







Objectives

- + Discuss the practice and inherent inaccuracy of spinal immobilization based solely on mechanism of injury.
- + Discuss and describe potential clinical findings in patients with unstable cervical spine fractures.
- + Discuss potentially harmful side effects of unnecessary spinal immobilization.
- + Compare and contrast NEXUS criteria and C-spine radiography in ruling out cervical spine fractures.
- + Discuss appropriate C-spine clearance algorithms.

SCI Epidemiology

- + Over 10,00 cases per year in the United States alone
- + Most common causes:
 - Motor vehicle accidents (44.5%)
 - Falls (18.1%)
 - Violence (16.6%) in urban settings
 - Sports injuries (12.7%)
- + 10-20% die before being hospitalized
- + 3% of those hospitalized never make it out of the hospital.

Category	Sub-category	Percentage
Self-harm and assault	Self-harm	0%
	Assault	1%
	Other	0%
Sports injuries	Diving	4%
	Tragics	1%
	Horse riding	3%
	Other	3%
Domestic and industrial accidents	Domestic	22%
	Accidents at work	12%
	Other	0%
Road traffic accidents	Car, van, coach, lorry	16.5%
	Motorcycle	20%
	Cycle	5.5%
	Pedestrian	1.5%
	Aeroplane, helicopter	1.5%

The Malayan C-Spine Study

- + Five year retrospective chart review at two university teaching hospitals.
 - University of Malaya
 - University of New Mexico
- + 354 patients seen with SCI
 - None of the 120 Malayan patients were immobilized
 - All of the 334 New Mexico patients were immobilized
- + Neurological disability was less for the Malayan subjects! (11% vs 21%)
- + Conclusion: immobilization has little or no effect on neurologic outcome.

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So Why Do We Immobilize?

- + In theory: to prevent secondary cord injury
 - + Primary cord injury occurs at the time of the accident
 - + Further manipulation makes any potential lesions larger and more severe
 - + Manipulation of unstable fractures may cause a new lesion.
- + In reality:
 - + Tradition
 - + Dogma
 - + Fear of litigation

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Mechanism of Injury

- + Falls of 2-3 times the patient's height
- + Diving injuries/axial loading
- + Vehicle vs. pedestrian MVC
- + Vehicle vs. bicycle or motorcycle MVC
- + MVC injuries:
 - + Speed greater than 40 mph
 - + Rollover
 - + Ejection
 - + Death or serious injury to another occupant
- + Significant trauma above the clavicles

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"No-Neck Fits Everyone" Society

- + Chapters all over the country
- + Use the same size of cervical collar on all patients
- + Cervical collars, *when properly sized*, only limit at most 75% of movement
- + Result is inadequate immobilization

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Other Reasons for Poor Immobilization

- + Inadequate equipment
 - + Not enough straps
 - + Too little padding
 - + Flimsy head immobilizers
- + Difficult environment or conditions
- + Patient combativeness
- + Anatomical abnormalities such as kyphosis
- + Very large or small patients
- + Provider laziness

Immobilized?

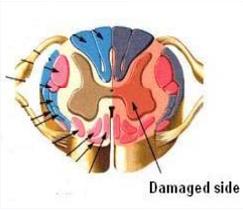
The photograph shows a grey mannequin torso lying on a yellow stretcher. It is secured with several colorful straps: red, blue, black, green, and yellow. The mannequin is positioned on a white surface against a blue background.

Clinical Findings

- + Cervical pain
- + Hemiparesis or hemiplegia
- + Paraparesis or paraplegia
- + Tetraplegia
- + Focal neurological deficits
 - + Brown Sequard Syndrome
 - + Central Cord Syndrome
 - + Anterior cord syndrome
 - + Posterior cord syndrome
 - + Cauda equina lesion
- + Priapism

Brown Séquard Syndrome

- + Usually results from penetrating trauma
- + Loss of function on affected side
- + Loss of pain and temperature sensation on opposite side



Brown Séquard Syndrome



Loss of pain and temperature

Loss of motor function

Anterior Cord Syndrome

- Usually results from bony fragments or pressure on spinal arteries
- Symptoms include:
 - Loss of motor function
 - Loss of pain sensation
 - Loss of light touch sensation
- Some light touch, vibration, motion and proprioception spared

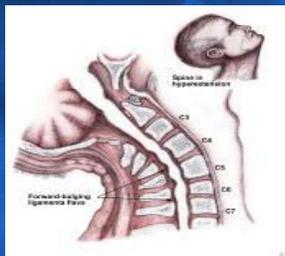


Central Cord Syndrome

- Usually occurs from hyperextension of cervical spine
- Weakness or parasthesia in upper extremities
- Preserved function of lower extremities
- Bladder dysfunction



Central Cord Syndrome



Posterior Cord Syndrome

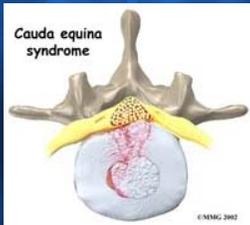
- ✦ Extremely rare
- ✦ Partial loss of proprioception
- ✦ Loss of deep touch sensation
- ✦ Loss of vibratory sensation
- ✦ Theoretically caused by hyperextension

Posterior Cord Syndrome

The diagram illustrates a cross-section of the spinal cord with various sensory and motor pathways. Labels on the left side include: Proprioception, Voluntary motion, Proprioception, Pain, temperature, and Light touch, pressure. Labels at the top and bottom center include: Proprioception, deep touch, vibration and Voluntary motion. The diagram shows the dorsal and ventral horns, and the surrounding meninges.

Cauda Equina Lesion

- ✦ Spinal cord proper ends at L1-L2
- ✦ Lesions may occur from lumbar or sacral fractures
- ✦ Sometimes iatrogenically induced
- ✦ May result in:
 - ✦ Saddle anesthesia
 - ✦ Lower extremity paresthesia
 - ✦ Sciatica
- ✦ Regeneration often possible



Harmful Sequelae

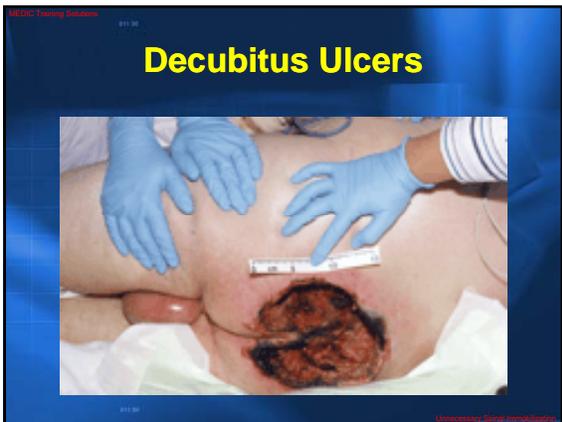
- ✦ Pain / Anxiety
- ✦ Increased intracranial pressure
- ✦ Risk of aspiration
- ✦ Respiratory Decompensation
- ✦ Decubitus ulcers
 - ✦ Occiput
 - ✦ Sacrum
 - ✦ Heels

Pain and Anxiety

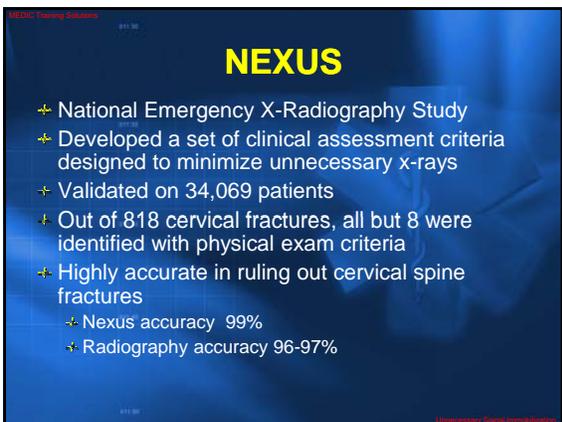
- ✦ Increased myocardial oxygen demand
- ✦ Psychological trauma
- ✦ Loss of sense of control
- ✦ May aggravate compression fractures

Respiratory Decompensation

- ✦ Supine immobilization results in 15-20% reduction in respiratory capacity
- ✦ Potential for airway compromise
- ✦ At risk:
 - ✦ Obese patients
 - ✦ Congestive heart failure patients







NEXUS Exam Criteria

- ✦ Must exhibit *all* of the following
 - ✦ No posterior midline C-spine tenderness
 - ✦ No evidence of intoxication
 - ✦ Normal level of alertness
 - ✦ No focal neurological deficit
 - ✦ No painful distracting injuries

When these things are present, the physical exam is MORE accurate than the x-ray at ruling out a cervical fracture!

Canadian C-Spine Study

- ✦ Off shoot of OPALS
- ✦ 8,924 patients
- ✦ Much the same results as NEXUS, except:
 - ✦ Patients over 65 were at greater risk
 - ✦ Clearer definitions of MOI
 - ✦ Injury above clavicles was greatest determining factor in whether to x-ray or not in high MOI cases

So, What Is a Distracting Injury?

- ✦ Any injury that interferes with the provider's assessment
- ✦ Any painful injury that distracts the patient from participating with the exam

The Maine Experience

- Implemented a spinal clearance algorithm for all EMS providers in 2002
- 16,019 EMS trauma transports
- 7,014 (44%) were immobilized
- 86 transported patients had spinal fractures
 - 12 were not immobilized (14%)
 - 11 stable fractures, 1 unstable T-spine fracture
 - The one unstable fracture had no permanent neurological deficits

Adjuncts To Improve Alignment And Comfort



So That We No Longer See Sights like This...



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Summary

- ✦ MOI is a poor predictor of C-spine injury
- ✦ Many EMS protocols require unnecessary immobilization
- ✦ Immobilization itself can have harmful consequences
- ✦ Physical exam criteria are sufficient in ruling out most cervical spine injuries

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Questions?

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www.kellygrayson.com
www.ambulancedriverfiles.blogspot.com
