Application of National Emergency X-Radiography Utilization Study Criteria, the Canadian C-Spine Rule and an Institutional Hybrid Model Among Children Aged 8 to 17 years in the Emergency Department: A Retrospective Review

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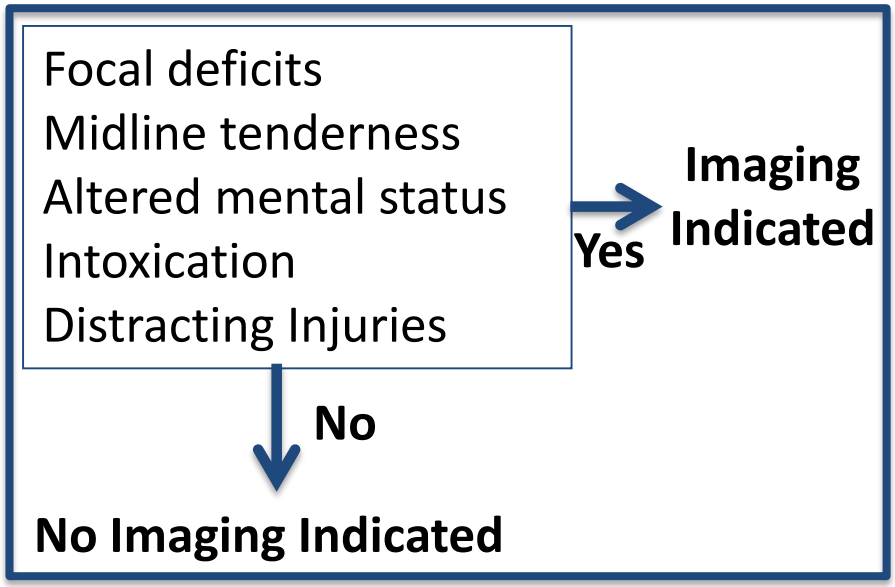
Pediatric C-spine Clearance

- Pediatric c-spine injuries - rare but devastating if missed
- Validated clinical decision tools – NEXUS and CCR for adult use
- No pediatric c-spine clearance tools validated

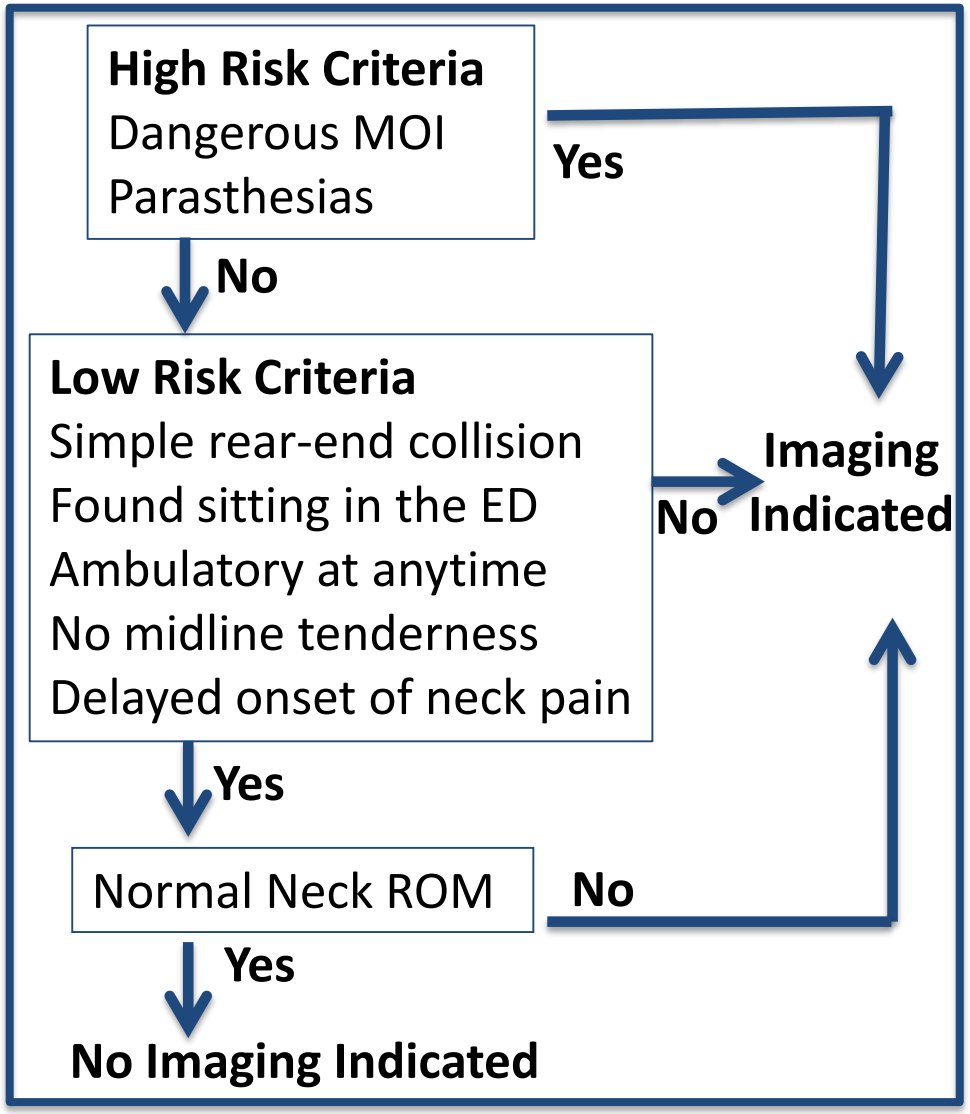
Hoffman JR et al, N Engl J Med. 2000.
Stiell IG et al, JAMA. 2001.

Adult Clinical Decision Tools

NEXUS



CCR



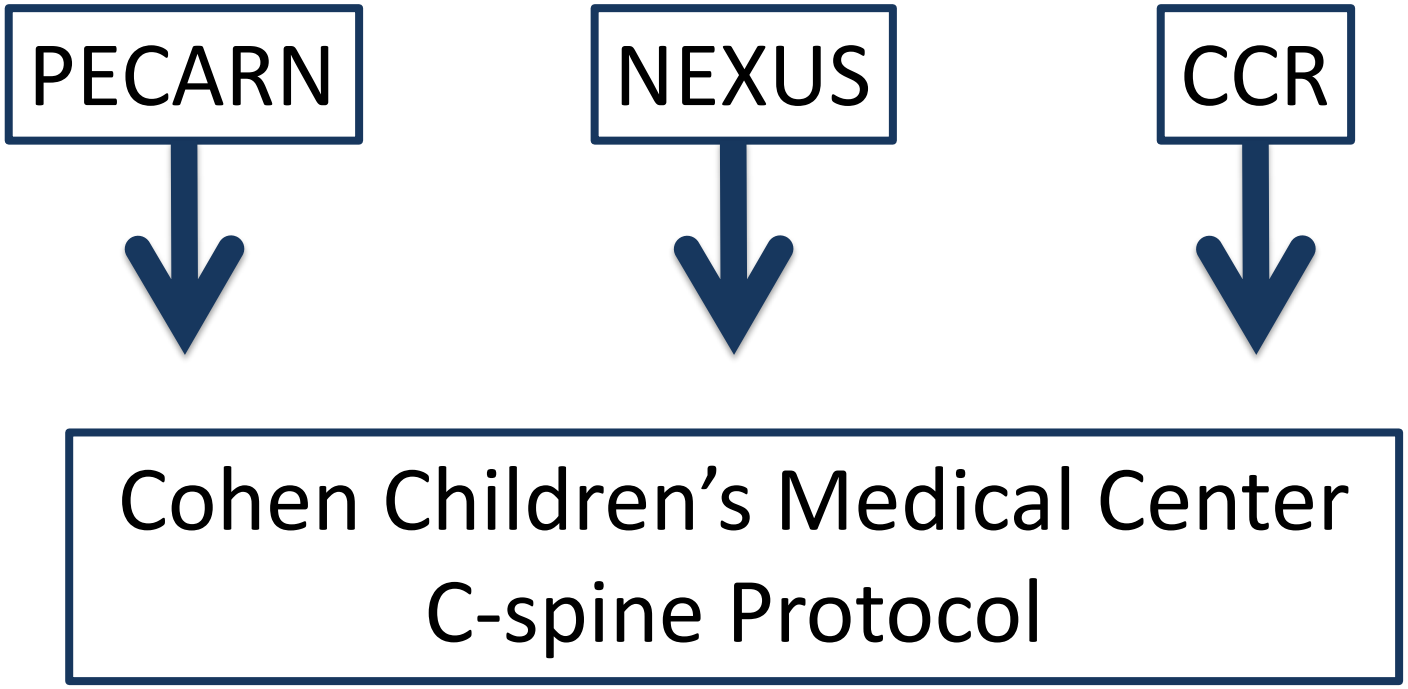
Hoffman JR et al, N Engl J Med. 2000.
Stiell IG et al, JAMA. 2001.

Pediatric C-spine Risk Factors

- Pediatric Emergency Care Applied Research Network (PECARN) retrospectively identified 8 factors highly associated with CSI in children 0-16 years.
  - Altered mental status
  - Focal neurologic deficits
  - Complaints of neck pain
  - Torticollis
  - Substantial injury to the torso
  - Predisposing condition for c-spine injury
  - High risk MVC
  - Diving

Leonard JC et al. Ann Emerg Med. 2011

CCMC Pediatric C-spine Protocol Development



CCMC C-spine Protocol: NEXUS components

1. All high risk criteria absent

- MOI: hanging, axial loading mechanism
- MOI: high risk MVC, diving
- Altered mental status (GCS <15, intoxication)
- Focal neurologic deficit or paresthesias in upper extremity
- Complaint of neck pain
- Substantial torso injury
- Condition predisposing for CSI
- Distracting injury

2. Absence of midline tenderness

3. Normal neck range of motion

CCMC C-spine Protocol: CCR components

1. All high risk criteria absent

- MOI: hanging, axial loading mechanism
- MOI: high risk MVC, diving
- Altered mental status (GCS < 15, intoxication)
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CCMC C-spine Protocol: PECARN components

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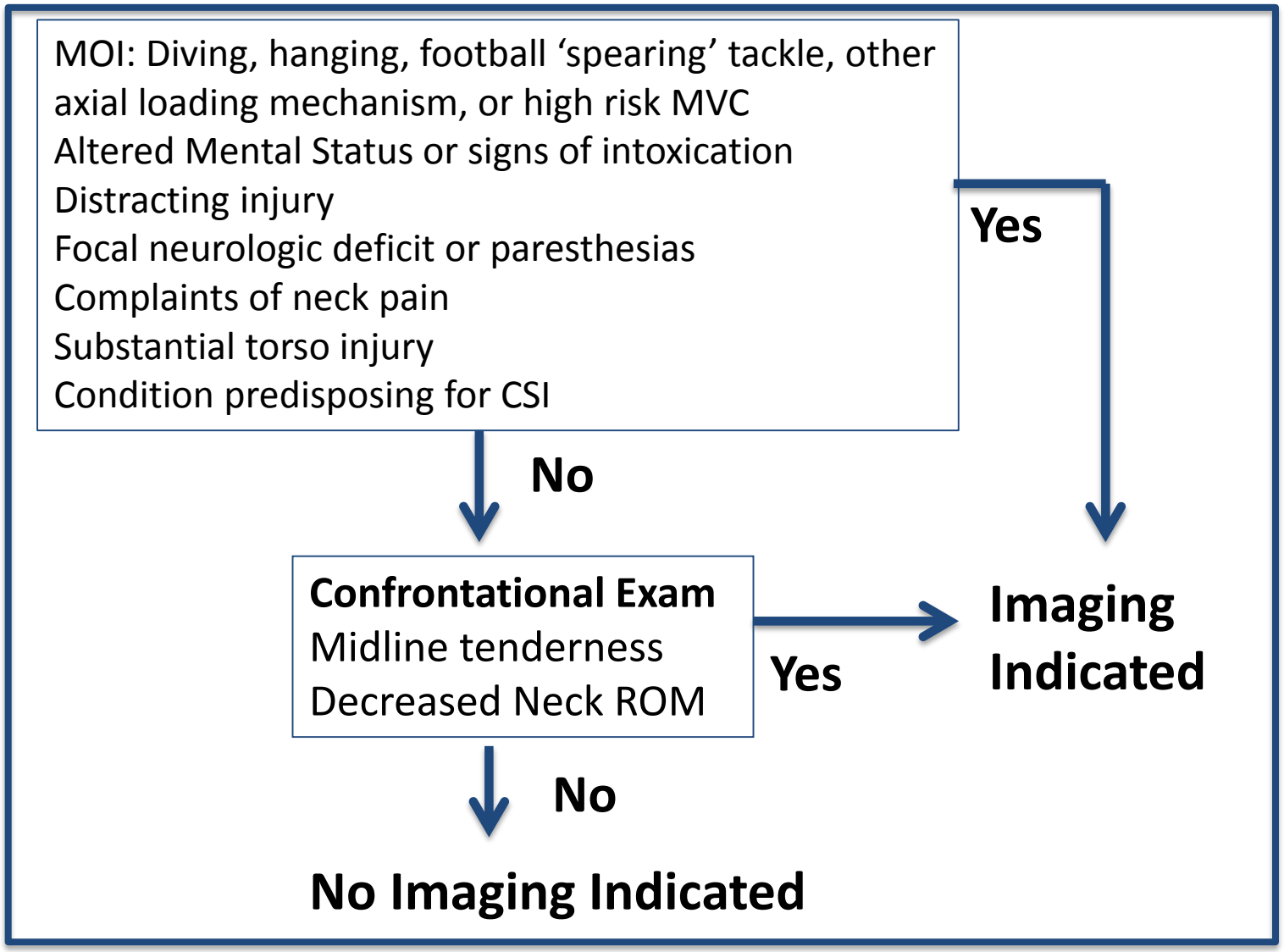
CCMC C-spine Protocol



Hypothesis

CCMC C-Spine protocol will identify all cervical spine injuries in children and reduce unnecessary cervical spine CT evaluation.

Initial Objective

To determine the number of cervical spine CT scans that could have been avoided in injured children aged 3 to 17 with application of the NEXUS, CCR and CCMC c-spine protocols

Methods

- **Design:** Retrospective chart review
  - IRB exempt

- **Inclusion criteria:** Patients 3-17 years who received a cervical spine CT scan for blunt trauma in the ED from 1/2010 to 11/2013

- **North Shore- LIJ Trauma**
  - ACS level I adult trauma center
  - NY state level I pediatric trauma center

Demographics	Total (n=486)	% of total
Age		
3 to <8 yo	54	11%
8 to <18 yo	432	89%
Gender		
Male	306	63%
Female	180	37%
Race		
White	211	43%
Black	126	26%
Hispanic	29	6%
Asian	55	11%
Other	65	13%

Mechanism of Injury

Mechanism of Injury	% of sample
Motor Vehicle Collision	18%
Pedestrian Struck	15%
Sports Injury	13%
Fall > 3ft or >5 stairs	12%
Other*	42%

*Includes: assault, axial load injury, bicycle accident, other motorized vehicle collision, or unknown mechansim

Clinically significant CSI in 1%

Age	MOI	Diagnosis	Treatment
4	Pedestrian Struck	C3 wedge deformity fracture	Patient deceased due to head trauma
10	Diving	C7 Fracture	Miami J collar
12	Diving	C4,C5 compression fracture	Surgical intervention
13	Bike accident	Rotary subluxation at C1 and C2	Aspen collar
16	Sports injury	C5 and C6 avulsion fracture	Miami J collar

All CSIs captured 3-7 yo

CT SCAN USE	NEXUS	CCR	CCMC C-spine Protocol
Indicated	61% (33)	70% (38)	83% (45)
Not Indicated	30% (16)	9% (5)	2% (1)
Unable to Determine	9% (5)	20% (11)	15% (8)

All CSIs captured 8-17 yo

CT SCAN USE	NEXUS	CCR	CCMC C-spine Protocol
Indicated	70% (303)	58% (250)	89% (384)
Not Indicated	24% (102)	16% (68)	3% (14)
Unable to Determine	6% (27)	26% (114)	8% (34)

Summary

- NEXUS and CCR would have reduced imaging utilization
- CCMC c-spine protocol would have identified all injuries, without lowering CT utilization
- **Future Work:** Prospective application of CCMC c-spine protocol

Thank You

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