Cervical Spine Trauma and Relevant Imaging Modalities

Taylor Lloyd, Harvard Medical School III
Dr. Gillian Lieberman, MD

November 2011
Outline

• Case Presentation
• Mechanisms of Injury
• Differential Diagnoses
• Imaging Modalities
• Anatomy
• Film Interpretation
Case 1

- 43 year old female restrained driver in motor vehicle crash at 40mph
- Airbag deployed
- Felt immediate neck pain without radiation
- No weakness of extremities, bowel, or bladder dysfunction
- Also experiencing some hip pain

• What are the structures of concern?
• What is the role of imaging?
Mechanisms of Spinal Injury

Each type of force theoretically produces a characteristic injury

Differential Diagnosis
(Structures of Concern)

• Spinal cord injury
  • Compression (hemorrhage, edema, spondylolethiosis)
  • Transection

• Vertebral fracture
  • Unstable
  • Stable

• Ligamentous injury
  • Unstable

• Vascular injuries
  • Vertebral arterial injury: in some case series, up to 46% of patients with MAJOR blunt cervical trauma
NEXUS guidelines:
To image or not to image..

Based on prospective, observational study, n=34,069
High sensitivity, 99.0% (95% CI 98-99.6%)
Low specificity, 12.9%

Cervical spine radiography is indicated unless the patient meets ALL 5 criteria:

✗ – No posterior midline cervical tenderness
✔ – No evidence of intoxication
✔ – Normal level of alertness
✔ – No focal neurologic deficit
✗ – No painful distracting injury

Menu of Tests

- Plain Film
  - 3 views (lateral, odontoid, AP)
- CT
  - With sagittal and coronal reconstructions
- MRI
To CT or not CT..

Based on meta-analysis of

7 randomized control trials and cohort studies, wherein
3 studies n >1000

Study inclusion criteria: CT and plain films in the setting
of blunt cervical spine trauma.

Gold standard varied
CT pooled sensitivity, 98% (95% CI, 96-99%)
Plain film pooled sensitivity, 52% (95% CI, 47-56%)

Recommendations:

– CT is preferred modality for high-risk patients
– Insufficient evidence that CT should replace plain
  films in patients at low risk of C-spine injury

Anatomy – The Cervical Spine

Anatomy – The Cervical Spine

Anatomy – The Cervical Spine

Vertebral Artery (superior to C1)

Anatomy

Anatomy

Anterior views with cross-section of occipital condyles, atlas (C1), and axis (C2)

Steele’s Rule

Superior View of Atlanto-Occipital Joint

Case 1
Status-Post MVA

CT Coronal and Sagittal Planes Cross-Referenced
Case 1
Status-Post MVA
Hangman’s Fracture:

Traumatic spondylolysis of C2: often a result of head hyperextension UPON the neck.

Posterosuperior view of hangman’s fracture of C2 vertebra

Hangman’s Fracture

MRI Findings

T2 Weighted MRI, Sagittal Cross-Section
Undisplaced Hangman’s Fracture

Hangman’s Fracture with Subluxation

Widely displaced neural arch fracture

Subluxation of C2 upon C3

Widely Displaced Hangman’s Fracture

Fragment anterior and inferior to C2 vertebral body

Wide separation of fracture fragments

Locking of C2 facets anterior to C3

Our Patient

Halo brace
Acknowledgements:

• Dr. Ammar Sarwar
• Dr. Karen Lee
• Dr. Gunjan Senapat
• Dr. Gillian Lieberman