

C-Spine Plain Films

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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 defecit*
- ▶ *Forceful Mechanism of injury*
- ▶ *Distracting injury*
- ▶ *Altered sensorium*



Modalities

▶ *Plain films – Lateral, AP, and Odontoid*

▶ *CT*

▶ *MRI*

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Interpretation of Lateral Plain Film

▲ *Mnemonic AABCS*

- ▲ *Adequacy*
- ▲ *Alignment*
- ▲ *Bones*
- ▲ *Cartilage*
- ▲ *Soft Tissue*



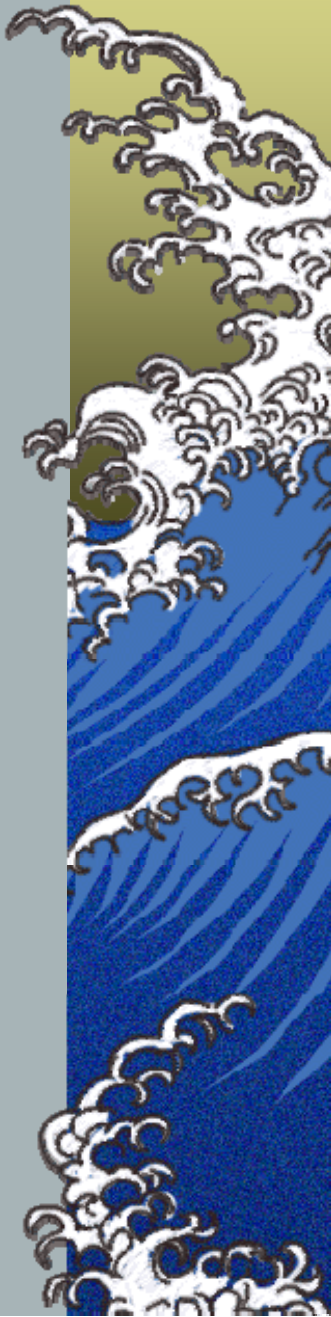
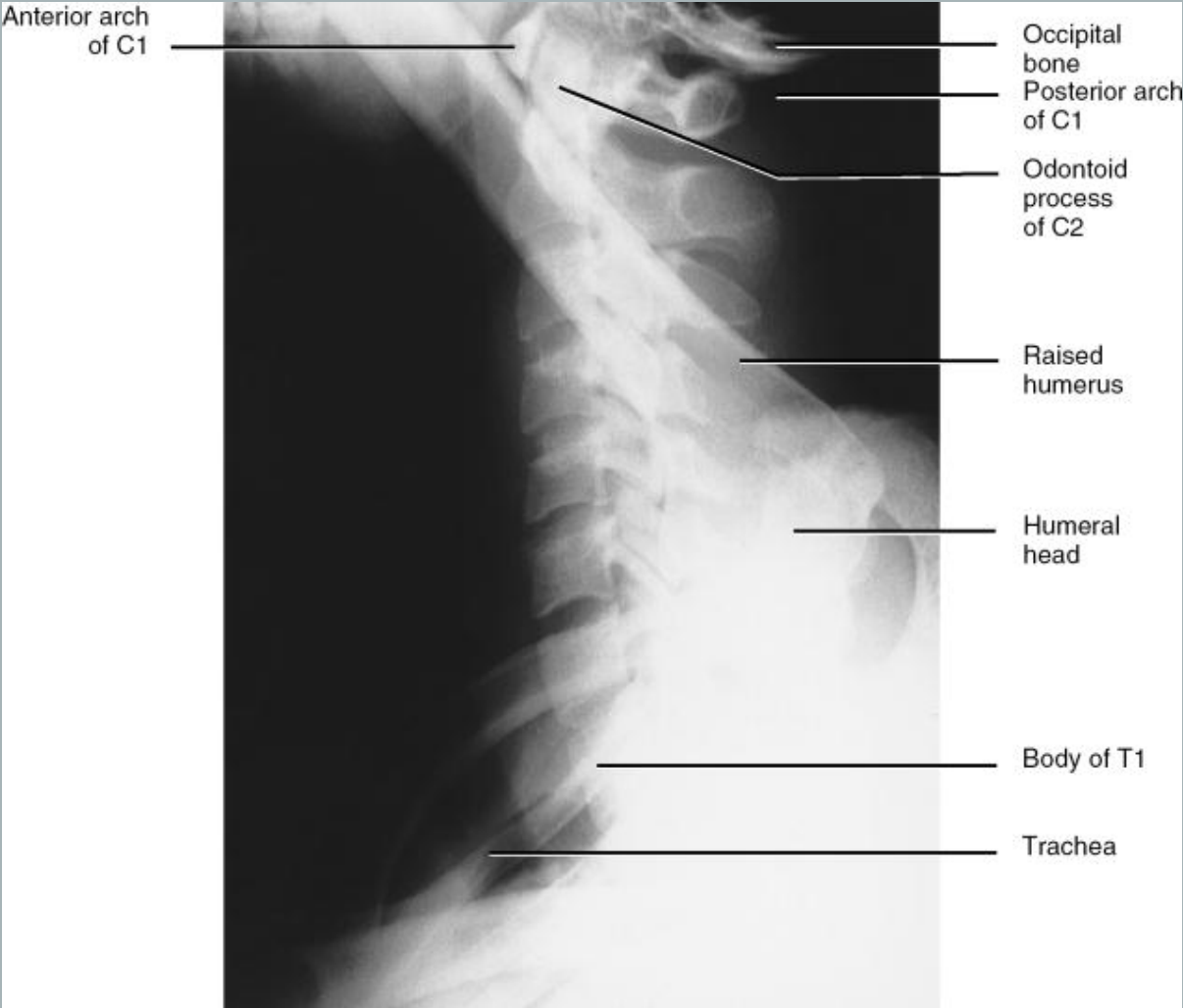
Interpreting Lateral Plain Film



- ▶ Adequacy
 - ▶ *Should see C7-T1 junction*
 - ▶ *If not get swimmer's view or CT*



Swimmer's View



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*

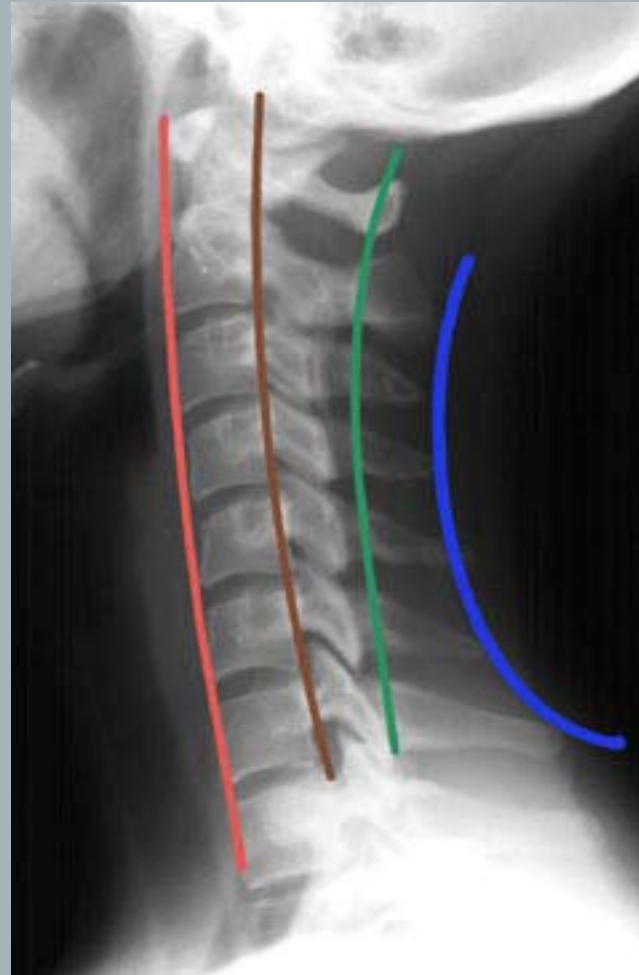
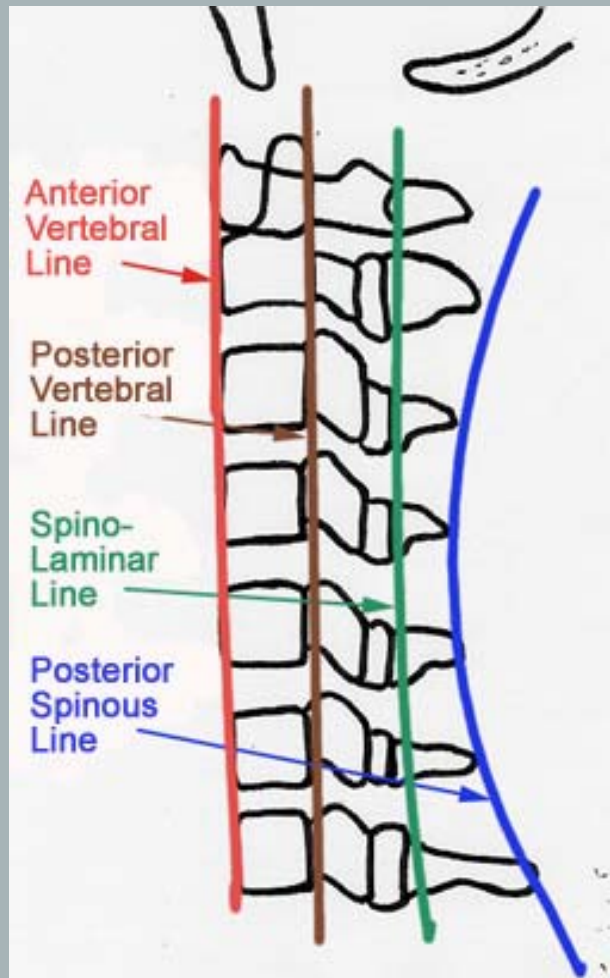
▲ *Formed by the junction of the spinous processes and the laminae*

▲ *Posterior Spinous Line*

▲ *Formed by posterior aspect of the spinous processes*



Alignment



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*



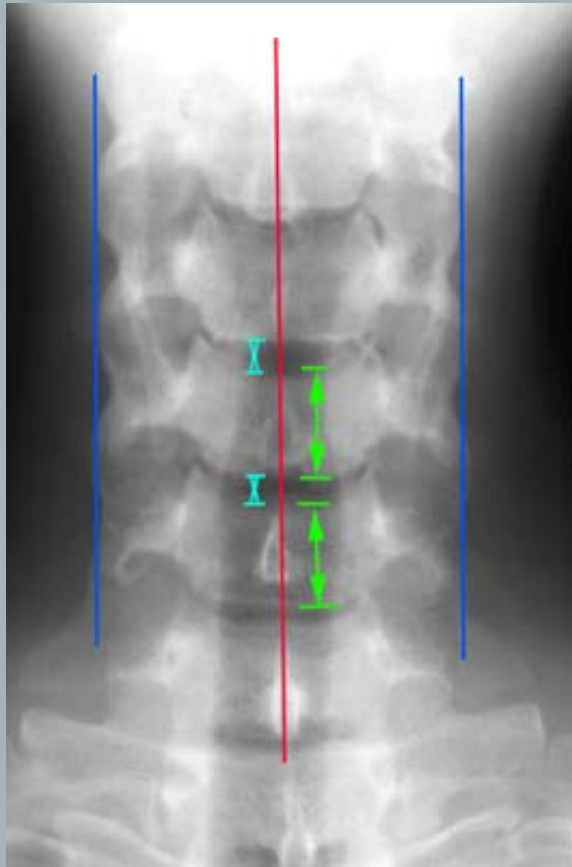
Soft tissue



- ▶ *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*



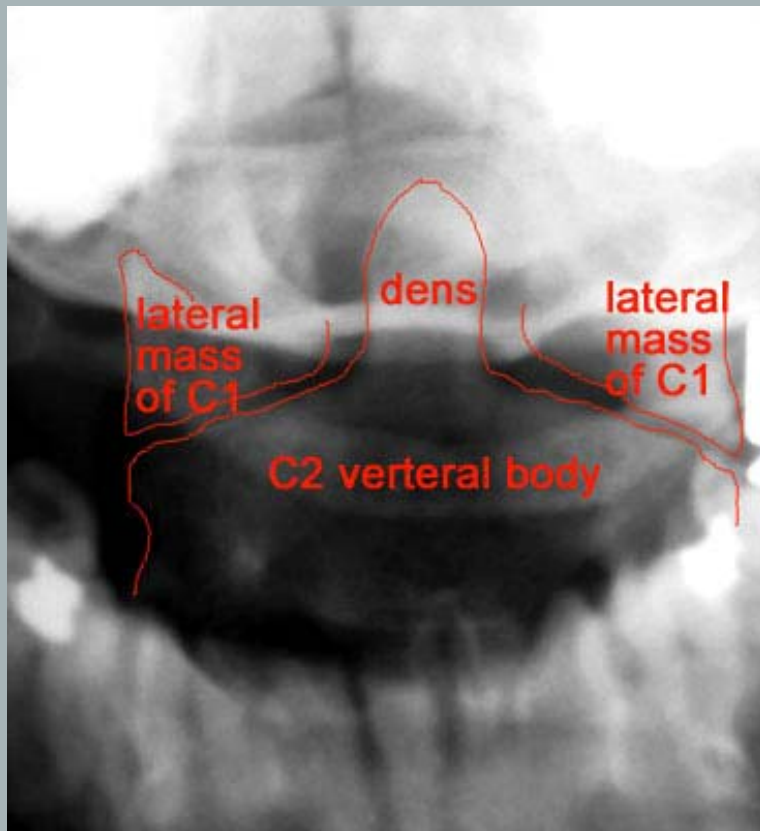
AP C-spine films



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



Odontoid view

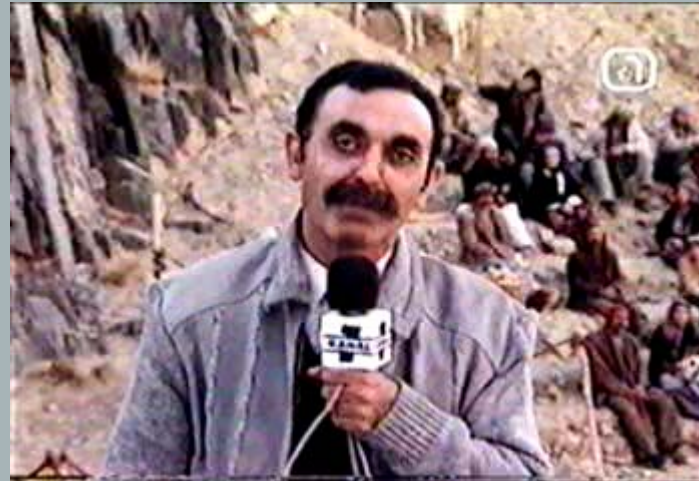


- ▶ *Adequacy: all of the dens and lateral borders of C1 & C2*
- ▶ *Alignment: lateral masses of C1 and C2*
- ▶ *Bone: Inspect dens for lucent fracture lines*



Fractures

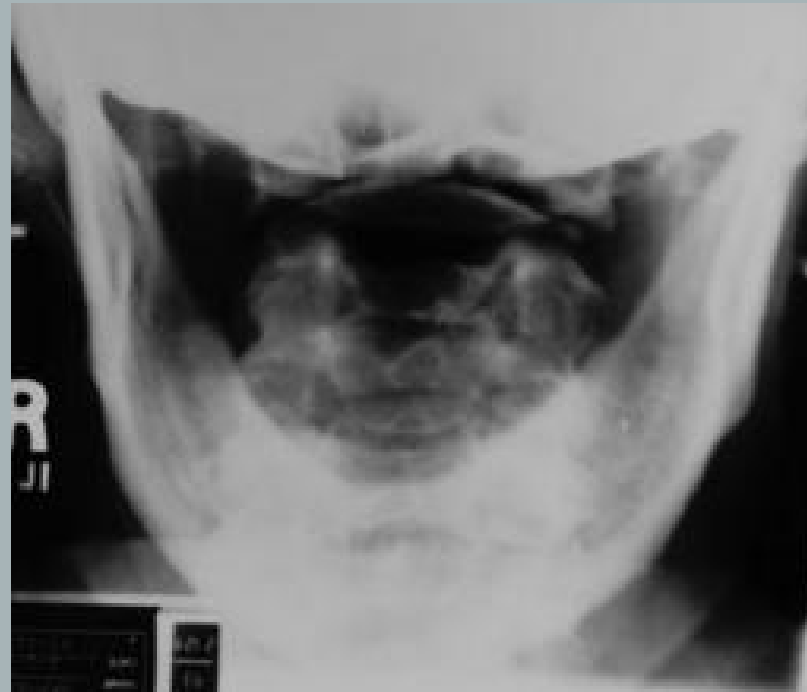
- ▶ *Mechanisms of injury*
 - ▶ *hyperflexion i.e. diving in shallow water*
 - ▶ *axial compression i.e. landing directly on head*
 - ▶ *Hyperextension i.e. hitting dashboard in MVC*



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, laminae, spinous processes and the posterior ligament complex*
- ▶ *As long as one column is intact the injury is stable.*

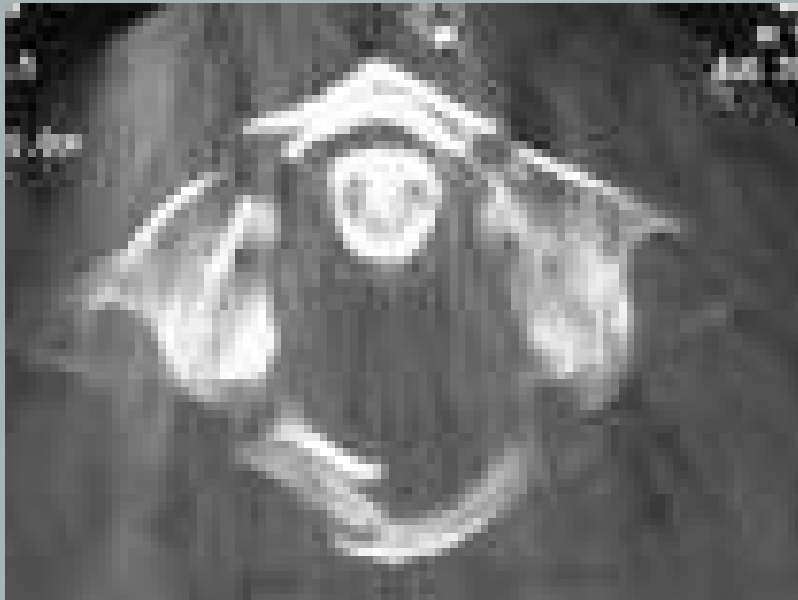




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Fractures



▲ *Jefferson Fracture*

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



Fractures



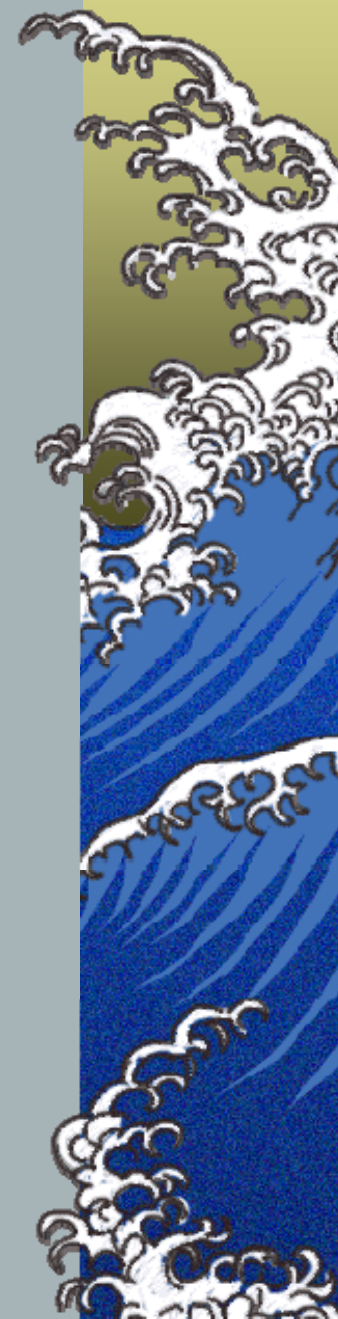
Fractures



▲ *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*





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Fractures

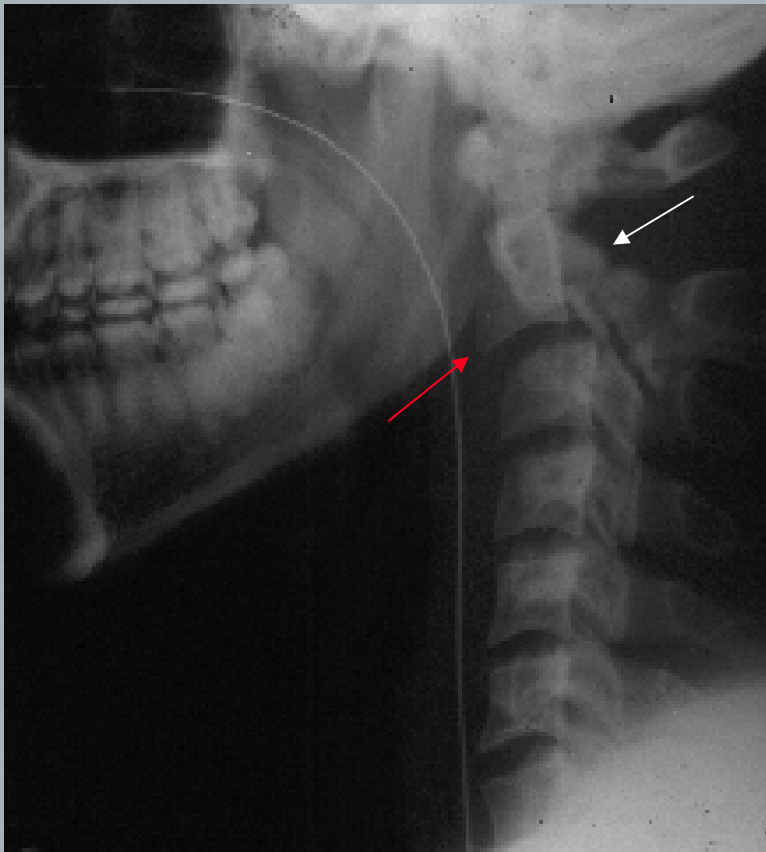


- ▶ *Bilateral Facet Dislocation*
 - ▶ *Flexion injury*
 - ▶ *Subluxation of dislocated vertebra of greater than $\frac{1}{2}$ the AP diameter of the vertebral body below it*
 - ▶ *High incidence of spinal cord injury*
 - ▶ *Extremely unstable*





Fractures

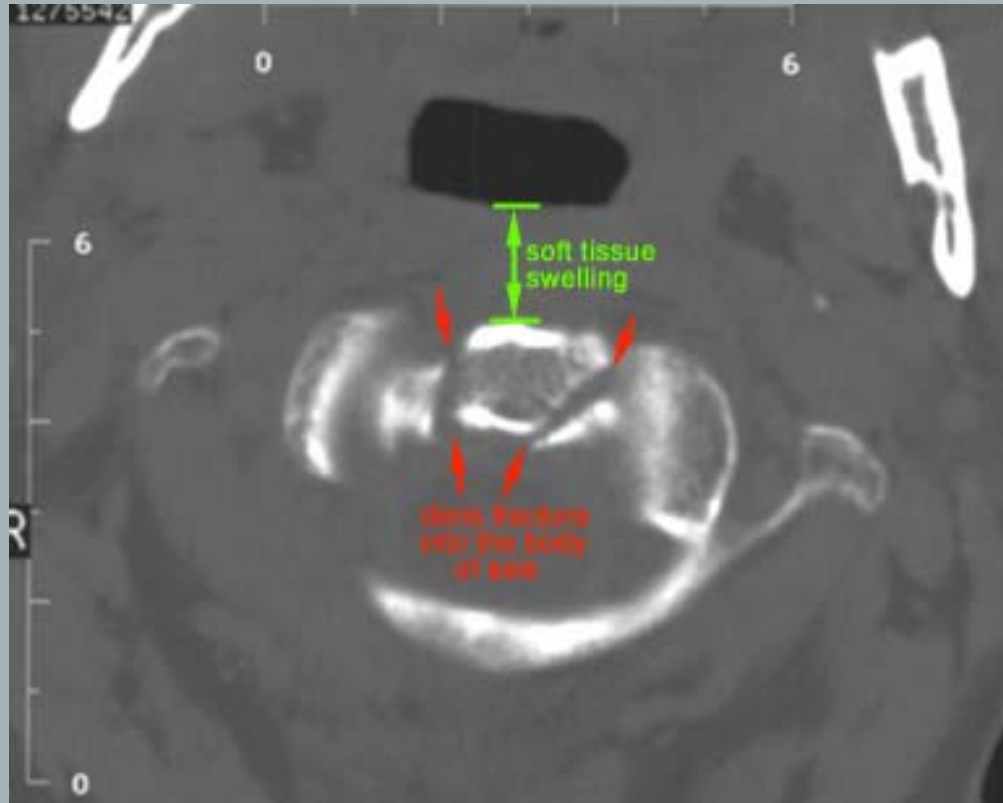


- ▶ *Hangman's Fracture*
 - ▶ *Extension injury*
 - ▶ *Bilateral fractures of C2 pedicles (white arrow)*
 - ▶ *Anterior dislocation of C2 vertebral body secondary to ALL tear (red arrow)*
 - ▶ *Unstable*









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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*

