

Essentials of Trauma Imaging: Spine Trauma Imaging (ES41B)

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Learning objectives

- 1) Appropriately employ radiography, CT and MRI when screening for spinal injuries.
- 2) Analyze spine images using a pattern approach.
- 3) Classify spine injuries into pathomechanical families.

I have no financial disclosures.

Screening for cervical spine injuries

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Last revision: 2011

**American College of Radiology
ACR Appropriateness Criteria®**

Clinical Condition: Suspected Spine Trauma
Variant 1: Cervical spine imaging not indicated by NEXUS or CCR clinical criteria. Patient meets key-words criteria.

Diagnostic Procedure	Rating	Comments	URL
X-ray cervical spine lateral only	1		Min
X-ray cervical spine AP lateral open mouth	1		Low
X-ray cervical spine AP lateral open mouth oblique	1		Low
X-ray cervical spine AP lateral open mouth oblique flexion extension	1		Low
CT cervical spine with sagittal and coronal reformats	1		Med
CT myelography cervical spine	1		Med
CTA head-neck	1		Med
MRI cervical spine	1		None
MRA neck	1		None
DVA arteriography cervical/neck	1		Med

Rating Scale: 1=Least appropriate, 9=Most appropriate

www.acr.org/SecondaryMainMenuCategories/quality_safety/app_criteria.aspx

Screening for cervical spine injury

- Thin-section CT, not radiography, is primary screening study for suspected cervical spine trauma
- 3-view radiography only when CT not readily available; not substitute for CT
- “Concerns about cost and radiation require careful selection of patients who truly are at risk and need imaging.”
- Applies to adults and older children

2007 ACR Appropriateness Criteria

Screening in younger children <16

- “...not sufficient evidence to establish reliability of NEXUS criteria in younger children, or to recommend whether radiography or CT should be initial imaging study.”
- Considerations regarding radiation exposure should be paramount
- Initial evaluation ...radiography (3-views) regardless of mental status.

2007 ACR Appropriateness Criteria

Screening for cervical soft tissue injury

- soft-tissue injuries are quite common after significant trauma,
- and many of these lesions do not lead to mechanical instability
- MRI should be primary modality
- MRI when neurologic status cannot be fully evaluated within 48 hours of injury, including those with normal CT examination

2007 ACR Appropriateness Criteria

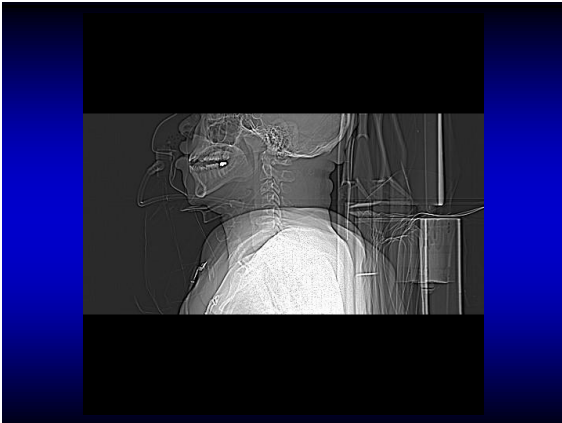
Screening for thoracic or lumbar injury

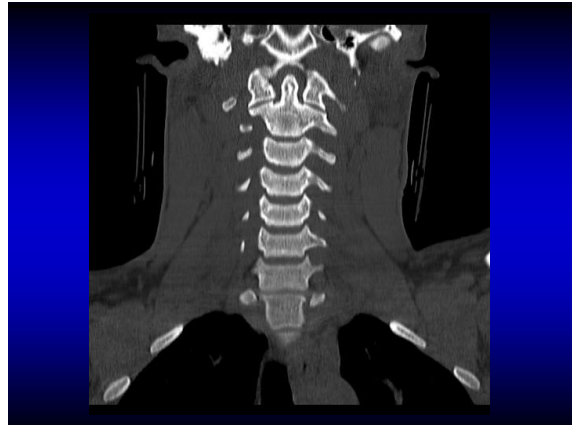
- MDCT is the procedure of choice, adults and children 16 – 18
- Radiography in children < 16 (AP, lateral)
 - *unless* the patient has already had a CT examination of the chest, abdomen, and pelvis

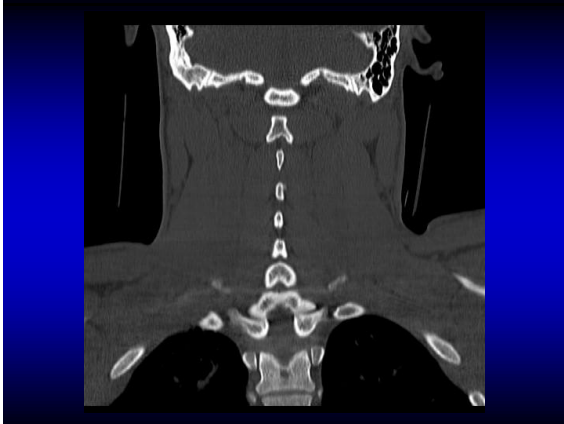
2007 ACR Appropriateness Criteria

KEY IMAGES approach a 400 image cervical spine MDCT

2 mm bone and soft algorithm
transverse, sagittal, coronal



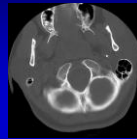




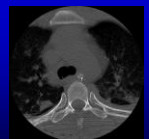
Analyze using pattern approach

1. Assess for adequate coverage
2. Assess for artifacts
3. Count the vertebrae
4. Cranio-cervical region in 3 planes
5. Lower cervical spine on sagittal images with reference to transverse and coronal

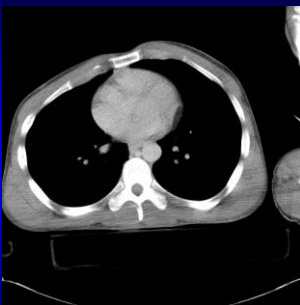
Assess for adequate coverage



- Top: occipital bone
- Bottom:
 - T1 if torso scan to follow
 - T4 if only C-spine imaged

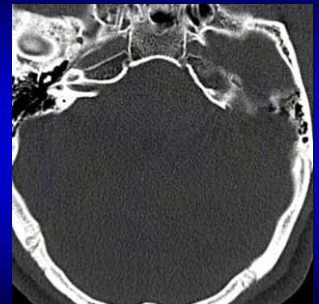


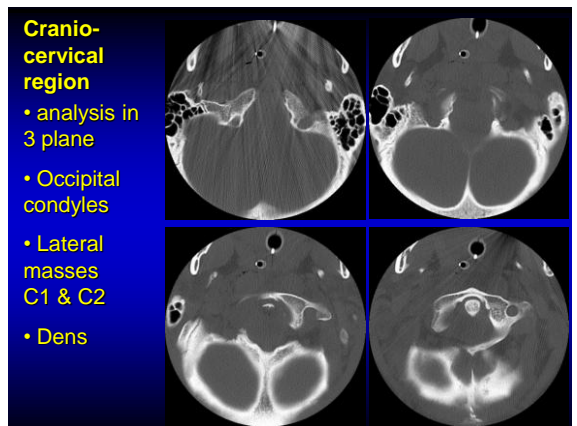
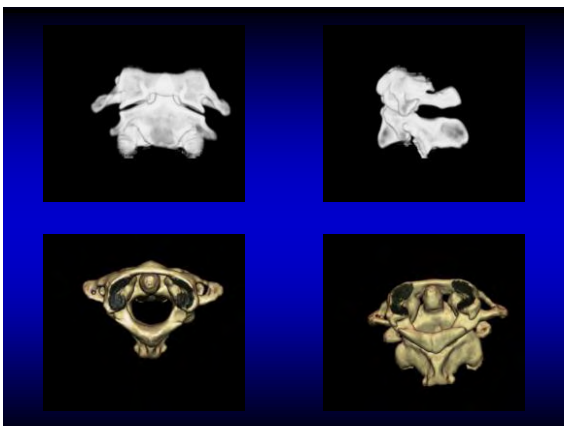
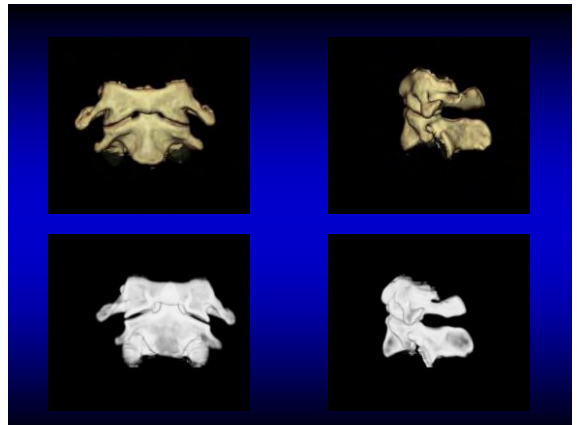
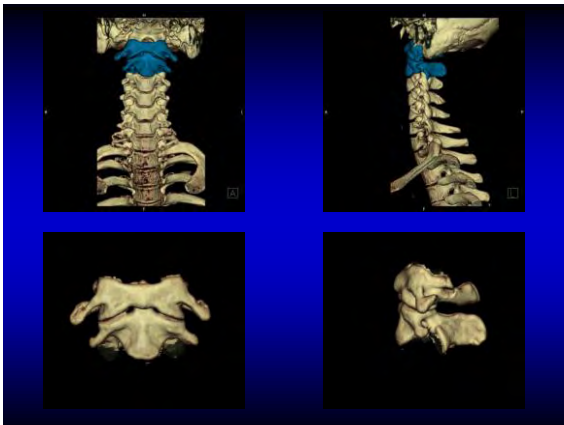
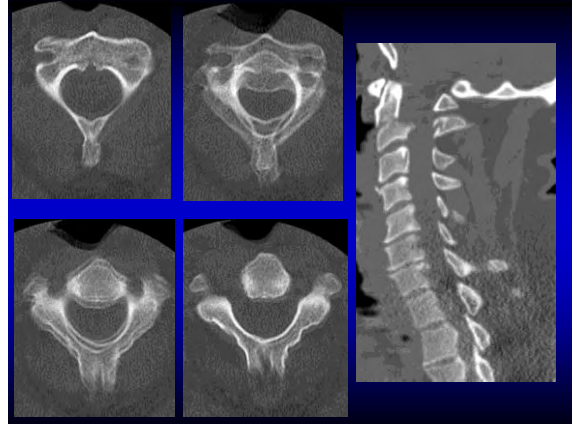
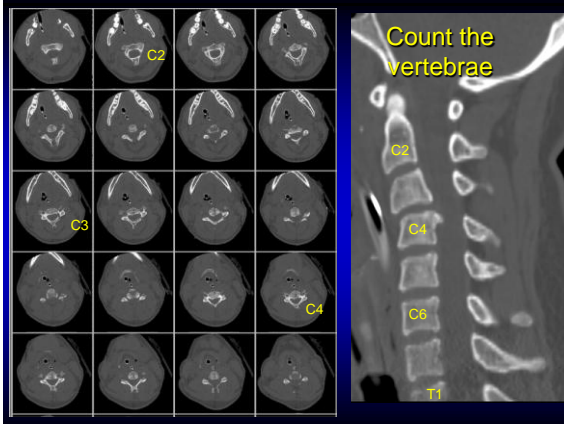
Assess for artifacts

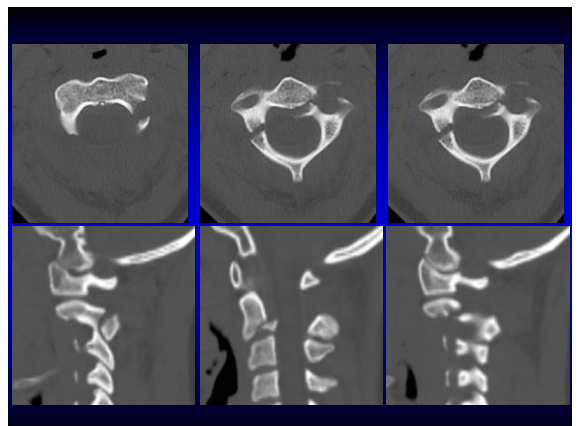
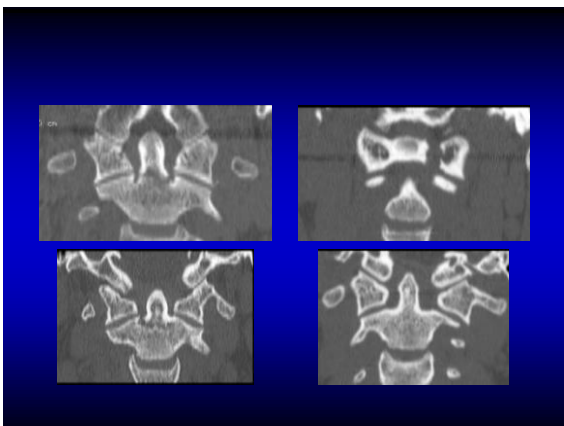
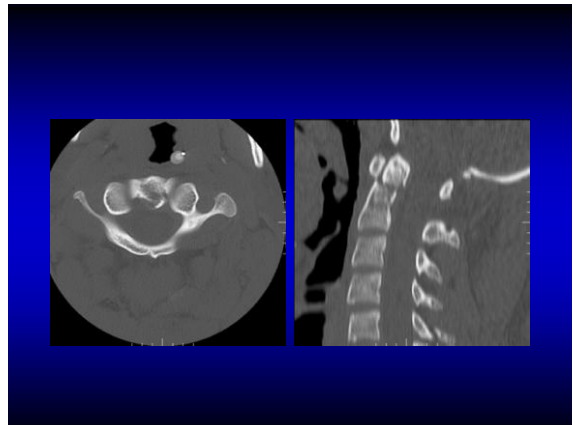
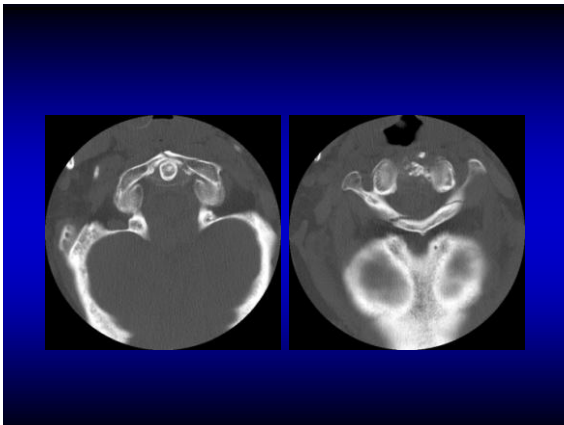
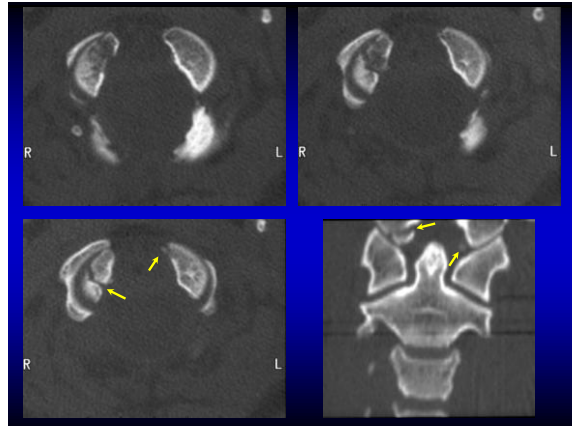
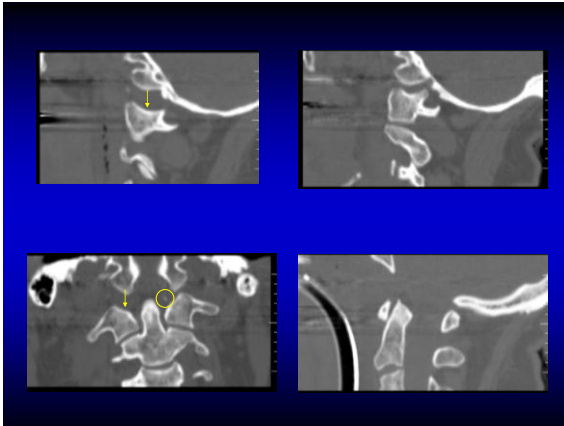


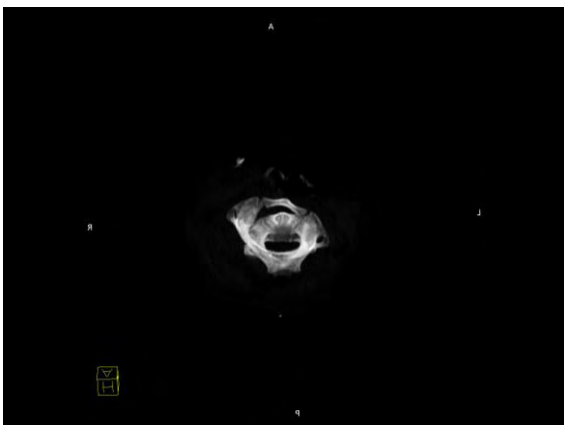
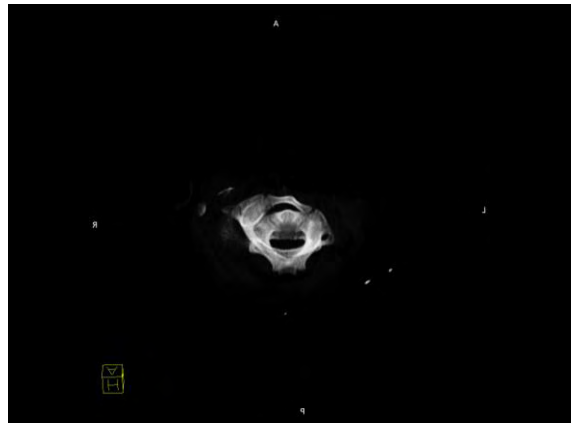
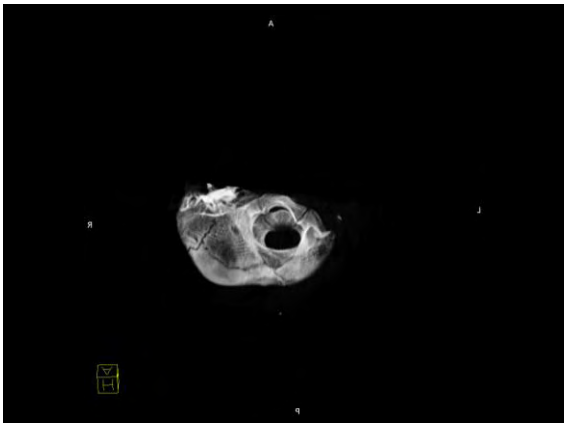
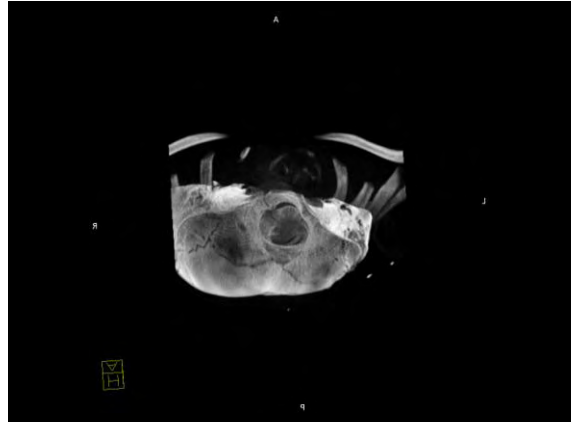
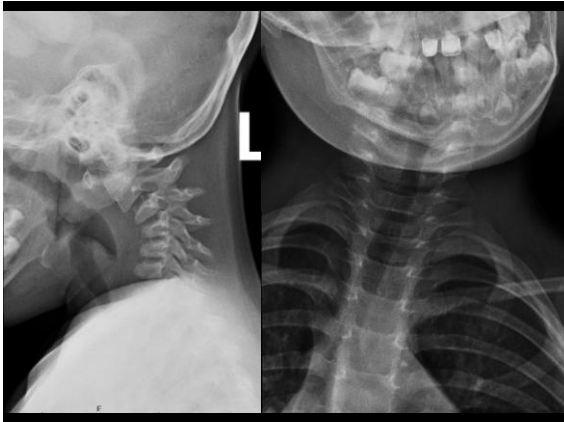
Assess for artifacts and major injuries

- Complete pedicolumnar rings
- Disrupted facet joints
- Rotational malalignment
- Patient motion

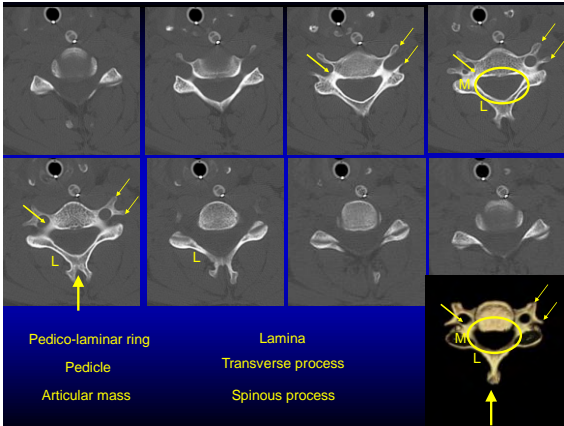






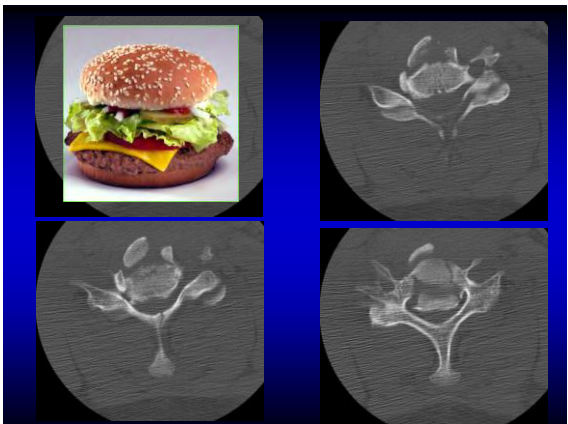
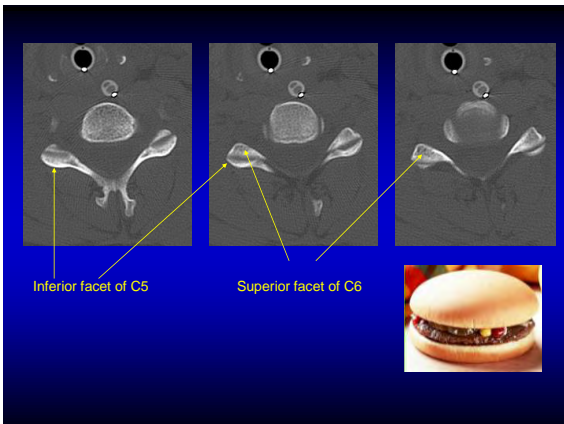
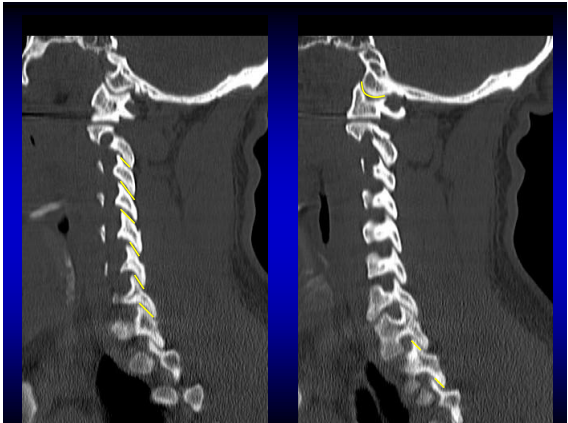
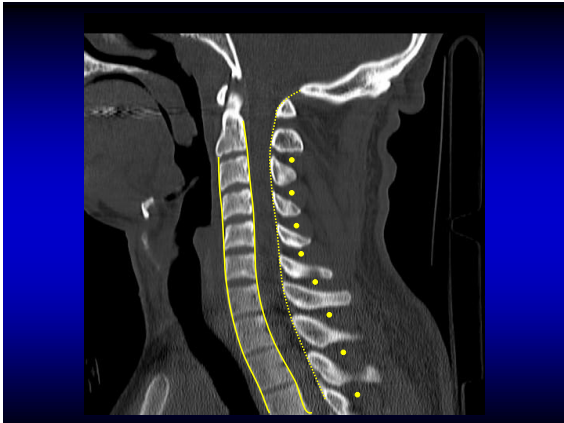


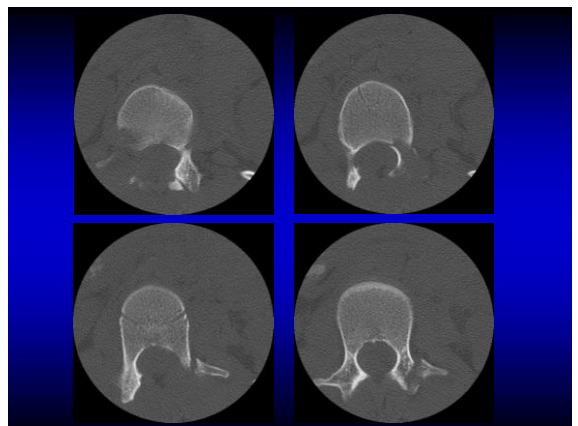
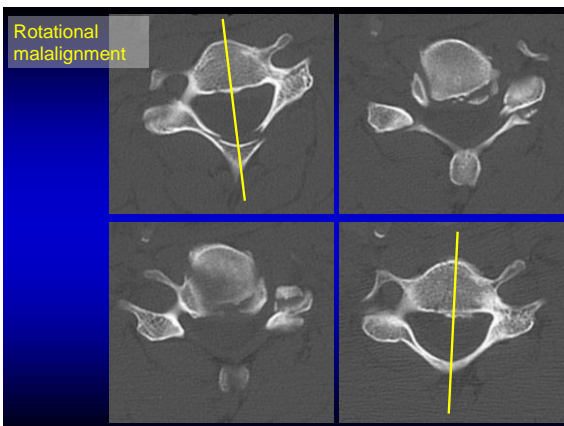
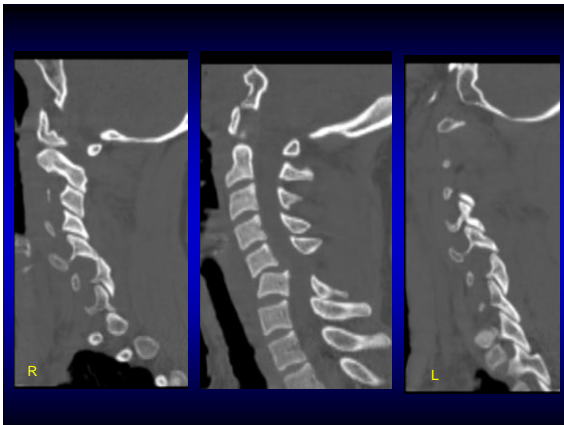
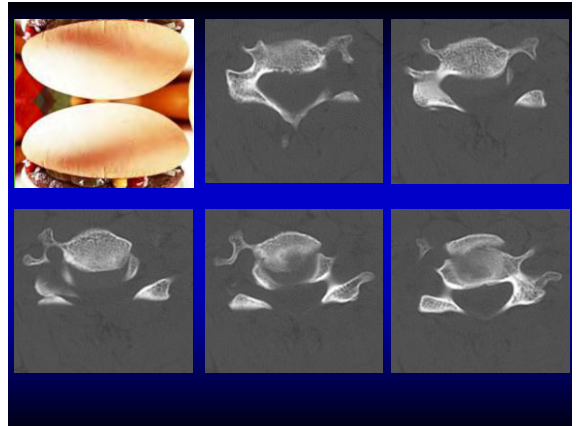
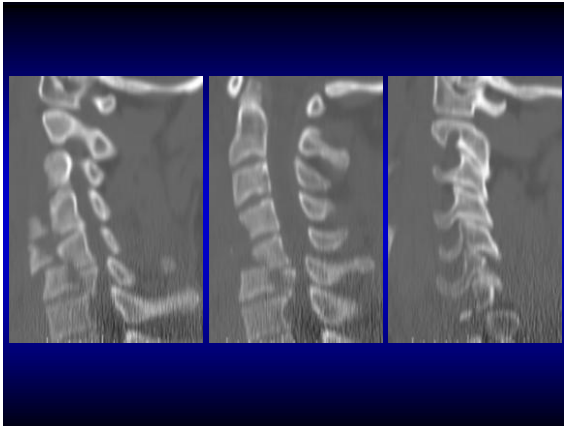
Lower cervical spine

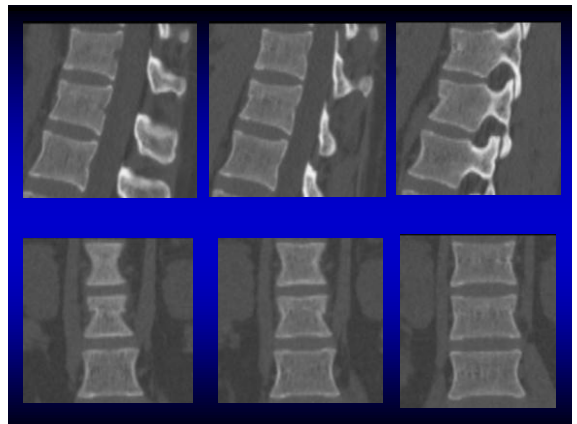
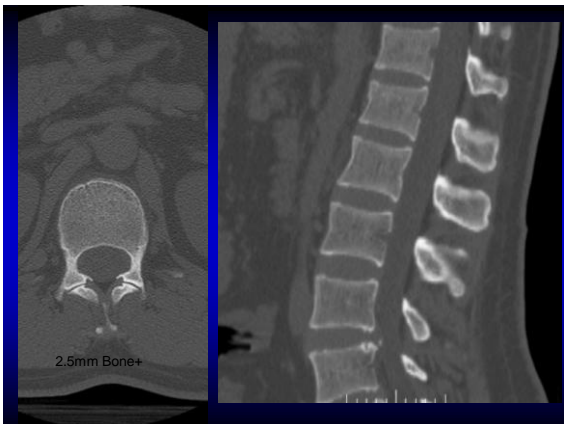
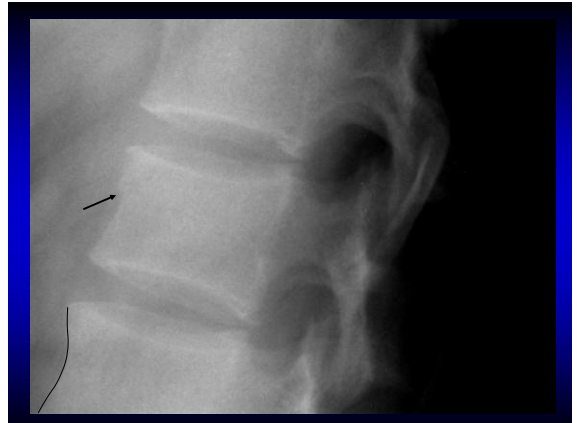
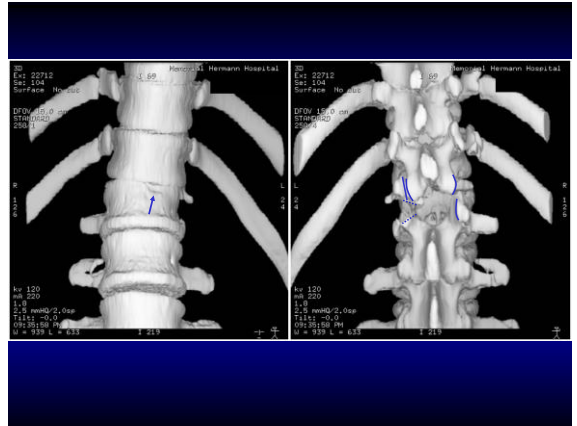
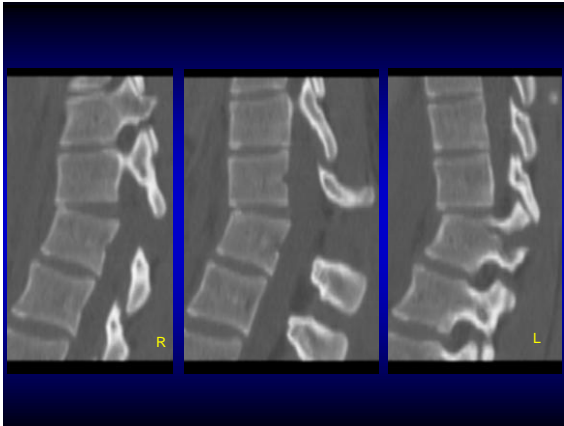


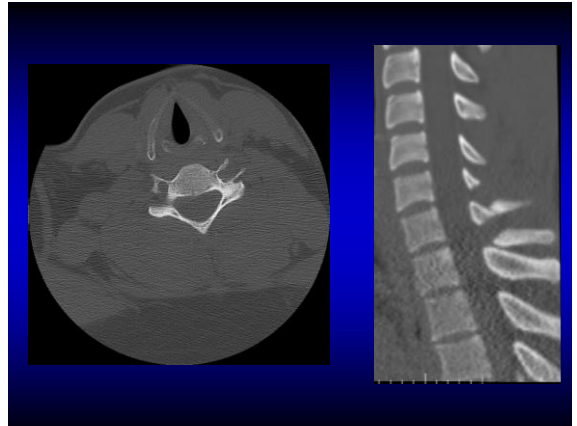
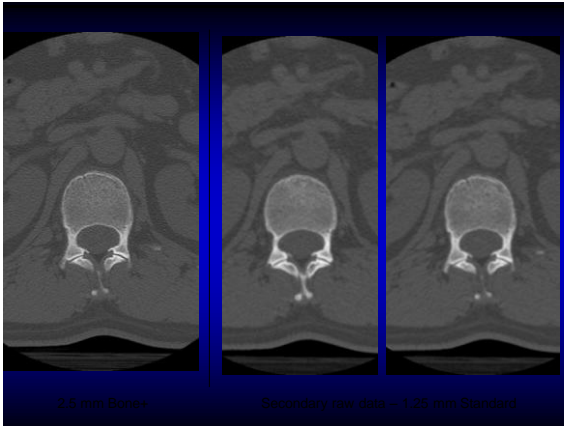
Sagittal reformatted images

- Mid sagittal alignment
 - Anterior translation
 - Kyphosis
 - Interspinous or interlaminar widening
 - Disc space widening
- Vertebral bodies for compression fracture
- Facet joints for fracture or subluxation
- Spinous process for missed fracture



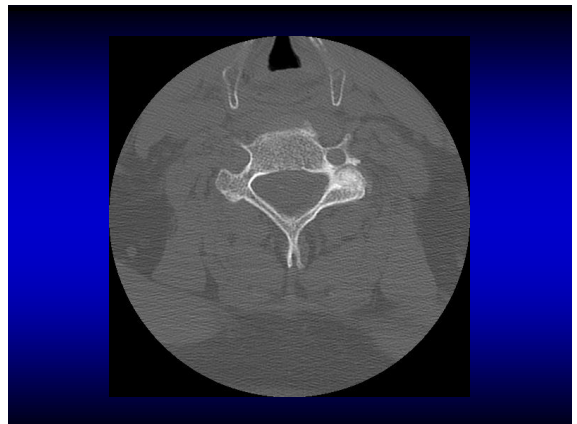
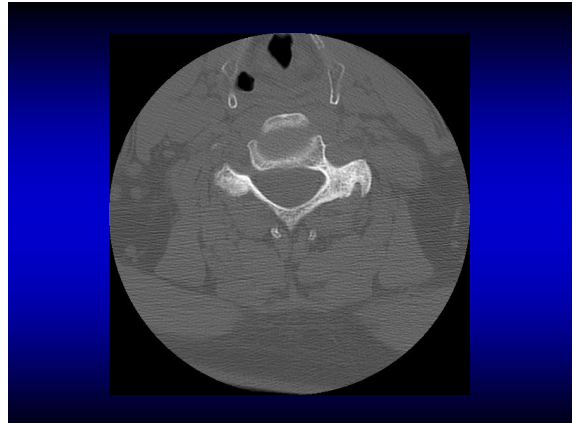


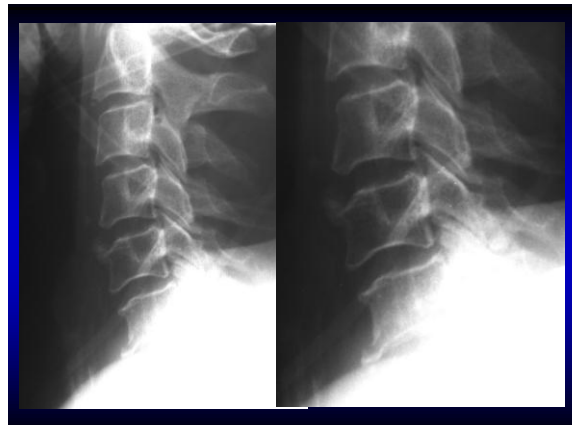
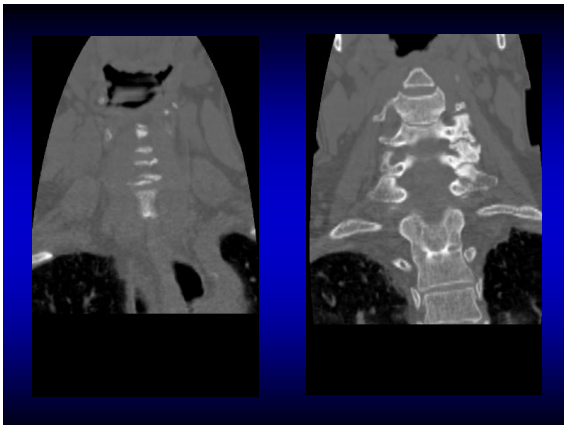
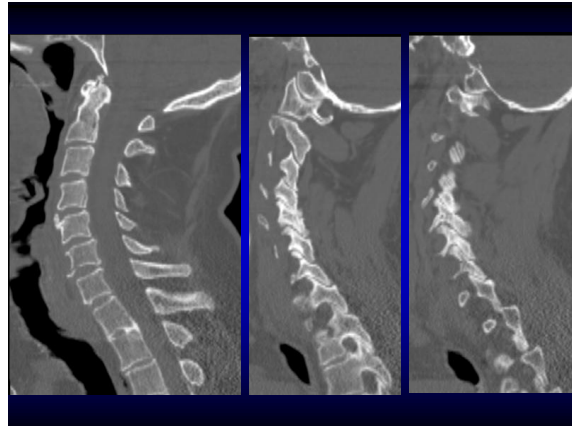
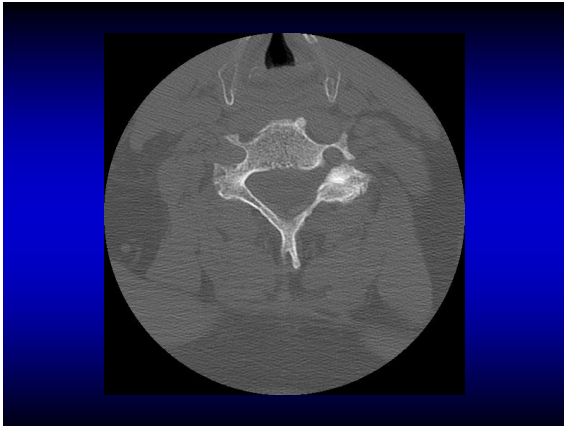




Coronal reformatted images

- Dens and C1-C2 articulations
- Transverse processes for fracture
- Spinous processes for rotational malalignment

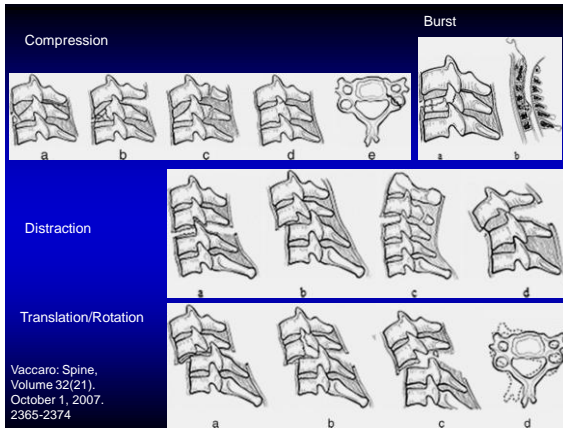




Classify spine injuries into pathomechanical families

- Scores injury based on: injury morphology, disco-ligamentous complex, and neurologic status
- Simplifies injury morphology
 - compression injuries,
 - distraction injuries,
 - rotational/translational injuries.

The subaxial cervical spine injury classification system: a novel approach to recognize the importance of morphology, neurology, and integrity of the disco-ligamentous complex.
 Vaccaro AR, Ruben RJ, Patel AN, Fisher C, Dvorak M, Lehman RA Jr, Anderson P, Harrop J, Oner FC, Arnold P, Fehlings M, Hedlund R, Madigan J, Reichme SJ, Assala B, Shainline M. Spine Trauma Study Group. Spine. 2007 Oct 1;32(21):2365-74. Review.
 PMID: 17905580 [PubMed - indexed for MEDLINE]



Conclusion

- Screen with MDCT and selective use of MRI; radiography of limited value.
- Radiation dose concerns warrant judicious use of any screening test.
- Analyze spine images using a systematic pattern.
- Classify spine injuries into pathomechanical families.
- Learn how the spine surgeons in your area classify injuries; try the Vaccaro system