Cervical Spine MRI Utilization for Identification of Cervical Spine Injuries Among Children With Non-Accidental Trauma

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NO DISCLOSURES
Background: NAT & c-spine injuries

- NAT is a significant cause of TBI and death in children
- Cervical spine injury has been associated with abusive TBI
- Incidence of cervical spine injuries in young children is low
**Background:**

**Cervical Spine Guidelines with NAT**

### Guideline for Inpatients with Suspect Physical Abuse

<table>
<thead>
<tr>
<th>Confirmed Intracranial Injury</th>
<th>Child protection team (CPT)</th>
<th>+/- special labs (ex, GA-Type II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal labs</td>
<td>Social work (includes DFCS/Law Enforcement referrals as appropriate)</td>
<td>Ophthalmology (&lt;6 mo or cranial imaging +, or other suspicion) (exam within 24 hours if clinically feasible)</td>
</tr>
</tbody>
</table>
| (LFTs, pancreatic enzymes; U/A) (<3 yo) | Trauma surgery | MRI brain/c-spine when clinically feasible (request "NAT protocol")

- DIC panel, Factor VIII, Factor IX, CBC/man diff; Type and Screen (consult hematology for further recommendations if indicated)
- +/- Platelet Function Assay
- Hematology consult if suspect underlying bleeding disorder

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* MRI of the brain/c-spine should be performed as soon as clinically feasible after the initial head CT in patients with suspected or confirmed closed head injury. Optimally, the MRI should be performed immediately after the initial CT or within 48 hours of it. Scheduling should be performed in concert with the MRI department to determine earliest scanner availability. When ordering an MRI, consider also obtaining an MRV at the radiologist's discretion because venous thrombosis is often proposed in court as a possible cause of the intracranial findings. A recommendation for MRI c-spine to be included in the MRI brain protocol is being piloted for 6 months and the decision to keep/withdraw the recommendation will be made after that time.

^ If the MRI is positive for injury, a follow up MRI should be considered for timing or prognostic information; discuss with radiologist.
Aims:

• Determine trends of cMRI utilization and treatment and outcome related to c-spine injury in children with non-accidental trauma (NAT)

• Compare cMRI utilization before and after NAT guidelines were implemented
Methods:

Institutional trauma registry
NAT
<9 years of age

503 patients (2009-2014)

PRE-
N=249
2009-2011

POST-
N=254
2012-2014
Results: cMRI Trends
Results: Clinical Characteristics

PRE- & POST-guidelines

<table>
<thead>
<tr>
<th></th>
<th>Pre-guideline (n=249)</th>
<th>Post-guideline (n=254)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>141 (56.6%)</td>
<td>144 (56.7%)</td>
<td>.99</td>
</tr>
<tr>
<td>ISS ≥ 16</td>
<td>109 (43.8%)</td>
<td>110 (43.3%)</td>
<td>.92</td>
</tr>
<tr>
<td>Head injury</td>
<td>173 (69.5%)</td>
<td>170 (66.9%)</td>
<td>.54</td>
</tr>
<tr>
<td>cMRI obtained</td>
<td>7 (2.8%)</td>
<td>84 (33.1%)</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>Injury identified on cMRI</td>
<td>2 (0.8%)</td>
<td>26 (10.2%)</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>C-collar applied at presentation</td>
<td>41 (16.5%)</td>
<td>70 (27.6%)</td>
<td>.003</td>
</tr>
<tr>
<td>Discharged with c-collar</td>
<td>0 (0.0%)</td>
<td>8 (3.2%)</td>
<td>.007</td>
</tr>
<tr>
<td>Deceased prior</td>
<td>11 (4.4%)</td>
<td>11 (4.3%)</td>
<td>.96</td>
</tr>
<tr>
<td>No. of craniotomy/craniectomy</td>
<td>13 (5.2%)</td>
<td>9 (3.5%)</td>
<td>.36</td>
</tr>
<tr>
<td>C-spine stabilization procedure</td>
<td>0 (0.0%)</td>
<td>1 (0.4%)</td>
<td>&gt; .99</td>
</tr>
<tr>
<td>Fatality</td>
<td>32 (12.9%)</td>
<td>19 (7.5%)</td>
<td>.05</td>
</tr>
</tbody>
</table>
## Results: Clinical Characteristics

### Summary c-spine injuries

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (months)</th>
<th>C-spine injury</th>
<th>Associated Injuries</th>
<th>ISS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>Ischemic injury within the central portion of the upper cervical cord</td>
<td>SAH</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>&lt;1</td>
<td>C5/6 distraction injury</td>
<td>Clavicle fracture</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Cervical cord edema</td>
<td>Skull fracture, SAH, SDH, EDH</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>Cervical cord edema</td>
<td>Skull fracture, intraparenchymal hematoma, SDH</td>
<td>25</td>
</tr>
</tbody>
</table>
Summary:

• Post-guideline group were much more likely to undergo cMRI (PRE- 2.8% vs. POST- 33.1% )

• Post-guidelines, there was a significant increase in cervical collar usage (PRE- 16.5 vs. POST- 27.6%) and more patients were discharged home with c-collar immobilization

• A single case of surgical stabilization was indicated in one patient in the post-guideline group

• Incidence of cranial injury and ISS were not significantly different between the PRE- & POST- guidelines.
Limitations:

- Lack of a clear guideline implementation date
- Retrospective
- Variations in physician decision-making in regarding to cMRI acquisition
- Rarity of clinically significant spine cord injury
- Clinical significance of ligamentous injury
Conclusions:

• Children are uniquely vulnerable to NAT, and their physiology predisposed them to a higher likelihood of cranial and cervical spine injury

• A heightened awareness of potential c-spine injury in this population increased the use of cMRI and soft-collar immobilization over a six-year period

• Severe c-spine injury remains rare and may not be readily impacted by increased use of cMRI.
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THANK YOU