KEEP THE BACKBOARD
Nothing Sensible Ever Goes Out of Fashion

Terence Valenzuela MD MPH FACP FACEP
A Series of Friendly Debates on Timely EMS Topics
Discussants

Dr. Fowler aka “Reverend Ray”

Dr. Valenzuela
Reverend Ray bringing the word
The Case Against the Spine board

- Spine boards do not immobilize the spine.
- Spine boards cause pain, impair breathing and increase risk of pressure ulcers.
- Spinal injuries are rare.
- There is no evidence of benefit from spinal immobilization.
Dr. Fowler says:

Spine boards Do Not Immobilize the Spine
Six healthy volunteer immobilized patients.

Computerized tilt board

Reflective markers were placed on the forehead, chin, zygomatic arches,

Quantification of head and body movement via achieved using four high-speed

Shuttered cameras (60 frames/second, shutter speed 1/500 sec) video-based motion analysis system
“None of the three immobilization techniques was successful in eliminating head motion or neck rotation. Movement of the trunk contributed substantially to the lateral bending that occurred across the neck.”

- Also
  - “The current study highlights the significance of trunk motion as a factor influencing the efficacy of immobilization strategies”
  - “The current results suggest that improvements in fixation of the head without comparable fixation of the trunk may be ineffective in reducing spinal motion at the neck.”
  - ? Argument for the long spine board?
Twenty five healthy volunteers

Immobilization methods

- Soft collar
- Philadelphia collar
- Tape and sandbags
- Tape + sandbags + Philadelphia collar

Instructed to flex, extend, bend lateral and rotate as much as possible

Cervical immobilization is a myth. Even the halo frame permits 4% motion.  

<table>
<thead>
<tr>
<th></th>
<th>Aspen Collar</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Restricted (degrees)</td>
<td>Restricted (degrees)</td>
<td>Percent</td>
</tr>
<tr>
<td>Extension</td>
<td>98.8 ± 12.4</td>
<td>31.1 ± 9.2</td>
<td>31.5 ±</td>
</tr>
<tr>
<td>Lateral bending</td>
<td>31.1 ± 4.2</td>
<td>15.9 ± 6.2</td>
<td>47.5 ±</td>
</tr>
<tr>
<td>Head rotation</td>
<td>64.6 ± 4.7</td>
<td>26.8 ± 7.3</td>
<td>40.7 ±</td>
</tr>
<tr>
<td>Study</td>
<td>Method</td>
<td>Lateral Bending in Degrees</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td></td>
</tr>
<tr>
<td>Podolsky 1983</td>
<td>Soft collar Philadelphia Collar Tape and sandbags</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Graziano 1987⁴</td>
<td>Stif-Neck Immobilizing Collar Kendrick Extrication Device (KED) Extrication Plus-One</td>
<td>8–16</td>
<td></td>
</tr>
<tr>
<td>Perry 1999</td>
<td>Towels Hedbed II Head wedges</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>
Dr. Fowler says:

Spine boards cause pain, impair breathing and increase risk of pressure ulcers.
Twenty one healthy volunteers (mean age 24) immobilized on long spine board for 30 mins

Pain (occipital, lumbar, sacral) reported by all subjects

Fifty five percent rated pain as moderate to severe

Obvious drug seekers

**TABLE 2. Long spinal board**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Prestrapping (L/min)</th>
<th>Poststrapping (L/min)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>5.52 ± 0.79</td>
<td>4.98 ± 0.67</td>
<td>.000</td>
</tr>
<tr>
<td>V₁</td>
<td>4.29 ± 0.64</td>
<td>3.99 ± 0.57</td>
<td>.007</td>
</tr>
<tr>
<td>F 25%-75%</td>
<td>4.11 ± 1.12</td>
<td>3.68 ± 1.02</td>
<td>.025</td>
</tr>
<tr>
<td>V₁:FVC</td>
<td>0.791 ± 0.05</td>
<td>0.793 ± 0.05</td>
<td>.854</td>
</tr>
</tbody>
</table>

Values are mean ± SD.

- Retrospective study of 27 patients with spinal cord injury during initial hospitalization.

- Thirteen developed pressure ulcers; 14 did not.

- Compared patient recall of immediate post-injury period

<table>
<thead>
<tr>
<th>Injury to &quot;rolled&quot;</th>
<th>No pressure ulcers</th>
<th>Developed pressure ulcers</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 hours</td>
<td>No pressure ulcers</td>
<td>Developed pressure ulcers</td>
</tr>
<tr>
<td>&gt; 3 hours</td>
<td>Developed pressure ulcers</td>
<td>No pressure ulcers</td>
</tr>
</tbody>
</table>


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**Table 1**

Factors associated with the development of pressure sores in spinal cord-injured males within 30 days of injury (*P* < 0.1)\(^a\)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Cases</th>
<th>Controls</th>
<th><em>t</em></th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consciousness (%)</td>
<td>45.5</td>
<td>18.8</td>
<td></td>
<td>0.09 (Fisher’s test)</td>
</tr>
<tr>
<td>Duration of immobilization prior to admission (hr)</td>
<td>17.1 ± 11.3</td>
<td>10.6 ± 7.6</td>
<td>1.777</td>
<td>0.06</td>
</tr>
<tr>
<td>Distance of injury site from Charity Hospital (miles)</td>
<td>80 ± 116</td>
<td>24 ± 27</td>
<td>2.056</td>
<td>0.05</td>
</tr>
<tr>
<td>Time on the spinal board (hr)</td>
<td>11 ± 6.3</td>
<td>6 ± 5.1</td>
<td>1.799</td>
<td>0.09</td>
</tr>
<tr>
<td>Initial blood pressure at the time of admission (mm Hg)</td>
<td>100.2 ± 22.6</td>
<td>121 ± 23.7</td>
<td>-2.492</td>
<td>0.02</td>
</tr>
</tbody>
</table>

\(^a\)Values are given as mean ± SD.
Dr. Fowler says:
Spinal Injuries are Rare
Blunt trauma + C-spine X-rays 34,069
Radiographic C-spine injury 818 (2.4%)
Injury “potentially unstable” 464 (57%)
Injury “clinically significant” 118 (14%)
# How Freakin’ Common Does it Have to Be?

<table>
<thead>
<tr>
<th>Severity of Injury</th>
<th>Average Yearly Expenses (in February 2013 dollars)</th>
<th>Estimated Lifetime Cost Age At Injury (discounted)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Year</td>
<td>Each Subsequent Year</td>
</tr>
<tr>
<td>High Tetraplegia (C1-C4) AIS ABC</td>
<td>$1,044,197</td>
<td>$181,328</td>
</tr>
<tr>
<td>Low Tetraplegia (C5-C8) AIS ABC</td>
<td>$754,524</td>
<td>$111,237</td>
</tr>
<tr>
<td>Paraplegia AIS ABC</td>
<td>$508,904</td>
<td>$67,415</td>
</tr>
<tr>
<td>Complete Motor Functional at Any Level AIS D</td>
<td>$340,787</td>
<td>$41,393</td>
</tr>
</tbody>
</table>

Data Source: Economic Impact of SCI published in the journal *Topics in Spinal Cord Injury Rehabilitation Volume 16 Number 4 in* 2013
How Freakin' Common Does it Have to Be?

- Status at hospital discharge
  - Incomplete Tetraplegia 41%
  - Incomplete Paraplegia 19%
  - Complete Tetraplegia 12%

- US Incidence of 4.0 per 10^5 population (12,400 spinal cord injuries/year)

- The proportion of complete injuries
  - 1970s: 53.6%
  - Since 2000: 48.7%

- Predictions for future
  - C1–C4 injuries: ↑ 2% /decade
  - Ventilator dependency: ↑ 1% /decade
Dr. Fowler says:

There is no evidence of benefit from spinal immobilization.

- Comparison University of New Mexico Trauma Center and University of Malaya, Malaysia Trauma Center

- A retrospective, 5 year chart review of all patients with acute blunt traumatic spinal or spinal cord injuries transported directly from the injury site to the hospital and admitted to the inpatient service or ED

- The University Hospital, University of Malaya in Kuala Lumpur, Malaysia, which is *not* served by an out-of-hospital emergency medical services (EMS) system.
- The University of New Mexico Hospital in Albuquerque, NM, which is *served by an extensive EMS system.*

The OR 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.

We repeated this analysis using only the subset of patients with isolated cervical level deficits. We again failed to show a protective effect of spinal immobilization (OR 1.52; 95% CI 0.64–3.63; p = 0.34).

**FLAWS**

- Few predictor variables:
  - Hospital
  - Age
  - Gender
  - Level of Deficit
  - Mechanism of Injury
- Outcome: Neurologic Injury
  - “disabled or not disabled”
  - Grouped by Decade
  - Three Categories
  - Four categories

FLAWS

- Does not include victims dead on scene or during transport
- Does not include severity of non-spinal injuries
- Severity of spinal injury varied within categories
  - “Even those injuries that were placed in discrete diagnostic categories were not matchable”
Conclusion not supported by data

- “The actual percentage of injuries that are likely to be made worse by lack of immobilization during the immediate post-injury period is much smaller. The risk of neurologic deterioration is greatly exaggerated”
The Holy Cochrane Library
Means of immobilization can cause tissue pressure and discomfort, difficulty in swallowing and serious breathing problems.

The effects on mortality, neurological injury, spinal stability and adverse effects in trauma patients remains uncertain.
The review authors could not find any randomized controlled trials of spinal immobilization strategies in trauma patients.

**Spinal cord damage** from injury causes **long-term disability** and can dramatically affect **quality of life**. The current practice of **immobilising trauma patients** before hospitalisation to prevent more damage **may not always be necessary**, as the likelihood of further damage is small.
End of Story?

• EBM’s Six Dangerous Words\textsuperscript{14}
• “There is no evidence to suggest”
• Presumes “evidence” = formal hypothesis testing in an adequately powered study
Objective: To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.

Design: Systematic review of randomized controlled Trials.

Data sources: Medline, Web of Science, Embase, appropriate internet sites and citation lists.

Study selection: Studies showing the effects of using a parachute during free fall.

Main outcome measure: Death or major trauma, defined as an injury severity score > 15.


Results: We were unable to identify any randomized controlled trials of parachute intervention.

Conclusions: As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomized controlled trials.
Clinical Significance

Advocates of evidence based medicine have criticized the adoption of interventions evaluated by using only observational data.

We think that everyone might benefit if the most radical protagonists of evidence based medicine organized and participated in a double blind, randomized, placebo controlled, crossover trial of the parachute.
From Where the Spinal Immobilization “Dogma”?


- Case series 77 patients treated for cervical fracture, dislocation or both at the Massachusetts General hospital from 1940-1950
It is a sad commentary that one in every ten patients' symptoms of cord compression or an increase in cord symptoms developed subsequent to the time of the original injury—during emergency care, during the time the diagnosis was being established, during definitive treatment or following reduction.

<table>
<thead>
<tr>
<th>Time of onset of neuro deficit</th>
<th>Patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate complete cord</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Immediate partial cord</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Nerve root pressure only</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>No deficit</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td><strong>LATE ONSET</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
<td>100</td>
</tr>
</tbody>
</table>

• “...it is the responsibility of the trained aide who is first called upon to care for the patient with a neck injury to institute emergency measures which will protect the cord”

• Traction applied to the long axis of the spine in the neutral position will protect the cord which has escaped injury at the time of or subsequent to fracture or dislocation of the cervical spine...”
“Traction is applied to the cervical spine, as first aid, by means of an adjustable brace”

“The brace is so constructed that it exerts a constant pressure against the chin and occiput in the cephalad direction and against the chest and shoulder girdle in a caudate direction”
“During the past 13 years, such a brace has been used successfully as a routine measure...

The brace must be worn at all times when the patient is moved from place to place...

“No cord injury occurred in any of these patients during these years while wearing one of the braces.”

- Case series of 958 patients who suffered spinal cord injury from 1941 to 1966 and treated in Toronto, Canada.

- 29 recorded cases where the record clearly indicates that the onset of paralysis was delayed for hours or days, so that progression occurred after an interval.
Case II

- 24-year-old male railroad worker whose train car derailed into a ditch.

- "He crawled out of the car and walked a few yards. After approximately half an hour, during which he rubbed his lower extremities with his hands, he was once more able to move his feet and legs and he got up and walked a few yards."

- "When he reached hospital 6 hours later his legs were paralyzed."

- "Simple first aid measures would prevent the development of such a devastating condition. These are more important in their long-term significance than the greatest of surgical skill applied after the paralysis has occurred."


- Treatment at the accident site
  - "If they (1\textsuperscript{st} responders) are poorly trained or carelessly disregard the correct methods of handling the injured person, they may risk his entire future"
  - "A small movement may irreparably injure the vulnerable spinal cord"

- Moving the Patient
  - The uppermost consideration in moving the patient is to stabilize the neck...
  - Our gratifying results may be partly due to the fact that the author lives on a small island (Hawaii) and has personally trained the ambulance paramedics"
Farrington JD 1968

"Extrication of Victims—Surgical Principles"
James Styner MD 1976

- Crashed his airplane with wife and children aboard
- Wife killed. Two children comatose from head trauma
- Local ED was closed and locked. MDs who responded did not stabilize their C-spines
- Helped develop ATLS course
Use of the Long Backboard
NAEMSP and ACS
PREHOSPITAL EMERGENCY CARE 2013;17:392–393

- Appropriate patients
  - Blunt trauma and altered Level of consciousness
  - Spinal pain or tenderness
  - Neurologic complaint
  - Anatomic deformity of spine
  - Drug or alcohol intoxication
- High-energy mechanism of injury and any of:
  - Drug or alcohol intoxication
  - Inability to communicate
  - Distracting injury
Use of the Long Backboard
NAEMSP and ACS
PREHOSPITAL EMERGENCY CARE 2013;17:392–393

- Not necessary
  - GCS = 15
  - No spinal tenderness or anatomic abnormality
  - No distracting injury
  - No intoxication
  - Penetrating trauma neck, etc. without deficit

- Rigid collar no spine board
  - Ambulatory at scene
  - Long transport
  - “Patients for whom a backboard is not otherwise indicated”
Summary

• Long board necessary to immobilize spine “enough”

• Evidence of adverse consequences for other than pain is weak

• Absence of evidence for benefit is not evidence of absence of benefit

• There were good reasons for initial adoption of long spine board

• Still, large number of patients for whom long
Good bye, Ray
References


