The Prehospital Validation of the Canadian C-Spine Rule by Paramedics

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Thank You

Physicians’ Services Incorporated Foundation

EHS Branch of the MOH and Long-Term Care
The Clinical Problem...

- Estimated 185,000 ED visits per year in Canada
- Enough to occupy 4 large Emergency Departments, full time
- Only 1% will have c-spine injury
What the Back Board does to You...

- Progressive pain in head, neck, and back
- Marked pulmonary restriction from chest straps
- Risk of aspiration
- Claustrophobia / Agitation
- Time and resource utilisation
The Canadian C-Spine Study

0. Variation in Use of C-Spine Radiography (N=6,855)
   *Can Med Assoc J* 1997

I. Derivation of the Rule (N=8,924)
   *JAMA* 2001

II. Prospective Validation (N=8,283)
   *SAGE* 2002
## Cumulative Classification Performance for 16,462 Cases

<table>
<thead>
<tr>
<th>Rule Positive</th>
<th>C-Spine Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Yes</td>
<td>312</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
</tr>
</tbody>
</table>

- **Sensitivity**: 99.7% (98-100)
- **Specificity**: 43.7% (43-45)
- **NPV**: 100%
Objectives

➢ To prospectively assess the Canadian C-Spine Rule when used by paramedics for alert and stable trauma patients

➢ Specific objectives are to determine:
  • accuracy of the rule
  • reliability of the rule
  • clinical sensibility, i.e. paramedics' accuracy, comfort, and ease of use
  • potential to reduce the need for prehospital c-spine immobilization
Design, Setting, Subjects

- Prospective cohort study
- 7 Canadian Sites
- Includes alert, stable, and cooperative adults with blunt trauma and potential injury to the neck
- Patients for whom standard basic trauma life support (BTLS) protocols require immobilization
Patient Assessments

- PCPs and ACPs have been taught to use the Canadian C-Spine Rule
- They assess patients at the scene, including tenderness and range of motion
- They immobilize according to current guidelines, NOT according to the rule
- They record findings on data form
The Canadian C-Spine Rule

1. Any High-Risk Factor?
2. Any Low-Risk Factor?
3. Ability to Rotate the Neck?
The Canadian C-Spine Rule

Please check off all of the following choices:

1. Any One High-Risk Factor Which Mandates Immobilization?
   No Yes
   - Age ≥ 65 years
   - Dangerous Mechanism
   - Numbness or Tingling in Extremities

2. Any One Low-Risk Factor Which Allows Safe Assessment of Range of Motion?
   No Yes
   - Simple rearend MVC **
   - Ambulatory at any time at scene
   - No neck pain at Scene
   - Absence of midline c-spine tenderness

3. Patient Voluntarily Able to Actively Rotate Neck 45° Left and Right When Requested, Regardless of Pain?
   No Yes
   - Able
   - Unable

O No C-Spine Immobilization

O C-Spine Immobilization

* Dangerous Mechanism
  - Fall from elevation > 3feet/5 stairs
  - Axial load to head, e.g. diving
  - MVC high speed > 100km/hr, rollover, ejection
  - Motorized recreational vehicles e.g. ATV
  - Bicycle collision

** Simple Rearend MVC Excludes:
  - Pushed into oncoming traffic
  - Hit by bus/large truck
  - Rollover
  - Hit by high speed vehicle > 100 km/hr
Outcome Measures

- Clinically Important Cervical Spine Injury
- Standard Radiography in ED, CT, MRI
- Telephone Follow-up if No Radiography
Clinically Unimportant Injuries

Require neither specialized treatment nor follow-up:

- Isolated avulsion fracture of osteophyte
- Isolated fracture of transverse process not involving body or facet joint
- Isolated fracture of spinous process not involving the lamina
- Isolated simple compression fracture < 25% of body height
Sample Size & Timeline

- 8,000 Patients
- 120 cases of cervical spine injury
- Study scheduled to be completed in 2006
Canadian Participants

Ottawa – May, 2002
Sarnia – October, 2002
Windsor – March, 2003
Halton – March, 2003
Calgary – May, 2003
Niagara – December, 2003
Nova Scotia – July, 2005
Recruitment by Center

Total Cases

- Ottawa: 1117
- Calgary: 591
- Windsor: 218
- Nova Scotia: 200
- Halton: 110
- Sarnia: 104
- Niagara: 57
<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (median)</td>
<td>40</td>
</tr>
<tr>
<td>Male Gender</td>
<td>48%</td>
</tr>
<tr>
<td>Mechanism</td>
<td></td>
</tr>
<tr>
<td>MVC</td>
<td>63%</td>
</tr>
<tr>
<td>Falls</td>
<td>20%</td>
</tr>
<tr>
<td>Admitted to Hospital</td>
<td>10%</td>
</tr>
<tr>
<td>Telephone Follow-up</td>
<td>45%</td>
</tr>
<tr>
<td>Indeterminate Outcome</td>
<td>429</td>
</tr>
<tr>
<td>C-Spine Fracture (n=14)</td>
<td>0.6%</td>
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</tbody>
</table>
Mechanism of Injury
**Patient Outcomes**  
*(N = 2397)*

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Clinically important injury (n=12)</td>
<td>0.5%</td>
</tr>
<tr>
<td>Fracture</td>
<td>0.6%</td>
</tr>
<tr>
<td>Dislocation</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ligamentous instability</td>
<td>0.3%</td>
</tr>
<tr>
<td>Clinically unimportant injury</td>
<td>82%</td>
</tr>
<tr>
<td>Stabilizing treatments</td>
<td>0.4%</td>
</tr>
<tr>
<td>Internal fixation</td>
<td>0.2%</td>
</tr>
<tr>
<td>Halo</td>
<td>0.04%</td>
</tr>
<tr>
<td>Brace</td>
<td>0.08%</td>
</tr>
<tr>
<td>Rigid collar</td>
<td>0.1%</td>
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### Classification Performance for 12 ‘Clinically Important’ Injury Cases

<table>
<thead>
<tr>
<th>Rule Positive</th>
<th>C-Spine Injury</th>
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<td>Yes</td>
<td>Yes: 12</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
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</tbody>
</table>

- **Sensitivity**: 100% (74-100)  
- **Specificity**: 42.7% (40-45)  
- **NPV**: 100%
**Classification Performance for 17 Cervical Spine Injury Cases**

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<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
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<td>925</td>
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<td>690</td>
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</tbody>
</table>

- **Sensitivity**: 94.1% (69-100)
- **Specificity**: 42.7% (40-45)
- **NPV**: 100%
### Classification Performance for 16 Cervical Spine Injury Cases

<table>
<thead>
<tr>
<th>Paramedic Pos.</th>
<th>C-Spine Injury</th>
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<tr>
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<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
<td>1158</td>
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<tr>
<td>No</td>
<td>1</td>
<td>717</td>
</tr>
</tbody>
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- **Sensitivity**: 93.8% (68-100)
- **Specificity**: 38.2% (36-41)
- **NPV**: 100%
### Classification Performance for 12 ‘Clinically Important’ Injury Cases

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**Sensitivity**

- Yes: 100% (74-100)
- No: 38.2% (36-41)

**NPV**

- Yes: 100%
- No: 100%
Agreement Among Paramedics

$N = 154$

Kappa = 94.1% (88.5 – 99.8)
How Comfortable…
N= 2200

- Very Uncomfortable: 5%
- Uncomfortable: 5%
- Neutral: 9%
- Comfortable: 25%
- Very Comfortable: 57%
**Discussion**

- Not all eligible cases enrolled
- Some cases indeterminate for CCR
- Some mis-interpretation by paramedics
- Not all cases underwent radiography
- One case not identified
Importance

- Could lead to a dramatic change in policies and protocols for EMS services throughout Canada and the U.S.
- Great potential to have the Canadian C-Spine Rule applied by paramedics
- Significantly reduce the number of patients who require immobilization
- Reduced patient discomfort, improved paramedic efficiency, and reduced pressure on our overcrowded EDs
**THANK YOU PARTNERS!**

<table>
<thead>
<tr>
<th>Andy Anton</th>
<th>Martin Lees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steve Donaldson</td>
<td>Dallas Labarre</td>
</tr>
<tr>
<td>Matt Stempien</td>
<td>Paul Bradford</td>
</tr>
<tr>
<td>Carrie Parkinson</td>
<td>Catherine Hedges</td>
</tr>
<tr>
<td>John Trickett</td>
<td>Corinne Burke</td>
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<tr>
<td>Pierre Poirier</td>
<td>Jennifer Girard</td>
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