Clearing the C-Spine

David Ouellette
Case #1 - Mother / Daughter MVC

- 34 y/o female
  - Dangerous mechanism
  - CHI
  - Mumbling incoherently
  - Femur # - distracting injury
  - ETOH - 22

- 9 y/o female
  - Dangerous mechanism
  - ? AO x 3
  - Potential thoracic spine injury – distracting injury, other spinal injury
  - Elbow dislocation - distracting injury

- Trauma room + people
- Vitals + 1° survey (ABCDE) + OMI
- 2° survey + c-spine evaluation
- Remove transport board + log roll
Case #1 - Mother / Daughter MVC

- 34 y/o female
  - Canadian C-spine Rule = Not applicable
    - GCS < 15
    - ? Early hemodynamic instability
  - Nexus Rule = Not applicable
    - GCS < 15 (not a (N) level of alertness)
    - Intoxicated
    - Painful, distracting injury
  - CT C-spine (already going to CT head b/c CHI)
    - Radiation risks justified
    - Is that enough imaging?
Case #1 - Mother / Daughter MVC

- 9 y/o female
  - Canadian C-spine Rule = Not applicable
    • Age < 16 yrs
    • ? Acute paralysis / neurological deficit
  - Nexus Rule = Not applicable
    • Painful distracting injury
    • Focal neurologic deficit
  - Orthopedic consultation
    • Spinal precautions (supine, board, collar)
    • MRI or CT scan
Evaluation of the C-Spine

• MVC / Trauma - EMS On Scene
  – Suspicion on C-spine injury
  – Boarded
  – Collared
  – Transported to ED

• Emergency Department
  – EMS transport board removed
  – Can c-spine be cleared clinically?
    • GCS 15
    • Exclusion criteria
  – Patient can not be evaluated
The Awake Patient

1. Clinical clearance
2. Canadian C-spine Rule
3. Nexus Rule
The Awake Patient

• Clinical clearance
  – Low risk mechanism
  – No pre-existing bony pathology
    • Severe osteoporosis, advanced arthritis, metastatic cancer, ankylosing spondylitis
  – No pain or palpable bony tenderness
  – Full ROM
The Awake Patient

• **Canadian C-spine Rule**
  – Blunt trauma with neck pain
  – Non-ambulatory with suspicion neck injury
  – Trauma above the clavicle
  – GCS = 15
  – Stable vital signs

• **Nexus Rule**
  – Blunt trauma
CANADIAN C-SPINE RULE

1. Any high-risk factor which mandates radiography?
   - Age ≥ 65 years
   - Dangerous mechanism
   - Paresthesias in extremities

   No

Rule Not Applicable if:
- Non-trauma cases
- GCS < 15
- Unstable vital signs
- Age < 16 years
- Acute paralysis
- Known vertebral disease
- Previous C-spine injury

Rule Not Applicable if:
- Motorized recreational vehicle
- Bicycle struck or collision

** Simple rear-end MVC Excludes:
- Pushed into oncoming traffic
- Hit by bus/large truck
- Rollover
- Hit by high speed vehicle

*** Delayed:
- i.e. not immediate onset of neck pain
1. Any high-risk factor which mandates radiography?

- Age ≥ 65 years
- Dangerous mechanism*
- Paresthesias in extremities

* Dangerous Mechanism:
- Fall from elevation ≥ 3 feet/5 stairs
- Axial load to head, e.g. diving
- MVC high speed (>100 km/h), rollover, ejection
- Motorized recreational vehicle
- Bicycle struck or collision

Simple recent MVC
- or
- Sitting position in ED
- or
- Ambulatory at any time
- or
- Delayed onset of neck pain***
- or
- Absence of midline c-spine tenderness

Able if:
- Yes
- Ignus
- Al disease
- E injury

Yes

Radiography

No

3. Able to actively rotate 45° left and right

Able

No radiography

** Delayed:
- Hit by high speed vehicle
- i.e. not immediate onset of neck pain
CANADIAN C-SPINE RULE

1. Any high-risk factor which mandates radiography?
   - Age ≥ 65 years
   - Dangerous mechanism*
   - Paresthesias in extremities

Rule Not Applicable if:
- Non-trauma cases
- GCS < 15
- Unstable vital signs
- Age < 16 years
- Acute paralysis
- Known vertebral disease
- Previous C-spine injury

2. Any Low-Risk Factors which allows safe assessment of range of motion?
   - Simple rear-end MVC**
   - Sitting position in ED
   - Ambulatory at any time
   - Delayed onset of neck pain***
   - Absence of midline c-spine tenderness

   Yes
   Radiography
   Unable

3. Able to actively rotate neck?
   - 45° left and right
   Yes
   Dangerous Mechanism:

   ** Simple rear-end MVC Excludes:
   - pushed into oncoming traffic
   - hit by bus/large truck
   - rollover
   - hit by high speed vehicle

   *** Delayed:
   - i.e. not immediate onset of neck pain
1. Any high-risk factor which mandates radiography?
   - Age ≥ 65 years
   - Dangerous mechanism*
   - Paresthesias in extremities

2. If yes, able to actively rotate neck?
   - 45° left and right

3. If yes, able to actively rotate neck?
   - 45° left and right

   Yes

   No radiography

   No

   Rule Not Applicable if:
   - Non-trauma cases
   - GCS < 15
   - Unstable vital signs
   - Age < 16 years
   - Acute paralysis
   - Known vertebral disease
   - Previous C-spine injury

   Dangerous Mechanism:
   - Fall from elevation ≥ 3 feet/5 stairs
   - Axial load to head, e.g., diving
   - MVC high speed (>100km/h), rollover, ejection
   - Motorized recreational vehicle
   - Bicycle struck or collision

   Simple rear-end MVC Excludes:
   - Pushed into oncoming traffic
   - Hit by bus/large truck
   - Rollover
   - Hit by high speed vehicle

   Delayed:
   - I.e. not immediate onset of neck pain
Canadian C-spine Rule

• Any high risk factor that mandates radiography?

• Any Low-risk factor which allows safe assessment of ROM?

• Able to actively rotate neck?

• No radiography
Canadian C-spine Rule

• Ian Stiell JAMA 2001
• Prospective cohort study – 8924 pts
• 20 standardized clinical findings from Hx/Px

• 1° outcome - clinical relevant fractures

• Clinically Irrelevant #’s
  – Osteophytic avulsion #’s
  – Transverse process # (not affecting the facet)
  – Simple compression # < 25%
  – Isolated spinous process #
Canadian C-spine Rule

- Sensitivity 100% (CI 98 – 100%)
- Specificity 42.5% (CI 40 – 44%)

Issues
- Complicated algorithm
- Low rate of x-rays criticized as insufficient
- 26% not enrolled in the study ??
- 577 did not receive proper F/U
Nexus Rule

- **Inclusion**
  - Blunt trauma
  - C-spine radiography

- **Exclusion**
  - Penetrating Trauma
  - C-spine imaging unrelated to trauma
  - No radiography

All criteria must be met, otherwise x-ray patients:

1. (N) level of alertness
2. No evidence of intoxication
3. No clinically apparent, painful distracting injury
4. No tenderness at the posterior midline of c-spine
5. No focal neurologic deficit
Nexus Rule

- Hoffman NEJM 2000
- National Emergency X-ray Utilization Study
- Multicentered (21) Prospective Observational Study
- 34,000 pts with blunt trauma
- Sensitivity 99.6% (90.7%)
- Specificity 12.6% (36.8%)
Nexus Rule

- Issues
  - 8 fractures were missed (814)
    - 2 - clinically significant
    - 1 - specific therapy
  - Canadian Validation Study
    - 13 missed #
    - 4 required halo; 1 required ORIF

- Xray rate increased 8% at Canadian centres

- Ambiguous criteria (intoxicated, (N) alertness)
Awake Patient - Bottom Line

• CCR or Nexus is acceptable
Evaluation of the C-Spine

- MVC / Trauma - EMS On Scene
  - Suspicion on C-spine injury
  - Boarded
  - Collared
  - Transported to ED

- Emergency Department
  - EMS transport board removed
  - Can c-spine be cleared clinically?
    - GCS 15
    - Exclusion criteria
  - Patient can not be evaluated
Cannot Evaluate Clinically

• Why?
  – ↓ LOC / Unconscious / Intubated
  – Failed CCR / Nexus
  – Significant pre-existing c-spine pathology

1. Wait until patient wakes up

2. CT C-spine

3. MRI
Wait until Conscious

• OK if patient expected to regain consciousness in 24-48 hrs;
  – then do clinical exam to rule out ligamentous injury

• Prolonged spinal immobilization leads to
  – pressure ulcers
  – Increase ICP, delirium
  – Increase VAP & VTE
  – Longer Ventilator requirements, ICU, hospital stay
  – Difficult respiratory support
  – Difficult nursing care
CT C-spine

• Journal of Trauma (2007)
  – Prospectively evaluated consecutive intubated adult blunt trauma patients
  – All had negative high-resolution CTs
  – Pts – short MV, fewer cxs, shorter time of immobilization, shorter ICU stays
  – Not adequately powered

• Journal of Trauma (2010)
  – U of Calgary, consecutive obtunded blunt trauma pts
  – CT + dynamic flex/ex views
  – No missed c-spine injuries

• Journal of Trauma (2010) Meta-analysis
  – CT vs CT + MRI
  – CT alone might miss important injuries
CT C-spine

• EAST guidelines
  – Neurologically intact awake patient
  – Negative CT scan is not enough
  – Need
    • Negative MRI OR
    • Negative Flex/Ex views

  – Obtunded Patient with Negative CT scan
    • Literature unclear
    • Some centres clear c-spines with negative CT only
    • Varied approaches by different centres
    • At LHSC, typically an In-Patient decision
Clearing the C-Spine

David Ouellette