing plain x-ray series vs CT scans for evaluation of the cervical spine ⁶.. Specifically, a CT must include axial images from the occiput to T1 with sagittal and coronal reconstructions. Not only is CT more accurate than plain radiography but also is time effective, cost effective, and does not require additional plain films.”

ADJUNCTIVE IMAGING IN THE ALERT PATIENT

MRI, ideally obtained within 72 hours of injury⁸, has become the adjunctive study of choice at most centers.

- MRI should be obtained in all patients with neurologic deficits attributable to a cervical spine injury INCLUDING those who do not have associated CT findings of fracture or other injury. Neurosurgery should be consulted based on clinical suspicion of a spinal cord injury and/or if the MRI is abnormal.
 - If the MRI is negative, the cervical spine can be cleared.

MRI is more sensitive than CT for identification of soft tissue and spinal cord injuries ⁸. If a CT is negative but there is a high clinical suspicion for an injury based on pain or neurologic findings an MRI should be obtained. MRI is not reliable for identification of bony injuries and thus is not the first choice for cervical spine imaging ⁶. Schuester et al. did one of the few studies to address MRI in the patient with pain despite a normal CT and with no neurological deficits.⁹ 93 of these patients underwent MRI. None were found to have clinically significant injury. There were no complications on follow-up. Clearly, additional study is warranted. The timing of MRI (greater or less than 48 hours) after injury is not shown to be clinically significant ¹⁰. However, edema improves the visibility of ligaments and thus may aid in visualizing ligamentous injury ⁸. Ideally, MRI should be obtained within 72 hours of injury. Given the time related pressure ulcer risk of cervical collars a decision about definitive management of the cervical spine within this time frame seems appropriate.

In neurologically intact, awake and cooperative patients, conventional flexion/extension X-Rays are an option for cervical spine clearance.

- If flexion/extension shows signs of injury, neurosurgery should be consulted.
- If flexion/extension is negative, the cervical spine can be cleared.
- If flexion/extension is equivocal, continue cervical spine precautions and repeat in 2 weeks or obtain an MRI.

There are few studies on Flexion/ Extension X-rays. An adequate range of flexion and extension was established at 30 degrees by Insko et al. ¹¹ The patient should be seated or standing and able to cooperate in the radiology department. Patients should move their neck actively, stop if they have pain and be instructed and assisted in maintaining alignment by a trained provider. MRI has superseded Flexion/ Extension films in many centers, including ours.

CERVICAL SPINE CLEARANCE IN THE OBTUNDED PATIENT

In obtunded patients with CT scans that are negative for acute injury, who move all extremities, the cervical collar can be removed and no further clinical exam is necessary.

- If there is clinical concern or based on attending judgement it is also acceptable to obtain a MRI.

In patients with motor or other neurologic deficits that are attributable to cervical injury MRI should be obtained.

- MRI should, ideally, be obtained within 72 hours ^{8 10}.
- If MRI cannot be obtained within 72 hours a definitive decision regarding a plan for management of the cervical spine should be made by the attending physician and documented in the chart.

In 2015 EAST released a guideline that attempts to update and address cervical spine clearance in the obtunded patient ¹². They conditionally recommend removal of the collar after a negative, high quality CT. ⁶

AREAS OF ONGOING CONTROVERSY, SPECIAL CASES AND COMMENTS

Geriatric Patients (Age 65 and older)

The cervical spine changes with age. When a hard collar does not fit appropriately (e.g. lordosis, kyphosis or other deformity), soft padding and tape may be more appropriate.¹³

The Canadian C-spine rule states age over 65 is a high-risk factor for cervical spine injury, and thus an indication for CT scan.⁴ It also requires a GCS of 15, which many patients with cognitive decline may not meet at baseline. Scanning all patients over 65 who fall is impractical, low yield and expensive. NEXUS included patients across all age groups³. It has been validated in retrospective reviews of geriatric patients.^{14 15} However, other studies conclude that the NEXUS criteria cannot be applied to the geriatric population^{16 17}. While there is no consensus it is clear that evaluation of the cervical spine in the elderly patient still requires an individualized approach and that CT of the cervical spine should be used more liberally in this population.

What is a “distracting injury”? When does another injury preclude clinical clearance of the cervical spine?

The NEXUS criteria for distracting injury were intentionally vague. “An attempt to define a “distracting” injury, for example, with a long list of various injuries that could distract a patient from a cervical-spine injury would be extremely misleading. Some contusions, for example, may be associated with extreme pain, whereas not all long-bone fractures are particularly painful. Therefore, we allowed the clinicians to judge whether the patients had an injury that could produce distracting pain and thus required cervical-spine imaging...”³ Attempts to understand the implications of “distracting injuries” have continued. Authors found that in military casualties with multiple trauma clinical clearance may be unreliable¹⁸. Others argue that clinical clearance may be safe even in patients with injuries that could be distracting.^{19 20 23} Overall, the judgement of a trained provider remains important to determining whether a patient with other injuries is reliable and appropriate for cervical spine clearance by clinical exam alone.

Can intoxicated patients be cleared by CT imaging alone?

A prospective, multi-center study published in 2017 by Martin et al. evaluated 10,191 patients, 30% of whom were intoxicated.²¹ CT was quite reliable in both intoxicated and sober patients. Among patients with a normal CT scan, the TOX+ cohort had significantly longer immobilization times and 25% were immobilized for longer than 12 hrs. There was one significant “missed injury” in the intoxicated group; a patient who had no fracture but developed central cord syndrome. While there may be changes in the future, there has not been shift in the guidelines from professional societies or leading organizations based on this study. This is an area to continue to follow as the research matures.

Normal vs Negative CT

There is a difference, of unclear significance, between a normal and a negative CT. Though this issue is not specifically addressed the EAST guidelines, and the studies they reviewed, seem to accept a final CT read of “negative for acute injury” as adequate to clear the cervical spine ⁶. This seems to be the current trend in the literature. Obviously if the radiologist notes equivocal findings those patients do not have a negative CT and should have further imaging

PERFORMANCE IMPROVEMENT MONITORING

Intent / Expected Outcomes

Performance / Adherence Measures

1. Will assess adherence and if this new CPG should be modified at morning report and PIPS as needed.
2. Cervical spine clearance or plan for management will be documented in the chart. Dot phrases .TRAUMACSPINECLEARVTWO or .TRAUMACSPINECLEARVONE are recommended.

Data Source: Patient record

SYSTEM REPORTING & FREQUENCY

The above constitutes the minimum criteria for PI monitoring of the MMCT-CPG. System reporting will be performed annually; additional PI monitoring and system reporting may be performed as needed.

The system review and data analysis will be performed by the MMC Trauma Service under the direction and responsibility of the MMC Trauma Medical Directory and MMC Trauma Medical Program Manager.

RESPONSIBILITIES

It is the Trauma Medical Director’s responsibility to ensure familiarity, appropriate compliance, and PI monitoring with this MMCT-CPG.

APPENDIX A: NEXUS Criteria (6)

Table 1. The NEXUS Low-Risk Criteria.*

Cervical-spine radiography is indicated for patients with trauma unless they meet all of the following criteria:

- No posterior midline cervical-spine tenderness,†
- No evidence of intoxication,‡
- A normal level of alertness,§
- No focal neurologic deficit,¶ and
- No painful distracting injuries. ||

* Criteria are from Hoffman and colleagues.²⁶

† Midline posterior bony cervical-spine tenderness is present if the patient reports pain on palpation of the posterior midline neck from the nuchal ridge to the prominence of the first thoracic vertebra, or if the patient evinces pain with direct palpation of any cervical spinous process.

‡ Patients should be considered intoxicated if they have either of the following: a recent history provided by the patient or an observer of intoxication or intoxicating ingestion, or evidence of intoxication on physical examination such as an odor of alcohol, slurred speech, ataxia, dysmetria, or other cerebellar findings, or any behavior consistent with intoxication. Patients may also be considered to be intoxicated if tests of bodily secretions are positive for alcohol or drugs that affect the level of alertness.

§ An altered level of alertness can include any of the following: a Glasgow Coma Scale score of 14 or less; disorientation to person, place, time, or events; an inability to remember three objects at five minutes; a delayed or inappropriate response to external stimuli; or other findings.

¶ A focal neurologic deficit is any focal neurologic finding on motor or sensory examination.

|| No precise definition of a painful distracting injury is possible. This category includes any condition thought by the clinician to be producing pain sufficient to distract the patient from a second (neck) injury. Such injuries may include, but are not limited to, any long-bone fracture; a visceral injury requiring surgical consultation; a large laceration, degloving injury, or crush injury; large burns; or any other injury causing acute functional impairment. Physicians may also classify any injury as distracting if it is thought to have the potential to impair the patient's ability to appreciate other injuries.

APPENDIX B: Canadian C-Spine Rule (6)

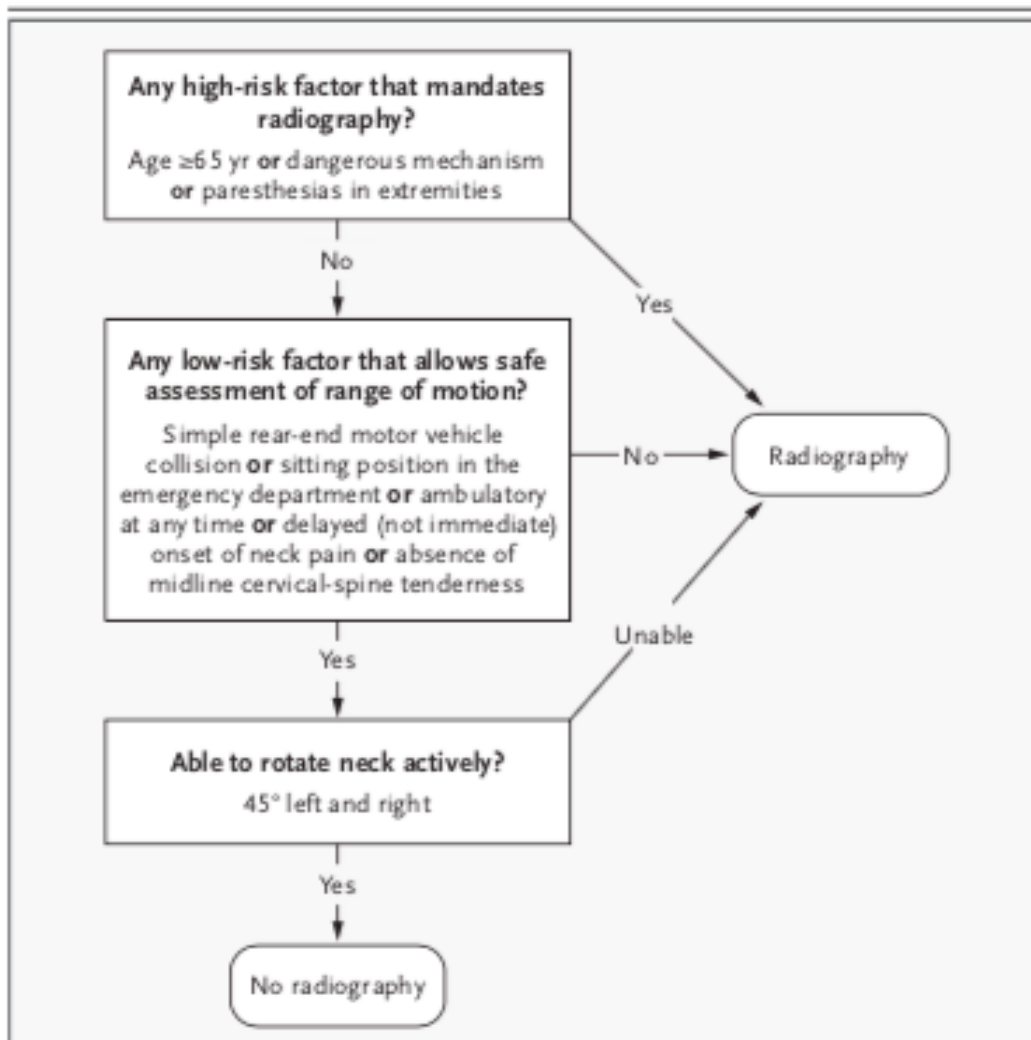


Figure 1. The Canadian C-Spine Rule.

For patients with trauma who are alert (as indicated by a score of 15 on the Glasgow Coma Scale) and in stable condition and in whom cervical-spine injury is a concern, the determination of risk factors guides the use of cervical-spine radiography. A dangerous mechanism is considered to be a fall from an elevation ≥3 ft or 5 stairs; an axial load to the head (e.g., diving); a motor vehicle collision at high speed (>100 km/hr) or with rollover or ejection; a collision involving a motorized recreational vehicle; or a bicycle collision. A simple rear-end motor vehicle collision excludes being pushed into oncoming traffic, being hit by a bus or a large truck, a rollover, and being hit by a high-speed vehicle.

REFERENCES

- ¹ Ajani, A., Cooper D., Chinese C. Optimal Assessment Of Cervical Spine Trauma In Critically Ill Patients: A Prospective Evaluation. *J Trauma* 1998; 26:487-491.
- ² Morris CG, McCoy E. Cervical Immobilization Collars In The ICU, Friend Or Foe? *Anesthesia* 2003;58:1051-1053
- ³ Hoffman JR et al. Validity Of A Set Of Clinical Criteria To Rule Out Injury To The Cervical Spine In Patients With Blunt Trauma. *N Engl J Med* 2000; 343 94-99
- ⁴ Stiell IG et al. The Canadian C-spine Rule For Radiography In Alert And Stable Trauma Patients. *JAMA* 2001; 286: 1841-1848
- ⁵ Stiell IG et al. The Canadian C-Spine Rule versus the NEXUS Low-Risk Criteria In Patients With Trauma. *N Engl J Med* 2003; 349: 2510-8
- ⁶ Moser N, et al. Validity and reliability of clinical prediction rules used to screen for cervical spine injury in alert low-risk patients with blunt trauma to the neck: part 2. A systematic review from the Cervical Assessment and Diagnosis Research Evaluation (CADRE) Collaboration. *Eur Spine J*. 2018 Jun;27(6):1219-1233.
- ⁷ EAST: Como JJ, et al, Cervical Spine Injuries Following Trauma, *J Trauma* 2009; 67(3): 651-9
- ⁸ Leypold B.G., Flanders A.E., Burns A.S. The Early Evolution of Spinal Cord Lesions on MR Imaging Following Traumatic Spinal Cord Injury. *Am Journal of Neuroradiology*. 2008 May;29(5):1012-6
- ⁹ Schuster R, Waxman K, Sanchez B, et al. Magnetic resonance imaging is not needed to clear cervical spines in blunt trauma patients with normal computed tomographic results and no motor deficits. *Arch Surg*. 2005; 140:762-766.
- ¹⁰ Daffner RH, Weissman BN, Wippold FJ, Angtuaco EJ, Appel M, Berger KL, Cornelius RS, Douglas AC, Fries IB, Hayes CW, et al. ACR appropriateness criteria: suspected spine trauma. *American College of Radiology*. 2012:1Y23.
- ¹¹ Insko EK, Gracias VH, Gupta R, Goettler CE, Gaieski DF, Dalinka MK. Utility of flexion and extension radiographs of the cervical spine in the acute evaluation of blunt trauma. *J Trauma*. 2002; 53:426-429.
- ¹² EAST: Patel, MB et al. Cervical Spine Clearance In The Obtunded Adult Blunt Trauma Patient: A systematic Review And Guideline From The Eastern Association For The Surgery Of

Trauma. *Journal of Trauma and Acute Care Surgery*. 2015: 78:430-441.

¹³ Jeanmonod R, Varacallo M. Geriatric Cervical Spine Injury. [Updated 2022 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470375/>

¹⁴ Touger M et al. Validity of a decision rule to reduce cervical spine radiography in elderly patients with blunt trauma. *Ann Emerg Med*. 2002; Sep;40(3):287-93

¹⁵ Evans D, et al. Application of national Emergency X-Ray Utilizations Study low-risk c-spine criteria in high-risk geriatric falls. *AJEM*. 2015;Sep;33(9) 1184-7.

¹⁶ Goode T, Young A, Wilson SP, Katzen J, Wolfe LG, Duane TM. Evaluation of cervical spine fracture in the elderly: can we trust our physical examination? *Am Surg*. 2014 Feb;80(2):182-4.

¹⁷ Denver D, Shetty A, Unwin D. Falls and Implementation of NEXUS in the Elderly (The FINE Study). *J Emerg Med*. 2015 Sep; 49(3):294-300.

¹⁸ Drew J, Chou VB, Miller C, Borg B, Ingalls N, Shackleford S. Clearing the Cervical Spine in a War Zone: What Other Injuries Matter? *Mil Med* 2015 Jul;180(7):792-7.

¹⁹ Rose MK, Rosal LM, Gonzalez RP, Rostas JW, Baker JA, Simmons JD, Frotan MA, Brevard SB. Clinical clearance of the cervical spine in patients with distracting injuries: It is time to dispel the myth. *J Trauma Acute Care Surg*. 2012 Aug;73(2):498-502

²⁰ Khan AD, Liebscher SC, Reiser HC, Schroeppe TJ, Anstadt MJ, Bosarge PL, Carroll SL, Quick JA, Barnes SL, Sobrino J, Murry J, Morin N, Gomez M, Consani H, Gonzalez RP. Clearing the cervical spine in patients with distracting injuries: An AAST multi-institutional trial. *J Trauma Acute Care Surg*. 2019 Jan;86(1):28-35.

²¹ Martin MJ, Bush LD, Inaba K, Byerly S, Schreiber M, Peck KA, Barmparas G, Menaker J, Hazelton JP, Coimbra R, Zielinski MD, Brown CVR, Ball CG, Cherry-Bukowiec JR, Burlew CC, Dunn J, Minshall CT, Carrick MM, Berg GM, Demetriades D, Long W; WTA C-Spine Study Group. Cervical spine evaluation and clearance in the intoxicated patient: A prospective Western Trauma Association Multi-Institutional Trial and Survey. *J Trauma Acute Care Surg*. 2017 Dec;83(6):1032-1040.

General Resources:

ACS TQP Best Practices Guidelines: Spine Injury

https://www.facs.org/media/k45gikqv/spine_injury_guidelines.pdf