Knowing changes everything.”
EMS Medicine Live

Welcome

October 2015
EMS Medicine Live

• Vision
  – Community & Academic
  – EMS Physician Education
    • Information Sharing
    • Board Preparation
  – Group involvement
    • Meet and see our peers
    • Involve your unique experiences and skills
EMS Medicine Live

Surveyed EMS Fellowship Directors

Keeping Tuesday at 1

Will reach out to interested EMS Fellowships
EMS Medicine Live

• Zoom
  – During presentation
    • Everyone will be muted
    • Chat questions to EMS Medicine Live to be answered either during or at the end of the presentation
    • Raise hand virtually in chat window
EMS Medicine Live

• Zoom
  – Recording

  – Previous Presentations
    Just google EMS Medicine Live
    First link is our web page
    Second link is Facebook page
EMS Medicine Live

• Zoom
  – Questions
    • Questions at the end
      – Unmute yourself to ask a question or
      – Message EMSMedicineLive if you have a question and
        I’ll ask for questions in order.
EMS Medicine Live

Today’s Speaker

Michael Millin, MD, MPH, FACEP
  Residency Michigan State
  Fellowship Oregon Health & Sciences Univ
  MPH Oregon State
  Assistant Professor at Johns Hopkins Hospital
    Med Dir of BWI Airport Fire and Rescue
    Med Dir Critical Care Transport Team
    NAEMSP S&P Committee
Spinal Immobilization to Spinal Cord Protection

A Change in Vernacular

Michael G. Millin, MD, MPH
Medical Director, BWI Airport Fire & Rescue Dept.
The world is flat....
Disclosure

• Financial
  • None

• Intellectual
  • Past chair, Standards and Clinical Practice Committee, National Association of EMS Physicians
  • Primary sponsor, Spinal Protection Protocol, Protocol Committee, Maryland Institute for Emergency Medical Services Systems
Objectives

• To explore the science behind the use of backboards for spinal immobilization

• Development of an evidence based practice standard for the use of backboards in the EMS environment

• Discuss the Strengths, Weaknesses, Opportunities, and Threats (SWOT) of spinal cord protection protocol vs. spinal motion restriction vs. spinal immobilization
The oath....

With regards to my patients, “...
I will do no harm or injustice....”

Another version…

“Almighty God! Thou has chosen me in Thy mercy to watch over the life and death of Thy creatures.”

Backboards

Benefit  Harm
PICO

• **Population** - Patients in the out-of-hospital or prehospital or EMS environment with a fractured spine or injury to the spinal cord or spinal column

• **Intervention** - In-line stabilization with soft padding

• **Comparison** - Immobilization with a hard backboard

• **Outcome** - Protection of spinal cord from injury
  
  No harm caused to patient
Radiology History

X-ray - early 1900s
CT - early 1970s
MRI - late 1970s
EMS History

• Accidental Death and Disability. 1966.
Why history is important....
“Fracture of the spine at any level should be carried in the supine position on a hard flat stretcher, maintaining as far as possible the normal contour of the spine by inserting a small pillow or pad (e.g. a folded garment) beneath the lumbar and cervical spines. It is of the greatest importance that a person with an injured spine should be lifted on to the stretcher with his back supported at several points. If the spine is allowed to sag excessively into a position of hyperflexion or hyperextension, which may occur when a man is lifted by his shoulders and legs, damage beyond repair may be done.”

Canadian Medical Association Journal. 1944.
The Beginning…1944

- Clarke-Moir Method
  - Place patient on stretcher, which should be hard and flat, with padding below the cervical and lumbar spine
  - Simple to protect entire spine
  - Padding for the curvature of the spine
  - Avoids excessive extension and flexion of the spine

- Note: No outcomes in this study. This is an editorial review.

77 Pts with C-spine injuries 1940-1950

8 pts with injuries identified after initial injury

All 8 with anterior dislocation
Geisler, et al. 1966

- 958 pts with spinal cord injury
- 29 pts with little or no initial spinal cord involvement
- Discussed 2 pts
  - Car crash 1949, initially mobile, six hours latter presented to hospital with inability to walk. Six months of rehab regained ability to walk.
Geisler, et al. 1966

- Patient #2
- Car crash 1955, shock and depressed skull fx
- “...observe to move all four limbs...”
- 48 hrs post injury, developed paralegia at T10
- Had decompressive laminectomy
- Permanent paralysis at the level of T4
“This man would surely have been protected from the paraplegic condition had the spinal instability been recognized and precautions taken.”

“The importance of proper first-aid was deduced from the fact that 29 patients developed further paralysis through faulty handling.”
Often referenced…

• Farington. J Trauma. 1968.

All about how to immobilize

Discuss the use of backboards for extrication

No patient outcome data
“Carefully splint the injured spine, avoiding abnormal or excessive motion. Be sure that the injured person is properly splinted and transported on a long backboard or special stretcher without bending or twisting the spine in any direction.”

• “The effect of pre-hospital spinal immobilisation on mortality, neurological injury, [and] spinal stability... remains uncertain.... the possibility that immobilisation may increase mortality and morbidity cannot be excluded....”

• 4453 relevant articles screen - no randomized trials with “real” patients

• 18 studies with “simulated patients” using healthy volunteers discussed
  • The more you strap the less motion
  • The more you strap the more complications
  • No ability to state a positive or negative effect on spinal cord injury
The bad....

• Pain

• Pressure Sores
The bad….

- Unnecessary radiological testing
- Respiratory compromise
Respiratory Compromise

  • 15 healthy, non-smoking volunteer males
  • Each strapped to a board and pulmonary function testing performed 3 times on board and off board
  • Best of 3 tests taken and averages of all volunteers obtained

  • FVC pre-strap 5.52 post-strap 4.98; \( p = 0.0001 \)
  • FEV1 pre-strap 4.29 post-strap 3.99; \( p = 0.0079 \)
Respiratory Compromise

  - 51 healthy children age 6-15
  - FVC measurements taken standing, supine, and backboard
  - Standing 2.63 +/- 1.07 Liters; Supine 2.45 +/- 0.99 L
  - Backboard -
    - Lateral strap 1.98 +/- 0.87 L; cross strap 1.97 +/- 0.80 L
  - Difference between supine and backboard P < 0.0001
Outcomes....

• Hauswald, et al. AEM. 1998
  • Retrospective review of pts with acute blunt traumatic spinal or spinal cord injuries
  • 120 pts University of Malaysia vs. 334 pts University of New Mexico
  • Neurological disability:
    • 11% vs. 21%; p = 0.02
  • Regression analysis
    • OR 2.03; 95% CI 1.03 - 3.99; p = 0.04
Outcomes....

• Haut ER, et al. J Trauma. 2010
  • Retrospective analysis of pts with penetrating trauma in the National Trauma Data Bank
  • Compared those with and without spinal immobilization
  • **Unadjusted mortality: 14.7% vs. 7.2%; p < 0.001**
  • OR for death 2.06 (95% CI 1.35 - 3.13)
  • NNTT = 1, 032; NNTH = 66
Biomechanics


  - Compressive forces directed vertically, forward and rearward were applied to three cadavers and 10 isolated columns.

  - Loads required to produce bony injury or ligamentous disruption ranged from 645 to 7,439 Neutons of Force.
Biomechanics

  - Studies on cadavers very different than forces on live tissue
  - Force applied to spinal column in acute episode from trauma is explosive and repetitive
  - Forces applied during emergency care are slow and constant
  - Force of gravity = 9.8 Neutons
  - Mechanism of “delayed” findings more likely to be edema and hypoxia than force of movement
Biomechanics

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Biomechanics


• A patient with a cervical collar was extricated from a vehicle by a crew of four firefighters and two paramedics.

• Biomechanical sensors placed on patient

• Self extrication total movement = 6.602 degrees

• Movement during extrication aided by equipment with long or short spine board = 11.717 - 26.086 degrees
Biomechanics

- Significant force to fracture cervical spine
- Less movement by patient self extricating than EMS providers placing patient on a board
  - Dixon M. PEC. 2013. (Abstract)
The goal....

Spinal Column Immobilization
Vs.
Spinal Motion Restriction
Vs.
Spinal Cord Protection
Normal Anatomy

- The spine is not flat
- Forcing the curved spine onto a flat board reverses normal anatomy and causes harm
Isn’t it time we stop fooling ourselves.....?
Isn’t it time we stopping ourselves….?
Who are we treating?

I ❤ ME

OR

[Image of a crowd]
Professional Society Standards…

• NAEMSP & ACS-COT
• ACEP
• AHA/ARC
Appropriate patients to be immobilized with a back-board may include those with:

- Blunt trauma and altered level of consciousness
- Spinal pain or tenderness
- Neurologic complaint (e.g., numbness or motor weakness)
- Anatomic deformity of the spine
- High-energy mechanism of injury and any of the following:
  - Drug or alcohol intoxication
  - Inability to communicate
  - Distracting injury

Utilization of backboards for spinal immobilization during transport should be judicious, so that the potential benefits outweigh the risks.
Spinal motion restriction should be considered for patients who meet validated indications such as the NEXUS criteria or Canadian C-Spine rules. Spinal motion restriction should be considered for patients with plausible blunt mechanism of injury and any of the following:

- Altered level of consciousness or clinical intoxication
- Mid-line spinal pain and/or tenderness
- Focal neurologic signs and/or symptoms
- Anatomic deformity of the spine
- Distracting injury

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.
“With a growing body of evidence showing more actual harm and no good evidence showing clear benefit, we recommend against the routine application of cervical collars by first aid providers (Class III: Harm, LOC C-LD).”

Maryland Protocol

• “Spinal protection” refers to the act of protecting the spinal cord from further injury.

• “Spinal immobilization” is the act of placing a patient on a backboard with cervical collar for the purpose of trying to prevent excessive movement of the spinal column.
Maryland Protocol

Spinal Protection Protocol
Inclusion criteria:

1. Midline spinal pain, tenderness, or deformity
2. Signs and symptoms of new paraplegia or quadriplegia
3. Focal neurological deficit
4. Altered mental status or disorientation
5. Distracting injury: Any injury (e.g., fracture, chest, or abdominal trauma) associated with significant discomfort that could potentially distract from a patient’s ability to accurately discern or define spinal column pain or tenderness.
Maryland Protocol

Cervical Collar ONLY

(1) Patients that are found by EMS providers to be standing or ambulatory
(2) Patients that have a GCS of 15 and are able to safely extricate themselves from the environment (e.g., vehicle seat) without gross movement (flexion, extension, or rotation) of the spinal column
(3) Patients that do not have evidence of a neurological deficit.
Maryland Protocol

Backboard = spinal immobilization

Patients meeting the *spinal protection protocol* that are with neurological deficit, or not able to ambulate on their own accord, **shall** be immobilized with cervical collar and a backboard.
Maryland Protocol

Pediatric Spinal Protection

1. Midline spinal pain, tenderness, or deformity
2. Signs and symptoms of new paraplegia or quadriplegia
3. Focal neurological deficit
4. Altered mental status or disorientation
5. Distracting injury
6. Neck pain or torticollis
7. High impact diving incident or high risk MVC (i.e., head on collision, rollover, ejected from the vehicle, death in the same crash, or speed > 55 mph)
8. Substantial torso injury
9. Conditions predisposing to spine injury
Maryland Protocol

Pediatric spinal Immobilization

Patients meeting the spinal protection protocol that are with neurological deficit, not able to ambulate on their own accord, or who are unable to respond during assessment shall be immobilized with cervical collar and a backboard.
Maryland Protocol

Backboard Applied by First Responder
(e.g. life guard, athletic trainer)

If EMS providers find patient immobilized on a backboard applied prior to arrival, the principles of the spinal protection protocol still apply.
Maryland Protocol

Other points

1. Helmet removal
2. Hemodynamic support
3. Oxygenation
Maryland Protocol

- **Strengths**
  - Scientifically based, stakeholder consensus
  - Consistent with NAEMSP statement

- **Weaknesses**
  - Not in line with ACEP statement

- **Opportunities**
  - Move the needle

- **Threats**
  - Uneducated ED staff
  - Uneducated public
Back to Harm vs. Benefit...
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proven benefit; no risks</td>
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</tr>
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<td>Criminal to use procedure.</td>
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Adopted from:
Spinal immobilization in the 21st century
Charles E. Cady, MD
Medical director
State of Wisconsin emergency medical services
The challenge of change…

“In medicine it requires a higher degree of evidence to remove something from the standard practice than it does to add something to the standard practice.”

Dr. Ritu Sahni, Immediate Past-President, NAEMSP

• Is this true??
• Is this right??
• It is just our culture to resist change?
If we really want to protect the spinal cord....

Extrication
If you still are not convinced.....
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Questions?
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Upcoming EML

• Tuesday November 24th
  Michael Dailey, *EMS And End-Of-Life Issues*

• Tuesday December 22nd
  Kevin Munjal, *Mobile Integrated Healthcare*