Protocol Directed Torture:
Unnecessary Spinal Immobilization

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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 10,000 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.

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 subject (11% vs 21%)
- Conclusion: immobilization has little or no effect on neurologic outcome.
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

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

“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
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
Clinical Findings
- Cervical pain
- Hemiparesis or hemiplegia
- Paraparesis or paraplegia
- Tetraplegia
- Focal neurological deficits
  - Brown Séquard 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
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

- Proprioception
- Deep touch, vibration
- Voluntary motion
- Light touch, pressure
- Pain, temperature

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 parasthesia
  - 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
Decubitus Ulcers

NEXUS

- National Emergency X-Radiography Study
- Developed a set of clinical assessment criteria designed to minimize unnecessary x-rays
- Validated on 34,069 patients
- Out of 818 cervical fractures, all but 8 were identified with physical exam criteria
- Highly accurate in ruling out cervical spine fractures
  - Nexus accuracy 99%
  - Radiography accuracy 96-97%
**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

Unnecessary Spinal Immobilization

- 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…
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

Questions?

Bibliography

- Dawodu S. Spinal Cord Injury: Definition, Epidemiology, Pathophysiology. www.emedicine.com
Bibliography