To Backboard or Not to Backboard? That is the Question!

Selective Spinal Immobilization

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Affiliations

- Medical Director for:
  - Grand Teton National Park
  - Teton County Search and Rescue
  - Jackson Hole Fire / EMS

* No financial or other conflicts to declare.
Objectives

✓ Anatomy and Injuries
✓ Current Standard of Care and Protocols
✓ Review research on spine injuries and treatment
✓ Implementing Selective Spinal Immobilization protocols into your system
CASE

✓ 32 y.o. female in snowmobile accident
  ✓ Severe Low Back Pain

✓ EMS/SAR Callout
  ✓ Helicopter - Snowmobile Ground Backup
Case

✓ Alert, Normal Vital Signs
✓ Isolated lumbar back pain (midline)
✓ Neurological exam intact
Case

✓ Can you ‘clear the spine’?
Case

✓ Logistics of Rescue

✓ 1130 Incident Time

✓ 1345 Helicopter Arr

✓ 2 hr 15 min

✓ 1420 At Hospital

✓ 3 hours

✓ Ground Time (+4hrs)
Case

✓ Spinal Immobilization
✓ IV Morphine, Compazine
✓ Helicopter transport to hospital
Spine

✓ C - Spine (7)
✓ 55% of spine injuries
✓ T - Spine (12)
✓ L - Spine (5)
✓ Sacrum/Coccyx (5/4)

✓ 28% Have 2nd Fx
Injuries

✓ Bones
✓ Ligaments
✓ Cord
  ✓ SCIWORA

✓ BLUNT
✓ Penetrating
Spinal Cord Syndromes

- Anterior Cord Syndrome - flexion injury
  - C5-6 (poor prognosis)
  - Paraplegia and loss of pain and temp
- Central Cord Syndrome - fall forward with hyperextension
  - Loss of motor greater in upper than lower extremities - variable sensory loss
Spinal Cord Syndromes

✓ Brown-Sequard Syndrome - hemisection of the cord (penetrating trauma)

✓ Ipsilateral motor (hemiplegia) and position sense loss

✓ Contralateral (2 levels below) sensory loss (pain and temperature)
Stable vs. Unstable

**Stable**

- Fracture unlikely to allow further injury
- Spinous/Transverse Processes

**Unstable**

- May allow future cord injury
Dermatomes

**SENSORY**

☑️ C6 - Thumb
☑️ T4 - Nipple
☑️ T10 - Umbilicus
☑️ L1 - Inguinal
☑️ L4 - Great Toe
☑️ S4 - Anus
Motor Levels

- C3-Diaphragm
- C5-Deltoid
- C6-Wrist Extensors
- C7-Elbow Extensors
- C8-Finger Flexors
- T1-Finger Abductors

- L2-Hip Flexors
- L3 - Knee Extensors
- L4-Ankle Dorsiflexors
- L5-Great Toe Extensors
- S1-Plantar Flexors
Terminology

- Spinal Immobilization
- Spine Stabilization
- (In Line Traction)
- Spinal Motion Restriction
- Spinal Clearance Protocols
- Focused Spine Assessment
- Selective Spinal Immobilization
Spinal Immobilization

- 1960-1970’s
  - EMS Standards Developed
  - Consensus and Common Sense
- Thought to be best patient practice
  - Severe Low Back Pain Thought to be best practice
- MAST Pants, Massive IVF in trauma
Who needs to be immobilized?
Even if they walked away from this?
Spinal Immobilization

✓ Do we immobilize for:
  ✓ Mechanism of Injury (MOI)?

or

✓ Symptoms and/or Physical findings?
Spinal Immobilization

- Little Research
- Never been shown to improve outcomes
Malaysian - New Mexico Study

✔ Hauswald, Acad Emerg Med 1998

✔ 5 yr retrospective chart review of 2 university hospitals

✔ Less neurologic disability in unimmobilized Malaysian patients

✔ Disproves many theories that previously justified widespread spine immobilization
Malaysian - New Mexico Study

✓ Primary injury done at time of impact
✓ Subsequent movements do little harm
✓ C-spine fractures = >2,000 to 6,000 N
✓ L-spine fractures = >4,200 N
✓ Head off the end of stretcher = 40 N
Spinal Immobilization

✓ BUT - Standard of Care (in United States)

✓ One of the most common EMS procedures

✓ Millions of patients immobilized each year

✓ Not necessarily the standard in other parts of the world
Most Current EMS protocols

✓ Apply spinal immobilization to all patients with potential for spine injury based on mechanism of injury

✓ If in doubt - IMMobilize!!!
The Research

✓ No Double-Blind Randomized Controlled Trial to assess spinal immobilization

✓ Kwan, Cochrane Database #2803
  2001/2007
The Research

- NEXUS
  - Hoffman, et. al. NEJM, July 2000
- Canadian C-spine Rule
  - Stiell, et. al. JAMA, Oct 2001
NEXUS

✓ Created a standard of clinical spine clearance in emergency departments

✓ Decreased imaging 12.6%
  (4,309/34,069 pts)
NEXUS

✓ All 5 criteria met = No Xray
  ✓ NO midline cervical tenderness
  ✓ NO focal neurological defect
  ✓ Normal alertness
  ✓ NO intoxication
  ✓ NO painful distracting injury
Canadian C-spine Rule

✓ Provides another clinical spine clearance pathway
✓ Slightly different protocol - more if/then
  ✓ Age listed as a factor (> 65 yo)
  ✓ Mechanism still plays a role
  ✓ Range of motion of neck - final test
The Canadian C-Spine Rule
For alert (GCS > 15) and stable trauma patients where cervical spine injury is a concern

1. Any High-Risk Factor Which Mandates Radiography?
   - Age > 65 years
   - Dangerous mechanism*
   - Paresthesias in extremities

   **No**

2. Any Low-Risk Factor Which Allows Safe Assessment of Range of Motion?
   - Simple rearend MVC **
   - Sitting position in ED
   - Ambulatory at any time
   - Delayed onset of neck pain ***
   - Absence of midline c-spine tenderness

   **No**

   **Yes**

3. Able to Actively Rotate Neck?
   - 45° left and right

   **Able**

   **No Radiography**

   **Unable**

   **Yes**

   **Radiography**

* Dangerous Mechanism:
  - Fall from elevation > 3 feet / 5 stairs
  - Hit head to head, e.g., diving
  - MVC high speed (> 100km/hr), rollover, ejection
  - Motorized recreational vehicles
  - Bicycle collisions

** Simple Rearend MVC Excludes:
  - Pushed into oncoming traffic
  - Hit by ice / large truck
  - Rollover
  - Hit by high speed vehicle

*** Delayed:
  - i.e., not immediate onset of neck pain

www.caep.ca
Actual Cord injury in most studies is well under 1%
Taking this to the field...

- ✓ Urban EMS
- ✓ Rural EMS
- ✓ Wilderness EMS
Urban EMS

✓ Rapid Transport
  ✓ Less than 15 minutes
  ✓ Present to emergency departments
    ✓ Spine clearing protocols
      ✓ NEXUS, Canadian C-Spine Rule
    ✓ Xrays or CTs
Rural EMS

✓ Prolonged Transport
  ✓ 15 minutes to 1-2 hours
  ✓ Air Bed, vacu-mattress, padding
  ✓ Early stage 1 Decubitis Ulcers (redness)

✓ Pt. uncomfortable, no provider risk
Wilderness EMS

- Extended Transport
- 2 Hours to Days
- Risks of Spinal Immobilization
  - Decubitus ulcers, pt. discomfort
  - Airway concerns - vomit, blood, etc.
  - Extrication problems, rescuer risks
- Risk vs. Benefit of Spinal Immobilization
Stratify Risks

✓ Evidence Based Wilderness Medicine
✓ No Double Blind, Randomized Controlled Trials
✓ Extrapolate data from urban settings
✓ Anecdotal
✓ Actual number of neurologically significant spinal injuries is very small
Focused Spine Assessment

✓ WMI (NOLS)
✓ WMA
✓ SOLO
Focused Spine Assessment

- Mechanism of Injury (Required)
- Reliable Patient
  - NO distracting injury, NO intoxication
- NO Spine Tenderness (midline)
- Normal Neurological Exam
  - Sensory - Sharp/Dull
Wilderness Spine Injuries

✓ To Backboard or Not To Backboard
  ✓ Hours to Days

✓ If unsafe - Move, Move, MOVE!!!
  ✓ Extreme patient/rescuer risk
Wilderness Settings - High Angle
Wilderness Settings - Cave
Wilderness Settings - Swiftwater
Wilderness Settings - Swiftwater
Wilderness Settings - Avalanche
Wilderness Settings - Snowmobile
Wilderness Settings - Combat Zone
Prolonged Care Considerations

- Padding - Pain Control
- Bend Knees (MORE PADDING!!)
Padding
Prolonged Care Considerations

✓ Hydration / Urination / Defecation
Prolonged Care Considerations

✓ Selective immobilization

✓ Lumbar Injury - Leave Head Free
Flight EMS

- Patients cleared in referral ED by CT and board certified EM/Trauma physicians
- Re-immobilized for transfer to trauma centers (because of protocol)
Why change what we’re doing?

- Patient comfort
- Airway compromise
- Vomit, blood, position
- Breathing compromise
- Skin Compromise
- Patient/Provider safety in technical settings
Some places have...

- Maine
- Michigan
- California
- National Park Service
- Jackson Hole, WY
- Malaysia (by default)
Selective Spinal Immobilization

Protocol Implementation

✓ Review Research
  ✓ References are a start
  ✓ Do your own search as well!!

✓ Medical Director / Medical Control Support
  ✓ Critical for success
Selective Spinal Immobilization

Protocol Implementation

- Review Established Protocols
  - State of Maine
  - National Park Service
  - Others

[Image of medical personnel working on a patient]
State of Maine

Figure 1. 2002 Maine EMS Spine Assessment Protocol.

Mechanism of Injury: Axial load (diving), blunt trauma, MVC* or bicycle, fall/tilt, adult fall from standing ht.

Don’t Immobilize

- No

Immobilize

- Yes
- Spine Pain/ Tenderness?
  - Yes
- Abnormal Sensory/Motor Exam?
  - No
- Disturbing Injury?***
  - No
- Unreliable? ***
  - Yes
- Intox/Alc/LOC/ Acute Stress Reaction
  - No

* MVC applies to crashes of all motorized vehicles: e.g. automobile, motorcycle, snowmobile, etc.
** Clearance of the spine requires the patient to be calm, cooperative, sober, and alert.
*** Disturbing injury includes any injury that produces clinically apparent pain that might distract the patient from the pain of a spine injury – pain would include medical as well as traumatic etiologies of pain.

This protocol may be used by MEMS licensees, at the AA level or above, who have successfully completed the MEMS Spine Injury Management Course.

www.maine.gov/dps/ems
## Spine Immobilization

**Scope of practice:** EMT, Parkmedic

**Indications:** Spinal immobilization is indicated for any patient with a history of trauma or found in the setting of potential trauma (including near-drowning) who meets any of the following criteria:

1. **Unstable Patient:** See Adult and Pediatric Major Trauma Protocols
2. **Pain:** Complaining of neck or back pain (without language barrier)
3. **Tenderness:** Midline posterior neck or back tenderness
4. **Altered mental status:** either GCS less than 15 or evidence of intoxication (drugs or alcohol)
5. **Distracting injury:** Any injuries which appear to be distracting patient from identifying neck or back pain (ex: major fractures)
6. **Neuro deficit:** Any numbness, tingling or weakness not obviously explained by a co-existing extremity fracture
7. **Restricted or painful range of motion:** if a patient meets none of the above 5 criteria then they should be asked to move their head slowly from side to side and forward and backwards. If they are unable/unwilling to do so or describe pain or numbness/tingling in their arms or legs they should be immobilized.

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**NPS EMS Field Manual, Version 02/05, Procedure 1150**
Selective Spinal Immobilization

Protocol Implementation

✓ Develop protocol that works for your system
✓ Age > 65 get a collar only? Backboard?
✓ Pediatrics excluded?
Selective Spinal Immobilization

Protocol Implementation

✓ Education of EMS providers
✓ Good QA/QI
Pearls

✓ Not everyone with blunt trauma needs spinal immobilization in the ED or in the field.

✓ Selective spinal immobilization can and should be done by prehospital EMS providers.
Questions?

Lecture Notes: www.wildernessdoc.com