The Evidence Behind Prehospital Spinal Immobilization Changes

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Disclosures:
Dr. Clemency has no significant conflicts of interest. He is the first author on one of the studies reviewed.

We will discuss the proposed new NY State protocol, it has been approved by the SEMAC, and is still awaiting DOH approval/implementations.

Portions of this presentation were adapted with permission from:
Jacobsen R. Mounting Evidence Against the Long Spine Board in EMS
Bart J. Spinal Immobilization Practice Update
U.S. Consortium of Metropolitan Medical Directors Position Statement
aka: The Eagles

“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.”

In the beginning...

Spinal immobilization, like most EMS procedures, was adopted with little (if any) scientific basis.
Orthopedists recommended immobilizing “above and below” the fracture.

This was extrapolated from long bones to the spine
And then extended to the “whole spine”.

In the beginning… (1966, based on a case from 1955)

EARLY MANAGEMENT OF THE PATIENT WITH TRAUMA TO THE SPINAL CORD

W. O. GEBLER, M. WYNNE-JONES and A. T. JOUSSE
Lyndhurst Lodge Hospital, Toronto, Canada

“This man would surely have been protected from the paraplegic condition had the spine instability been recognized and precautions taken.”

In the beginning… (1968)

C-collar and a backboard were promoted 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.


And so it began.

Penetrating Trauma: The low hanging fruit

- A retrospective review of 30,956 patients suffering penetrating trauma from the ACS NTDB during 2001-2004
- 4.3% immobilized
- 8.1% overall mortality
- GSW pts more likely to be immobilized


Penetrating Trauma: The low hanging fruit

- Number Needed to Treat
  - Patients with an incomplete spinal injury and required and operative procedure
  - 30 of 30,956 patient had a "potential benefit"
  - NNT = 1,032
- Number Needed to Harm
  - Number of patients who would need to be immobilized to be associated with 1 additional death
  - 14.7% vs 7.2% (p < 0.001)
  - NNH = 66

A final nail in the coffin

“This study suggests that thoracolumbar immobilization is almost never beneficial in patients with torso GSW, and that a higher mortality rate existed among those GSW patients without vertebral column injury vs those with such injuries.”


Meanwhile...

The spinal immobilization rates continued to increase.

Most immobilization was based on mechanism (any mechanism)
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Cervical Spine Decision Rules are Great!


TLS Spine Decision Rules are Nonexistent!
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“When in doubt, immobilize”


- 5,432 patients immobilized by EMS and transported to a trauma center (2010-2013)
- 233 (4.3%) had an acute thoracolumbar fracture, dislocation or subluxation
- 29 (0.5%) had an “unstable” injury
What about the ground level falls?
No highly unstable injuries were found among the 951 subjects who were immobilized following ground level falls.
While we were immobilizing everyone, what was everyone else doing?

- Patents with spine injuries in Albuquerque (where everyone was immobilized), were compared to Kuala Limpur (where no one was immobilized)
- The 2 hospitals were comparable in physician training and clinical resources.

A tail of 2 cities...

- There was less neurologic disability in the unimmobilized Malaysian patients (OR 2.03; 95% CI 1.03–3.99; p = 0.04). This corresponds to a <2% chance that immobilization has any beneficial effect.
- Results were similar when the analysis was limited to patients with cervical injuries (OR 1.52; 95% CI 0.64–3.62; p = 0.34)

Why should the backboard have a monopoly?

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's the best way to minimize spinal movement? Hint... it’s not a backboard

Biomechanical analysis of spinal immobilisation during prehospital extrication: a proof of concept study
Mark Dixon,1,2 Joseph O'Halloran,3 Niamh M. Cummins4

The objective of this study is to establish which technique provides the minimal deviation of the cervical spine from the neutral inline position during the extrication of the RTC patient using biomechanical analysis techniques.

Table 1: Self-extrication instructions

<table>
<thead>
<tr>
<th>Instruction sequence</th>
<th>Instruction</th>
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<tbody>
<tr>
<td>Step 1</td>
<td>“Do you understand what we are asking you to do?” Try and keep your head as still as possible. Stop at any time if you feel pain or strange sensations in your body.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Slowly move your right foot and place it on the ground outside the car.</td>
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<tr>
<td>Step 3</td>
<td>Using the steering wheel, support pull yourself forward.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Keep your left hand on the steering wheel and place your right hand on the edge of the seat behind your head.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Turn slowly on your seat to face the outside, your left leg should follow when you step but remain seated.</td>
</tr>
<tr>
<td>Step 6</td>
<td>With both feet flat on the floor stand straight up using your arms for balance.</td>
</tr>
<tr>
<td>Step 7</td>
<td>Take two steps away from the car.</td>
</tr>
</tbody>
</table>
Conventional extrication techniques record up to four times more cervical spine movement during extrication than controlled self extrication.


On arrival at the hospital

- 50 “Immobilized” patients were prospectively evaluated upon arrival in the ED.
- 15 (30%) had at least one unattached strap or piece of tape that should have attached their head to the board
- 44 (88%) were found to have greater than 2 cm of slack between their body and at least one strap.


En route to the hospital

During transport, once on a backboard, patients still subject to significant head to toe and side to side forces.

Step 1: Paint a student...

Step 2: Carefully laid him on a backboard
Step 3: Then lifted the student off.

We re-painted our student....and laid him on our cot mattress.
Comparison of points of contact showed increased points of contact and more comfortable than backboard.

Jacobsen R. Mounting Evidence Against the Long Spine Board in EMS

Evidence of HARM

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

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


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Evidence for HARM

Pressure sores/tissue hypoxia

Good evidence that even short time periods on board cause tissue hypoxia on contact points as well as pressure wounds.....becomes 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

Routine spinal immobilization for trauma patients has become established in developed countries throughout the world. Cervical spinal injury is, however, relatively rare in trauma patients, and immobilization practice was developed largely without firm supporting evidence. In recent years, published evidence has suggested that spinal immobilization may in some cases be harmful.

Our findings present a growing body of evidence documenting the risks and complications of routine spinal immobilization. There is a possibility that immobilization could be contributing to mortality and morbidity in some patients and this warrants further investigation.

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.”

But what about the children?

A prospective cohort of Pediatric trauma patients (prospective cohort)

Spinal immobilization was associated with:

- Increased pain
- Increased radiographic usage
- Increased admission to the hospital.
But what if they just will not hold still?

• Alcohol Intoxication
• Drug Use
• Psychiatric
• Dementia
• Pediatrics
• Head Injury


But what if they just will not hold still?

• Tightening the straps may restrict movement but not the forces generated by the patient on the spine in resistance to restraining efforts.
• Attempting to enforce immobilization of the uncooperative patient may result in more force transmission to the spine than before the struggle commenced.

But what if they just will not hold still?

• Forcing a patient into immobilization will probably not limit movement and definitely not reduce forces.
Its not About Movement, It's About Force

Most patients who do have spinal injuries are mechanically 'stable' at least in the short term-stable in that significant force would need to be applied to the injured site to cause further damage.

Reducing visible spinal movement does not necessarily reduce movement at the injured site both because movement at uninjured sites requires minimal force and because force applied at the injured site may not cause gross movement of the rest of the spine.

Mechanical work at the injured site will by definition be minimised by minimising force and energy there.

Mechanical work can increase injury but movement per se cannot.

What questions do we ask?

Did my patient have trauma?
Could my patient have a spine injury?
Could my patient have an unstable spine injury?
Could my patient have an unstable spine injury that could get worse?
Could my patient have an injury that could get worse due to not using a long board — and how is that balanced against my patient’s risk of getting worse because of a backboard.

What national associations are supportive of the current NY spinal immobilization paradigm?

a) American College of Surgeons
b) American College of Emergency Physicians
c) National Association of EMS Physicians
d) None of the Above
And ACEP went even further.

Backboards should not be used as a therapeutic intervention or as a precautionary measure either inside or outside the hospital or for inter-facility transfers. Spinal immobilization should not be used for patients with penetrating trauma without evidence of spinal injury.

PROPOSED PROTOCOL CHANGE

The following is the proposed new protocol, it has been approved by the SEMAC, and is still awaiting DOH approval/implementations.
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Research/Brainstorming

Draft Protocol Presented/SEMAC Approves TAG

TAG Report Presented/SEMAC Approval

New York State Vortex Implemented

SEMAC - ENDORSEMENT

PROPOSED PROTOCOL CHANGE

2015 Suspected Spinal Injuries

For patients meeting Adult or Pediatric Major Trauma Criteria (Protocol T-6 or T-7) with a BULNT mechanism of injury:

1. Spine injury should be suspected.
2. The patient should be placed in a properly fitted cervical collar and spinal movement minimized.
PROPOSED PROTOCOL CHANGE

For patients meeting Adult or Pediatric Major Trauma Criteria (Protocol T-6 or T-7) with a PENETRATING mechanism of injury or for patients NOT meeting Adult or Pediatric Major Trauma Criteria with a BLUNT mechanism of injury, spine injury should be suspected if one or more of the following criteria are present:

1. Altered mental status – Associated with trauma - for any reason including possible intoxication from alcohol or drugs (GCS<15)
2. Complaint of neck and/or spine pain or tenderness
3. Weakness, tingling or numbness of the trunk or extremities at any time since the injury
4. Deformity of the spine not present prior to the incident
5. Painful distracting injury or circumstances (i.e., anything producing an unreliable physical exam)
6. High Risk mechanism of injury associated with unstable spinal injuries that include, but are not limited to:
   - Axial Load (i.e., diving injury, spearin tackle)
   - High speed motorized vehicle crashes or roll over
   - Pedestrian or bicyclist struck/collision
   - Falls >3feet/3steps or patient's height

PROPOSED PROTOCOL CHANGE

If a spine injury is suspected, the patient should be placed in a properly fitting rigid cervical collar, and spinal movement minimized.

Patients without any of the above findings may be transported without the use of a cervical collar or any other means to restrict spinal motion.

PROPOSED PROTOCOL CHANGE

Notes:
A long spine board is one of multiple modalities that can be used to minimize spinal movement. Electing not to use a long spine board will not constitute a deviation from the standard of care.

Spinal movement can be minimized by application of a properly fitting rigid cervical collar and securing the patient to the EMS stretcher.

When spinal motion restriction has been initiated and a higher level of care arrives, patients should be reassessed for spinal injury (per this protocol).

When possible, the highest level of care on scene will determine if spinal motion restriction is to be used or discontinued (collar removed, etc.)

Long spine boards do not have a role in transporting patients between facilities.
What should we do with our back boards?

"I WOULD RATHER BE SAFE THAN SORRY"

EMS culture:
Are you sure!!!
There's lots of ways to get worse.


Challenges to Implementation
Challenges to Implementation

"The morning shift would like to speak with you."

I don't always accidentally

But when I do, I accidentally the whole thing.