C-Spine Plain Films
Outline

- Epidemiology
- Indications for C-spine imaging
- Modalities
- Interpretation
- Types of fractures
Epidemiology

- 7000-10000 c-spine injuries treated each year
- Additional 5000 die at the scene
- Mean age is 30.7, Mode is 19
- 82% males
- 50% MVC, 25% Falls, 10% Sports

*www.med-ed.virginia.edu/courses/rad/cspine/index.html*
Indications for C-spine Films

- Tenderness
- Neurologic deficit
- Forceful Mechanism of injury
- Distracting injury
- Altered sensorium
Modalities

- *Plain films – Lateral, AP, and Odontoid*
- *CT*
- *MRI*
Interpretation of Lateral Plain Film

*Mnemonic AABCS*

- Adequacy
- Alignment
- Bones
- Cartilage
- Soft Tissue
Interpreting Lateral Plain Film

- Adequacy
  - Should see C7-T1 junction
  - If not get swimmer’s view or CT
Swimmer’s View

- Anterior arch of C1
- Occipital bone
- Posterior arch of C1
- Odontoid process of C2
- Raised humerus
- Humeral head
- Body of T1
- Trachea
Interpreting lateral Plain Film

Alignment

- Anterior vertebral line
  - Formed by anterior borders of vertebral bodies
- Posterior vertebral line
  - Formed by posterior borders of vertebral bodies
- Spino-laminar Line
  - Formed by the junction of the spinous processes and the laminae
- Posterior Spinous Line
  - Formed by posterior aspect of the spinous processes
Alignment

- Anterior Vertebral Line
- Posterior Vertebral Line
- Spino-Laminar Line
- Posterior Spinous Line
Bones
Cartilage

- Predental Space should be no more than 3 mm in adults and 5 mm in children
- Increased distance may indicate fracture of odontoid or transverse ligament injury
Cartilage Cont.

- Disc Spaces
  - Should be uniform
  - Assess spaces between the spinous processes
Soft tissue

- **Nasopharyngeal space (C1)** - 10 mm (adult)
- **Retropharyngeal space (C2-C4)** - 5-7 mm
- **Retrotracheal space (C5-C7)** - 14 mm (children), 22 mm (adults)
- **Extremely variable and nonspecific**
AP C-spine films

- Spinous processes should line up.
- Disc space should be uniform.
- Vertebral body height should be uniform. Check for oblique fractures.
Odontoid view

- Adequacy: all of the dens and lateral borders of C1 & C2
- Alignment: lateral masses of C1 and C2
- Bone: Inspect dens for lucent fracture lines
Fractures

- **Mechanisms of injury**
  - hyperflexion i.e. diving in shallow water
  - axial compression i.e. landing directly on head
  - Hyperextension i.e. hitting dashboard in MVC
Fractures

- Classified as stable or unstable
- Stability of cervical spine is provided by two functional vertical columns
  - Anterior column: vertebral bodies, the disc spaces, the anterior and posterior longitudinal ligaments and annulus fibrosus
  - Posterior column: pedicles, facets and apophyseal joints, laminar spinous processes and the posterior ligament complex
- As long as one column is intact the injury is stable.
Fractures

- **Jefferson Fracture**
  - Compression fracture of C1 ring
  - Most common C1 fracture
  - Unstable
  - Commonly see increase in predental space on lateral if transverse ligament is damaged and displacement of C1 lateral masses on odontoid.
  - Obtain CT
Fractures
Fractures

- **Burst Fracture**
  - Fracture of C3-C7 from axial loading
  - Spinal cord injury is common from posterior displacement of fragments
  - Stable if ligaments intact
Fractures

- **Clay Shoveler’s Fracture**
  - Flexion fracture of spinous process
  - C7>C6>T1
  - stable
Flexion Teardrop fracture

- Flexion injury causing a fracture of the anteroinferior portion of the vertebral body
- Unstable because usually associated with ligamentous injury
Fractures

- **Bilateral Facet Dislocation**
  - Flexion injury
  - Subluxation of dislocated vertebra of greater than ½ the AP diameter of the vertebral body below it
  - High incidence of spinal cord injury
  - Extremely unstable
Fractures

- **Hangman’s Fracture**
  - Extension injury
  - Bilateral fractures of C2 pedicles (white arrow)
  - Anterior dislocation of C2 vertebral body secondary to ALL tear (red arrow)
  - Unstable
Fractures

**Odontoid**
- Complex mechanism of injury
- Generally unstable
- **Type 1 fracture through the tip**
  - rare
- **Type 2 fracture through the base**
  - Most common
- **Type 3 fracture through the base and body of axis**
  - Best prognosis
Summary

- Know when to order C-spine films: tenderness, forceful injury, altered sensorium, distracting injury, neurologic deficit
- Remember your AABC’S
- Order CT for evaluation of extent of fracture or MRI if suspect soft tissue injury