Spinal Care for Injured Athletes.......Time for a Change?

Ryan C. Jacobsen MD, EMT-P

Johnson County EMS System Medical Director
Assistant Professor of Emergency Medicine
Truman Medical Center/Children’s Mercy Hospitals and Clinics
Disclosures/Conflicts of Interest

• None
Questions about Spine Boards

• Spineboards/c-collars came about as a result of intensive/rock-solid evidence that showed benefit in injured patients.

• Spineboards/c-collars are comfortable and reduce pain in injured patients.

• Spineboards/c-collars reduce mortality.

• Spineboards/c-collars allow patients to breathe easily.

• Spineboards/c-collars are dogmatic, awful, torture devices used “just because”.
Objectives

• Understand current state of spinal care in EMS and associated dogma.

• Understand the historical perspectives on prehospital spinal care and immobilization in the U.S.

• Review of the evidence/literature surrounding prehospital spinal immobilization.

• Benefits of reducing the use of the long spine board as an immobilization device.

• What about athletes?
What we are NOT talking about.....

• We are NOT clearing C, T-and L-spines in the field.

• We are NOT in any way minimizing or de-emphasizing spinal care.
Scope

Incidence of Spinal Cord Injury is estimated at 40/million/year in the U.S.
   (approx. 11,000 new cases/year)

Almost 40 million EMS calls/year and nearly 30 million transports/year.

Spinal Cord Injury is RARE!
Dogma regarding Spinal Immobilization

- Trauma=unstable spine injury=spinal cord injury=permanent neurological deficit=bad.

- Any additional movement of the neck/back may cause an injury that was not present immediately following the initial trauma...or it may worsen an injury that was there prior to any subsequent medical intervention.

- Further injury is avoided by immobilizing the spine.

- Immobilization of the spine is safe/harmless.

- Medicolegal issues prevent us from changing.
History
History

• Geisler et al. 1966
  • Retrospective study of trauma patients with delayed paralysis.

  • “failure to recognize the injury and protect the patient from the consequences of his unstable spine.” ...regarding an MVC patient with skull fracture in 1955 who had delayed onset of paraplegia T4.

  • “the importance of proper first-aid (by EMS providers in field) was deduced from the fact that 29 patients [in their review] developed further paralysis through faulty handling.”

The Dogma begins....

• Now the medical community believes that trauma patients should be immobilized on rigid devices to minimize the risk of delayed paralysis in the setting of occult spinal column injury.
History Continued

• Farrington, 1968

• Described the placement of a C-collar and a long or short backboard as necessary to keep the head and neck from sagging during extrication.

• The backboard was designed to assist in minimizing spinal movement during complex extrication maneuvers by freeing the hands of rescuers from actively holding spinal precautions.

• The backboard was not initially envisioned to be a long-term device to actually immobilize someone onto after they were extricated.

Farrington DJ. Extrication of Victims. Journal of Trauma. 1968;8(493-512)
The beginning of formal EMS

1971
American Academy of Orthopedic Surgeons (AAOS) published first guidelines for EMS. *Emergency Care and Transportation of the Sick and Injured.*

Advocated use of spinal immobilization using a backboard and C-collar for trauma patients with signs and symptoms of spinal injury.
History Continued

• Bohlman, 1979.

• Linked delayed paraplegia, in 100 of 300 hospitalized cervical spine fracture patients, with concern that these injuries were being “under-appreciated”.

• Blamed EMS=inevitable knee jerk response

• Began applying spinal immobilization, using backboards and C-collars, based on mechanism of injury alone.

• Riggins RS, Kraus JF. The risk of neurologic damage with fractures of the vertebrae. J Trauma 1977;17:126-133.
There I Fixed It
Evidence

**NO** randomized controlled studies ever done.

Quality of evidence?
Evidence for HARM

- **Respiratory compromise** (reduces FVC, FEV1 in healthy patients strapped to a board)

- Effect on injured patients? Ptx, pulm contusions, rib fx etc..

Evidence for HARM

• Pressure sores/tissue hypoxia

• Good evidence that even short time periods on board cause tissue hypoxia on contact points as well

• Worse with elderly and severely injured folks who can’t readjust on board (aka spinal cord injured patient!)

Evidence for HARM

• **Increased pain**
  
  Healthy subjects placed on boards developed numerous complaints when on boards for short times (headaches, back, neck pain, dizziness, nausea)

  
  
  
Evidence for HARM

- **Increase in unnecessary radiologic imaging in ED (this is both a cost and radiation risk issue)**

Evidence for Harm

• Hauswald et al. 1998.
• Compared neurologic outcomes of spinal injury patients in New Mexico, where every EMS patient received full, spinal immobilization, to those of spinal injury patients in Malaysia, where none of the EMS patients received spinal immobilization.

The Odds Ratio for disability was higher for patients in the United States (all with spinal immobilization) after adjustment for the effect of all other independent variables (2.03; 95% CI 1.03-3.99; p = 0.04).

The estimated probability of finding data as extreme as this if immobilization has an overall beneficial effect is only 2%. Thus, there is a 98% probability that immobilization is harmful or of no value.

They repeated analysis using only the subset of patients with isolated cervical level deficits. They again failed to show a protective effect of spinal immobilization (OR 1.52; 95% CI 0.64-3.62; p = 0.34).
Evidence for Harm

- Leonard et al. 2012

- Pediatric trauma patients (prospective cohort over 13 months)
  - spinal immobilization was associated with increased pain and radiographic usage and increased admission to the hospital.

  pain score (3 versus 2)
  cervical radiography (56.6% versus 13.4%)
  Admitted (41.6% versus 14.3%).

C-collar HARM

• Do they really immobilize?
• They increase ICP.......that’s bad.
• Airway management?
  • Mouth opening?
  • Respiratory depression?
  • Stretch? Internal decapitation?
Cochrane Review

• “Unwarranted spinal immobilization can expose patients to the risks of iatrogenic pain, skin ulceration, aspiration and respiratory compromise, which in turn can lead to multiple radiographs, resulting in unnecessary radiation exposure, longer hospital stay and increased costs. The potential risks of aspiration and respiratory compromise are of concern because death from asphyxiation is one of the major causes of preventable death in trauma patients.”

• Kwan I, Bunn F, Roberts I. Spinal immobilization for trauma patients. Cochrane Database of Systematic Reviews. 2009;1:1-15
“Current best practices reflect that there are no randomized controlled trials to evaluate the benefits of spinal immobilization in out-of-hospital trauma patients. As a result, current EMS protocols are based principally on historical precedent, dogma and medico-legal concerns, and not on scientific evidence. This situation is further complicated by the reality that such studies will not likely be performed in the future, primarily as a result of perceived legal and ethical concerns. There is, however, a growing body of literature that points to the potential deleterious effects of spinal immobilization, whether or not this modality is applied in an appropriate fashion.”
Evidence for Benefit

• ???
We have assumption that LSB’s/C-collars actually immobilize the spine.....
3 points of contact for LSB

- Occiput
- T-spine
- Sacrum
We painted a student....
Then carefully laid them on a LSB
Then lifted the student off...
160lbs Male on Tactilius Sensor Pad

No Pad
Competitor’s Gel

Pro-Tech Back Board Pad
Limitations of Studies on Long Spine Boards

• Studies on the effectiveness of backboards as an immobilization device have only included cooperative patients, healthy volunteers, and cadaver models; no study has been done evaluating patient resistance and its effect on the spine.
What about Scoop Stretchers

- Del Rossi et al. 2010
- Scoop Stretchers and the “lift and slide” technique were able to restrict motion of the spine as well as the log-roll technique with long board.

What Extrication Technique Causes Least Spine Movement?

• Cervical Spine Motion During Extrication. A Pilot Study

• They used motion capture video to look at motion of spine during different techniques of extrication from car.
Extrication techniques and Spine Motion

4 Different Techniques were compared

1. The patient was allowed to exit the vehicle on their own and lie on a backboard.

2. The patient was allowed to exit the vehicle on their own with a C-Collar in place and lie on a backboard.

3. The patient was extricated head first via standard technique by two paramedics with a C-Collar alone. (Standard technique involves turning the driver so that the legs are in the passenger’s seat, allowing the driver to lie back and raising the right hip so a long board can be placed under the hip. A second paramedic who enters the front seat passenger’s door helps slide the patient up on to the board.)

4. The patient was extricated head first via standard technique by the two paramedics with a C-Collar and a KED.
Author Conclusions?

• “Ultimately, we documented the least movement of the cervical spine in subjects who had a cervical collar applied and were allowed to simply get out of the car and lie down on a stretcher.”
Extrication techniques on Spine Movement

Dixon M, O'Halloran J, Cummins NM.

METHODS:
A crew of two paramedics and four fire-fighter first responders extricated a simulated patient from a prepared motor vehicle using nine different extrication techniques. The patient was marked with biomechanical sensors and relative movement between the sensors was captured via high speed infrared motion analysis cameras. A 3D mathematical model was developed from the recorded movement.

RESULTS:
Control measurements were taken from the patient during self-extrication and movement was recorded of 4.194° left of midline (LOM) to 2.408° right of midline (ROM) resulting in a total movement of 6.602°. The least deviation recorded during equipment aided extrication was movement of 3.365° LOM and 8.352° ROM resulting in a total movement of 11.717°. The most deviation recorded during equipment aided extrication was movement of 1.588° LOM and 24.498° ROM resulting in a total movement of 26.086°.

CONCLUSIONS:
Conventional extrication techniques record up to four times more cervical spine movement during extrication than controlled self-extrication. This proof of concept study demonstrates the need for further evaluation of current rescue techniques and the requirement to investigate the clinical and operational significance of such movement.
Ambulance Cots are essentially Padded Long Spine Boards

- Once the patient is secured to the ambulance cot, the backboard becomes redundant, as the standard transport cot provides a flat surface to which the patient can be secured.
- Like the hospital bed, the ambulance cot and straps can provide spinal protection reducing spinal flexion, rotation, and lateral motion.
- In addition, the cot mattress can conform to the anatomic shape of the spine and the non-slick surface minimizes patient movement on the cot.
- Transport on a mattress is largely without the downside risks of the backboard.
Our EMS Cot
Comparison of points of contact showed likely increased points of contact and more comfortable than LSB.
A stretcher mattress, without the long spine board, significantly reduces lateral movement of the head torso and hip during EMS transport

David Wampler, PhD, LP
Assistant Professor
University of Texas Health Science Center at San Antonio
Goal: The purpose of this study was to compare the lateral motion allowed by the LSB to that allowed by stretcher mattress alone.
Randomized 2-way crossover healthy volunteer trial
Subjects (9) were secured to either LSB or stretcher mattress.
All had a rigid cervical collar and foam headblocks
Driven at low speed on a closed course
  - 15 right and 15 left turns.
Then secured by the other mechanism
Lasers were aimed at targets on the subject
Lateral movement was recorded during turns.
## Results

<table>
<thead>
<tr>
<th></th>
<th>Stretcher (cm)</th>
<th>LSB (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head</td>
<td>Chest</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>0.5</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Stdev</strong></td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>205</td>
<td>205</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
Head vs Torso Movement

Head
- Stretcher – 0.5 cm
- LSB – 1.0 cm

Torso
- Stretcher – 1.2 cm
- LSB – 2.2 cm
Using Logic as an argument to reduce LSB use in the field
We’ve all met these elderly/kyphotic patients

- Risk>>>>>benefit
Faulty Assumptions

The time that the patient hits the ED door **DOES NOT** mean that their evaluation and/or care begins at that point in time.

Patients who arrive immobilized may stay that way for significant periods of time until they are seen and removed from the board by someone authorized to do so.
New Thoughts

- Hauswald: *A Re-conceptualisation of Acute Spinal Care*
  - Injury caused by **ENERGY (MVC, Fall, GSW)**, *not motion*.
  
- Energy at time of injury great

- Energy during EMS care/extrication is minimal

- Motion at uninjured segments different than injured segments and force may not equate to visible motion.

- Longboard: low friction surface, energy to anchor points (head/neck)...isn’t that worse?
Increases Ability for Providers to Expose Patients While Enroute to Hospital?
Virtually Impossible to Gain Access to patient when strapped to Long Spine Board

- If you do unstrap enroute you’ll only have head secured as fixed point (that’s bad!)
Benefits to reducing LSB use

- Decreased awkward extrication of stable patients who could self-extricate
- Less resources/manpower needed (two folks and a cot for most minor MVC’s with neck pain).
- Less scene time when using cot straps and not securing head.
- More exposure/access to patient enroute.
- More comfort for patient.
- Saves patient from ED doc who leaves on board in hospital.
- Decrease radiological studies.
- Decreases cost.
- Decrease in resistance to placing a c-collar in elderly or borderline patient when not mandated to use LSB.
People don’t like to change...

Diffusion of Medical Progress: Early Spinal Immobilization in the Emergency Department
Mark Hauswald, MD, Darren Braude, MD, MPH

Abstract

Objectives: To examine the spread of new techniques of spinal care through one state’s emergency departments (EDs).

Methods: This was a telephone survey of all 36 EDs in a single state. One physician from each ED was contacted and given a short structured survey instrument to determine when patients who arrived at the ED on backboards were removed from the backboards. Removal was classified as “immediate” if it was done before clinical or radiographic exclusion of cervical spine injury and “delayed” if it was done only after interpretation of any indicated diagnostic radiologic procedures. Further questions were asked to determine if all physicians in the group used the same technique and how this technique had been adopted.

Results: In all but four hospitals, patients were removed from backboards in the same manner by all physicians, using a protocol or standard procedure. Fifteen of these did immediate and seventeen did delayed removal. In all but one case, the approach of immediate removal was initiated at the hospital by a physician trained or recently working at a university facility. Eight respondents stated that transport service requirements influenced their decision.

Conclusions: Although logic and the medical literature support removing all patients from a backboard immediately, physicians were unlikely to change their practice after their formal training had been completed until a new member of their group had done so.

Note: Although logic and the medical literature support removing all patients from a backboard immediately, physicians were unlikely to change their practice after their formal training had been completed until a new member of their group had done so.

ACADEMIC EMERGENCY MEDICINE 2007; 14:1087–1089 © 2007 by the Society for Academic Emergency Medicine

Keywords: spinal injuries, spinal immobilization, physician practice patterns, health knowledge, attitudes, practice
Let’s wait for a RCT...

- SCI is RARE.

- Truman Medical Center example
If Spine Boards were a Medication?

• If a medication had the same risk/benefit as the LSB, use of the drug would be stopped immediately by the FDA.
What about Athletes?
NATA Position

• We’re changing dogma

• Trainers can be paralyzed by fear of any movement........

• Once we close the ambulance doors all bets are off......
Logic and Trainer Issues

- Who is the best person to remove devices?
- Do you come to the ED?
- Do you ride in the ambulance?
- NFL versus Pee Wee league?
- Work with the local EMS medical director and EMS crews.
JOCO EMS Athlete protocol

- **Spinal immobilization for athletes wearing protective gear:**
  - Remove helmet and shoulder pads (or other protective gear) on-scene prior to movement of patient.
  - After removal of protective gear, apply cervical collar and move patient as indicated.
Seemed like a good idea at the time........but
Spine Boards as Modern Art?

- Maybe their best use?
Best Picture EVER

Photo Courtesy of The Platte County Citizen Newspaper