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# Cervical Spine Injury Guidelines

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## Disclosures

**Nothing to Disclose**



## Objectives

Review the types of cervical spine injuries

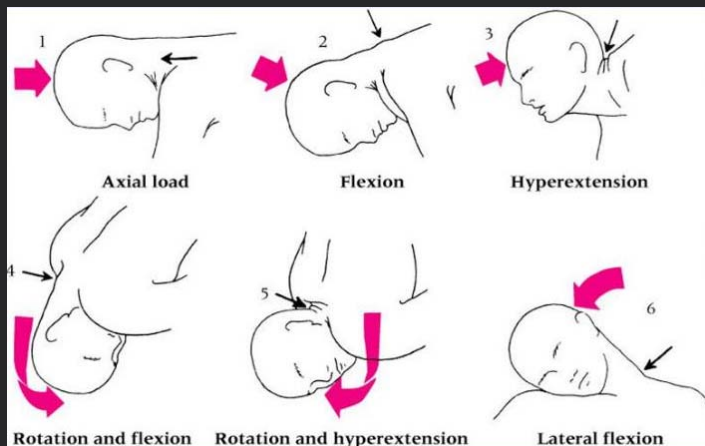
Understand guidelines for cervical spine imaging

Discuss the methods and pros vs cons of cervical spine immobilization

## Cervical Spine Injuries

### Types of C-spine injuries

- Main injury mechanisms
  - Axial Load
  - Flexion
  - Extension
  - Rotation
  - Lateral Flexion



## Cervical Spine Injuries

### Fracture Patterns

Flexion: most common mechanism

- Anterior atlantoaxial subluxation
- Anterior subluxation (hyperflexion sprain)
- Anterior wedge fracture
- Clay-shoveler fracture
- Flexion teardrop fracture
- Bilateral facet dislocation
- Hyperflexion fracture-dislocation



## Cervical Spine Injuries

Lateral flexion

- Unilateral occipital condyle fracture
- Lateral mass C1 fracture

Flexion-rotation

- Unilateral facet dislocation
- Rotatory atlantoaxial dislocation

Extension

- Hangman fracture
- Extension teardrop fracture
- Posterior arch C1 fracture
- Posterior atlantoaxial subluxation



## Cervical Spine Injuries

### Extension-rotation

- Articular pillar fracture <sup>5</sup>
- Floating pillar

### Axial loading/compression

- Burst fracture (with axial loading)
- Jefferson fracture

### Complex injuries

- Atlantooccipital dissociation (shearing)
- Occipital condyle fracture
- Odontoid process fracture



## Cervical Spine Injuries

- General indicators of instability include:
  - more than one vertebral column involvement
  - increased or reduced intervertebral disc space height
  - increased interspinous distance
  - facet joint widening
  - vertebral compression greater than 25%

## Cervical Spine Imaging

### Who needs imaging?

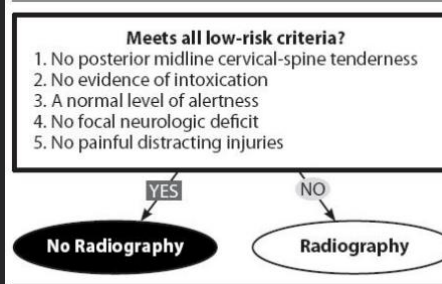
- Rule out badness
  - Stable vs Unstable
  - +/- Neurologic deficit
- CT vs X-rays vs MRI
- Who do we need to worry about?
- Who do we NOT need to worry about?



## NEXUS

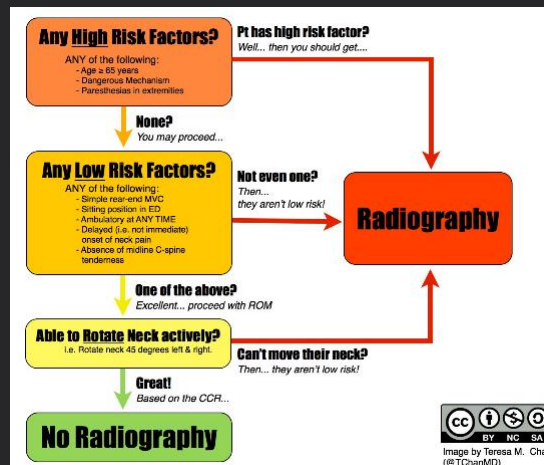
- Inclusion Criteria
  - Blunt neck trauma
- 99.6% sensitive for clinically important injury
- 12.9% specific
- Unlike Canadian C-spine rule, not age-stratified (only 8.6% elderly)
- **Imaging NOT necessary if:**
  - **No midline cervical tenderness**
  - **No focal neurologic deficits**
  - **Normal alertness**
  - **No intoxication**
  - **No painful distracting injury**

Figure 11. National Emergency X-Radiography Utilization Study (NEXUS) Criteria



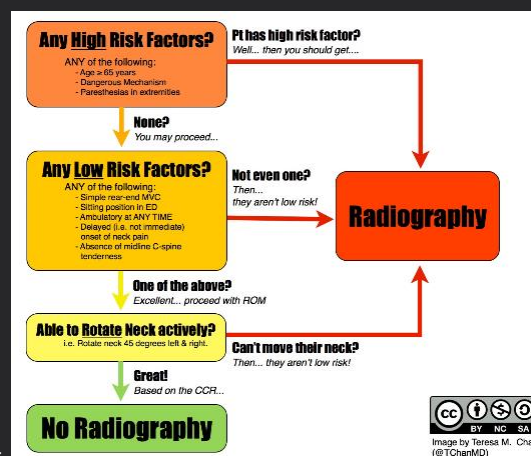
## Canadian C-Spine Rule

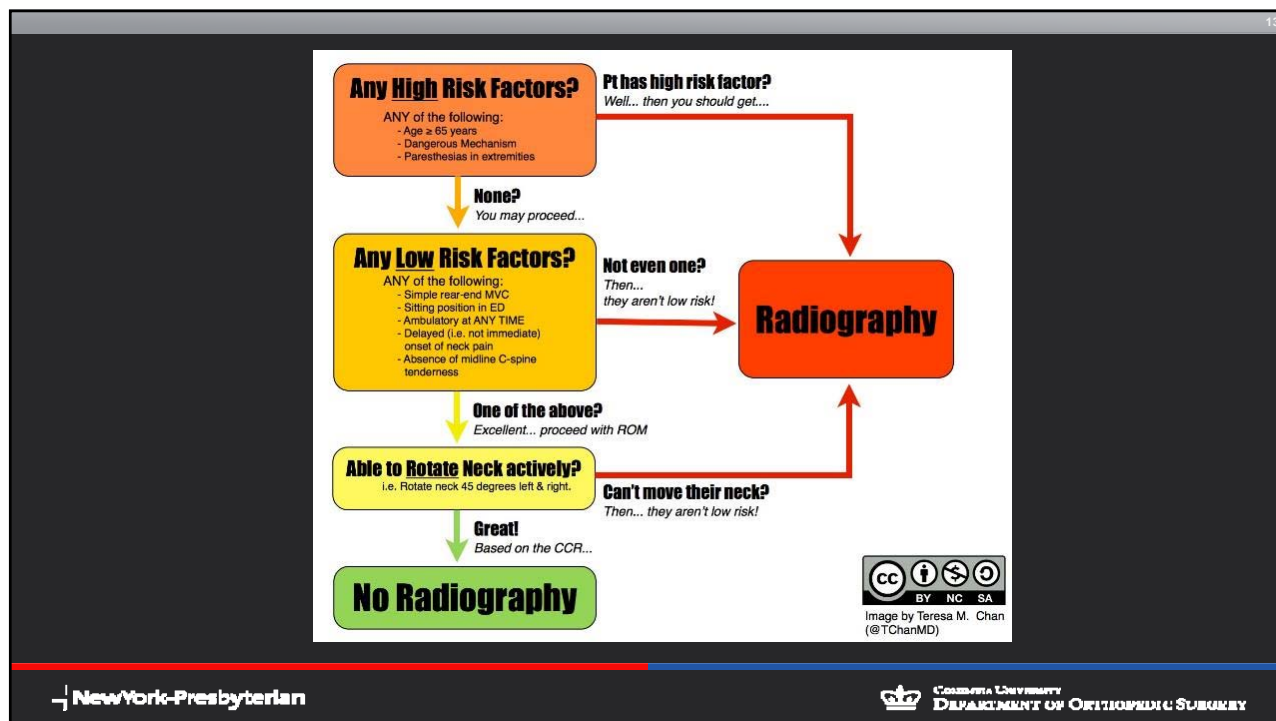
- Inclusion
  - GCS = 15
  - Stable VS (SBP > 90, RR 10-24/min)
  - Stable blunt neck trauma
    - > Neck pain based on MOI
    - > No neck pain but with visible injury above clavicles, non-ambulatory, and dangerous mechanism
- Exclusion:
  - Non-trauma or minor trauma
  - Penetrating trauma
  - GCS < 15
  - Hemodynamically unstable
  - Age < 16
  - Pregnancy
  - Acute paralysis
  - Previous spinal disease or surgery
  - Injury >48 hours prior



## Canadian C-Spine Rule

- C-spine can be cleared if 3 criteria are met:
  - NO high-risk factors
    - > Age > 65
    - > Dangerous mechanism
    - > Paresthesias in extremities
  - ANY low-risk factor
    - > Simple rear-end MVC
    - > Delayed onset of pain
    - > Sitting position in ED
    - > Ambulatory at any time
    - > Absence of midline c-spine tenderness
  - ROM
    - > Able to rotate 45 degrees to left and right





## Canadian C-spine Rule

- 100% sensitivity and 42.5% specificity for identifying clinically important c-spine injuries
  - “Clinically important” = Fracture, dislocation, or ligamentous instability which requires stabilization or specialized follow-up
  - Not clinically important
    - > Avulsion fracture of osteophyte
    - > Isolated transverse process fracture involving facet joint
    - > Isolated spinous process fracture not involving lamina
    - > Simple compression fracture (<25% vertebral body height)





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## Cervical Spine Immobilization


Traditional practice is to assume the worst and take every precaution

- Manual in-line stabilization
- Rigid cervical collar
- +/- Hard backboard, side blocks, straps

Does this make sense?

- What is the goal?
  - Prevent further harm
    - Creation or worsening of neurologic deficit
- Are we achieving our goal?

### C Collars





Philadelphia

Miami J

Soft

Aspen

 NewYork-Presbyterian
 Cornell University  
DEPARTMENT OF ORTHOPAEDIC SURGERY



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## Cervical Spine Immobilization

- **Rationale:**
  - Injured patients may have unstable spinal injury
  - Need to immobilize to prevent further harm
  - Cervical collars provide this immobilization, preventing further injury
- **What's the real story?**

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## Cervical Spine Immobilization

### 4 Types of patients

- Uninjured (96%)
- Stable cervical spine fracture (3%)
- Unstable cervical spine fracture with neurologic deficit
- **Unstable cervical spine fracture without neurologic deficit**

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## Cervical Spine Immobilization

### Taking a closer look

- 1-5 million patients per year in US receive spinal immobilization
  - Rate of c-spine fracture is 2-5%
  - Unstable injuries are 1-2%
    - Of these, most already had neurologic deficits on arrival

**True cervical spine injuries with neurologic deficits are rare, and those that only develop deficits later are even more rare**

- 41 case reports
  - 30 with no identifiable triggers, 1 after removal of collar, multiple **after collar placement**

**Most patients cannot benefit from immobilization.**

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## Cervical Spine Immobilization

### What is “immobilization”?

- Seven cervical vertebrae
  - “Splint from joint above to joint below”?
- Correctly fitted cervical collars allow:
  - 30 degrees flexion/extension
  - 16 degrees lateral bending
  - 27 degrees of rotation
- Cervical collars don’t reduce movement in cadavers with unstable fractures (Horodyski, et al)
- Even internal fixation does not eliminate all movement



**Goal is not to prevent any and all neck movement. At best, aim is “spinal motion restriction”.**

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## Cervical Spine Immobilization

Would external immobilization be helpful?

- Cervical fractures occur with >2000-6000 Newtons of force
- 4kg head hanging free to gravity generates ~40 Newtons of force
- Awake patients with injuries will spontaneously protect their necks
- Unlikely that small, low-speed movements are enough to cause additional injury

Eliminating neck movement likely will not benefit any type of patient

Non-immobilized patients do not have worse neurologic outcomes (Hauswald, et al, 1998).

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## Cervical Spine Immobilization

The flip side: what harm are we doing?

- C-collars are **uncomfortable**
- Increase **intracranial pressure** and decrease venous return
- Increase **aspiration risk**, especially in patients who may vomit
  - Difficult to open mouth
  - Difficult to swallow
- **Difficulty managing airway**
  - Increased **intubation time** in patients presenting to EDs in c-collars
  - Additional **respiratory compromise** – 15% decreased FEV1 with backboard and collar
- **Delay in treatment**
- **Cost**
  - Materials, as well as down-stream testing to “clear” collar



## Cervical Spine Immobilization

What should we be doing?

A more “common sense” approach

- Limit spinal motion and protect patient in transport
- Special attention to patients with altered mental status, significant mechanisms, or neurologic symptoms
  - Prehospital use of CCR
- Allow awake, alert patients with no neurologic symptoms to transport in position of comfort

Spinal Immobilization				
	No Neck Pain or Tenderness	Neck Pain or Tenderness	Neuro Signs or Symptom	Altered Mental Status
Ambulatory	Position of Comfort	Gurney Position of Comfort with/without Support	Full	Position of Comfort
Non-ambulatory	Position of Comfort	Gurney supine Position of Comfort with extrication support	Full	Full

## Summary

- True spinal injuries are rare but potentially devastating
- Traditional immobilization does not come without adverse effects
- Applying rigid immobilization in extremely low- or no-risk situations subjects patient to potential harm and minimal, if any, benefit
- “Spinal motion restriction” and careful transfer/transport likely to provide equally effective protection without associated harms in most cases
- Higher level of concern and protection valid for patients who are **unconscious**, have **neurologic deficits**, or **severe mechanisms** of injury

## References

- Shafer, J, Naunheim, R, West, J, "Cervical Spine Motion during extrication: A pilot study" J Emerg Med 2009.
- Hauswald M, Ong G, Tandberg D, Omar Z. "Out-of-hospital spinal immobilization: its effect on neurologic injury." Acad Emerg Med, 1998; 5: 214-9.
- Rhee P, Kuncir EJ, Johnson L, et al. Cervical spine injury is highly dependent on the mechanism of injury following blunt and penetrating assault. J Trauma, 2006; 61: 1,166-70
- Stroh, G, Braude, D "Can an out-of-hospital cervical spine clearance protocol identify all patients with injuries? An argument for selective immobilization", Annals of Emergency Medicine, Jun 2001;37(6):609-15.
- Domeier, R, Frederiksen, S, Welch, K, "Prospective Performance Assessment of an Out-of-Hospital Protocol for Selective Spine Immobilization Using Clinical Spine Clearance Criteria", Annals of Emergency Medicine, Aug 2005;46(2):123-31
- Burton, J, Dunn, M, et al "A Statewide, Prehospital Emergency Medical Service Selective Patient Spine Immobilization Protocol", Journal of Trauma and Acute Care Surgery, July 2006; 61(1):161-7
- Luscombe MD, Williams JL. Comparison of a long spinal board and vacuum mattress for spinal immobilisation. Emerg Med J, 2003; 20: 476-8
- Vaillancourt, C, Charette, M, et al "Evaluation of the safety of C-spine clearance by paramedics: design and methodology", BMC Emergency Medicine, 2011; 11:1
- Conrad, B, Marchese, D, et al "Motion in the Unstable Cervical Spine When Transferring a Patient Positioned Prone to a Spine Board", J Athl Tr, Nov-Dec 2013; 48(6):797-803
- Horodyski M, DiPaola CP, Conrad BP, Rehtine GR., "Cervical collars are insufficient for immobilizing an unstable cervical spine injury." J Emerg Med. 2011;41(5):513-519.
- Ben-Galim P, Dreifangel N, Mattox KL, et al. "Extrication collars can result in abnormal separation between vertebrae in the presence of a dissociative injury." J Trauma. 2010;69(2):447-450.

## Questions?



AMAZING  
THINGS  
ARE  
HAPPENING  
HERE

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