

AMSER Case of the Month

October 2021

41 y/o male presenting with neck pain s/p fall.

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Patient Presentation

- **HPI:** Patient is a 41 y/o M who presents to the ED with neck pain.
- 3 weeks ago he was playing basketball and fell to his left side. He subsequently experienced moderate left lower neck pain, without sensory changes, weakness or gait instability.
- Since that event, he reports neck pain that is 4/10 in severity, significant neck stiffness and reduced ROM, and chronic mild LUE weakness, especially with abduction and flexion.
- This chronic pain/discomfort prompted the patient to present to the ED.

Patient Presentation

- In the ED he denies dysphagia, dyspnea, increased weakness, paresthesia, numbness, or bowel/bladder incontinence. He also denies any more recent trauma.
- He was then admitted to the neurosurgery floor for further work-up and management.

Patient Presentation

- **PMH:** Ankylosing spondylitis (AS)
- **Medications:** Etanercept (50 mg/mL, 1 mL injection subcutaneously, once weekly) and Oxycodone-acetaminophen (5-325 mg PO q8h PRN)
- **Surgical Hx:** Non-contributory.
- **Family Hx:** Non-contributory.
- **Social Hx:** Never-smoker. Drinks 1-2 alcoholic drinks per week.

Physical Exam

- **Vitals:** BP 137/72 | Pulse 53 | Temp 98.4 °F (Oral) | Resp 16 | SpO2 100% on RA | BMI 31 kg/m2
- **Neuro:** A&O x 3;
 - Cranial Nerves: PERRL, EOMI, sensation intact V1-V3, no facial droop, hearing intact and equal b/l, tongue midline, palate elevation, shoulder shrug 5/5
 - Motor:
 - Upper extremities:
 - Right: deltoid 5/5, biceps 5/5, triceps 5/5, wrist extension 5/5, grip 5/5
 - **Left: deltoid 4+/5, biceps 4+/5 (NEXUS Criteria positive), triceps 5/5, wrist extension 5/5, grip 5/5**
 - Lower extremities:
 - Right: hip flexion 5/5, knee extension 5/5, knee flexion 5/5, dorsiflexion 5/5, plantar flexion 5/5
 - Left: hip flexion 5/5, knee extension 5/5, knee flexion 5/5, dorsiflexion 5/5, plantar flexion 5/5
 - Reflexes 2+ throughout, neg. Hoffman's, neg. Babinski
 - Sensation intact bilaterally
 - Neg. pronator drift

What Imaging Should We Order?

ACR Appropriateness Criteria

Variant 2:

Age greater than or equal to 16 years. Suspected acute cervical spine blunt trauma. Imaging indicated by NEXUS or CCR clinical criteria. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT cervical spine without IV contrast	Usually Appropriate	☼☼☼
Radiography cervical spine	May Be Appropriate	☼☼
Arteriography cervicocerebral	Usually Not Appropriate	☼☼☼
CT cervical spine with IV contrast	Usually Not Appropriate	☼☼☼
CT cervical spine without and with IV contrast	Usually Not Appropriate	☼☼☼
CT myelography cervical spine	Usually Not Appropriate	☼☼☼☼
CTA head and neck with IV contrast	Usually Not Appropriate	☼☼☼
MRA neck without and with IV contrast	Usually Not Appropriate	○
MRA neck without IV contrast	Usually Not Appropriate	○
MRI cervical spine without and with IV contrast	Usually Not Appropriate	○
MRI cervical spine without IV contrast	Usually Not Appropriate	○

This imaging modality was ordered by the neurosurgeon

Imaging Findings (unlabeled)



CT Spine w/o contrast

Imaging Findings (labeled)



CT Spine w/o contrast

- Cervical spine straightening, multilevel flowing thin syndesmophytes, and facet fusion along the entire length of the cervical spine, consistent with pt's h/o AS.
- Nondisplaced transverse fracture through vertebral level C7 (red arrow).
- No associated vertebral body height loss or retropulsion of the posterior vertebral body cortex.

ACR Appropriateness Criteria

Variant 1: Acute onset myelopathy. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI spine area of interest without and with IV contrast	Usually Appropriate	0
MRI spine area of interest without IV contrast	Usually Appropriate	0
CT myelography spine area of interest	May Be Appropriate	Varies
CT spine area of interest with IV contrast	May Be Appropriate	Varies
CT spine area of interest without IV contrast	May Be Appropriate	Varies
Arteriography spine area of interest	Usually Not Appropriate	Varies
Radiography spine area of interest	Usually Not Appropriate	Varies
MRA spine area of interest with IV contrast	Usually Not Appropriate	0
MRA spine area of interest without and with IV contrast	Usually Not Appropriate	0
MRA spine area of interest without IV contrast	Usually Not Appropriate	0
MRI spine area of interest with IV contrast	Usually Not Appropriate	0
CT spine area of interest without and with IV contrast	Usually Not Appropriate	Varies
CTA spine area of interest with IV contrast	Usually Not Appropriate	Varies

This imaging modality was ordered next to rule out disc herniation

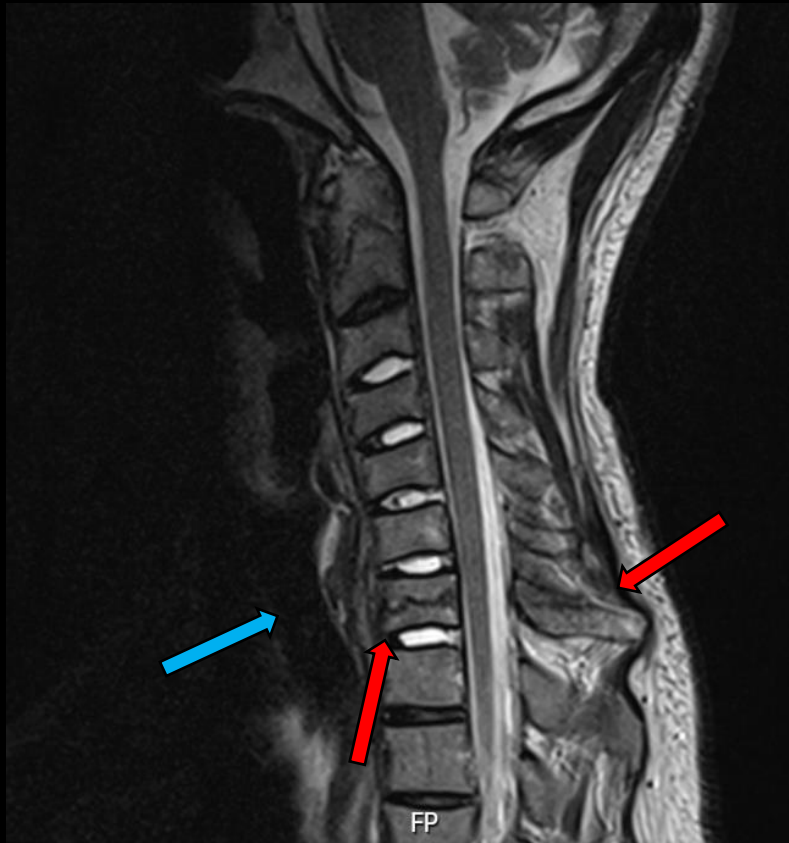


Imaging Findings (unlabeled)



Sagittal T2-weighted MRI

Imaging Findings (labeled)



Sagittal T2-weighted MRI

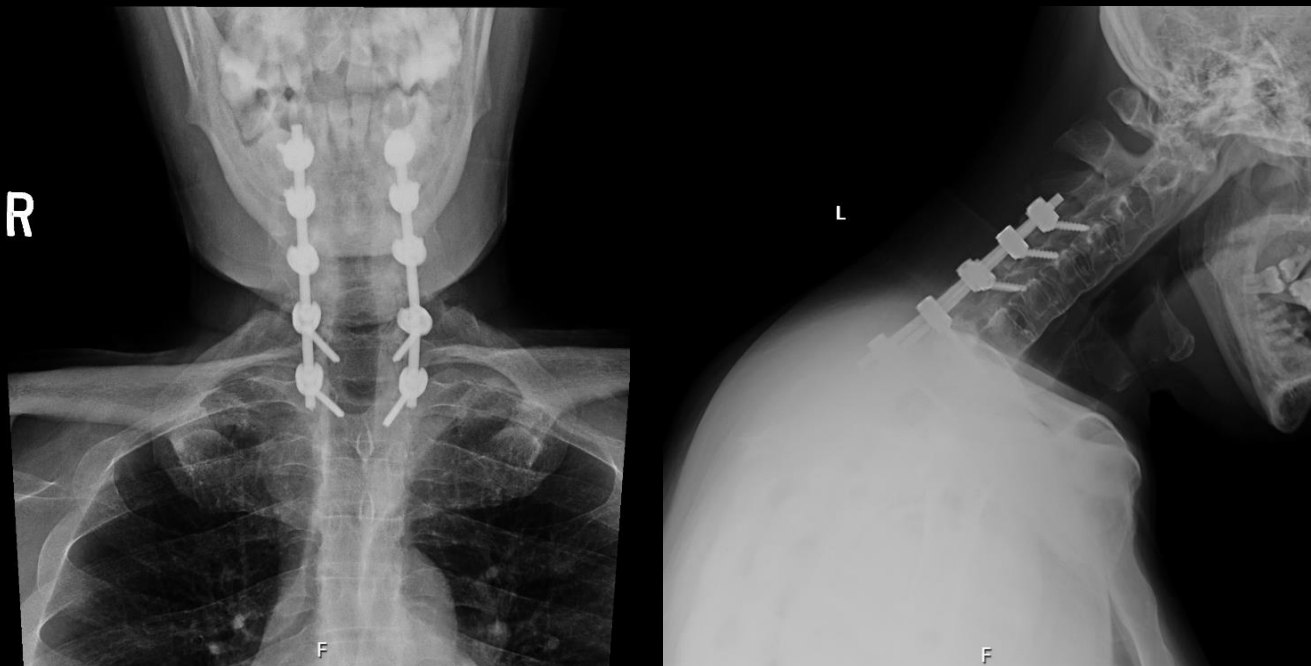
- Redemonstration of bridging syndesmophytes.
- There is a T1 linear hypointensity that extends through the C7 vertebral body and through the posterior elements, including the pedicles, right facet, and spinous process (red arrows).
- There is a small prevertebral hematoma with associated soft tissue swelling and slight anterior displacement of the esophagus (blue arrow).

Final Dx:

Transverse 3-Column Fracture
of the C7 vertebra
in a patient with Ankylosing Spondylitis

Final Diagnosis:

Transverse 3-Column Fracture (C7 vertebra)



Post-op X-rays of C-spine

Case Management

The patient was operated on 4 days after presenting to the ED.

He underwent C4-T2 fusion with bilateral lateral mass screws from C4-C6 and pedicle screws at T1-T2.

Case Discussion (Fractures and AS)

- Patients with fused spine disorders such as ankylosing spondylitis (AS), as in this case, and diffuse idiopathic skeletal hyperostosis (DISH) are at increased risk for unstable spinal injuries.
- Patients with AS are at least twice as likely to get vertebral fragility fractures following trauma than those without AS.
- This increased risk of fracture may be due to the increased spinal rigidity or low bone mineral density (BMD) that is seen in AS.
- Fractures usually involve all 3 columns of the spine and, in particular, involve injury to the posterior osteoligamentous components.

Case Discussion (cont.)

- Transverse 3-column fractures are felt to result from shearing forces (distractive-extension or distractive-flexion) with extension or flexion injury of the vertebral body and a distraction injury of the posterior elements.
- In AS, the lower cervical spine is most commonly involved, with the most common type of fracture being an extension fracture (distractive-extension more common than distractive-flexion or compression fractures).
- They most commonly occur with car accidents where the passenger was restrained with only a lap seatbelt (“seat belt injury”). They may also be seen in patients who have fallen, as in this case.

Case Discussion (cont.)

- Transverse 3-column fractures in patients with fused spinal disorders are often overlooked because they can occur with relatively minor trauma and patients can be minimally symptomatic.
- They are unstable fractures and, if unrecognized, may result in neurologic complications and diskovertebral junction disease, including pseudoarthrosis and diskovertebral junction destruction that can mimic infectious spondylodiskitis.
- Acute complications can include spinal deformity, cord involvement, epidural hematoma and vertebral artery injury.

Case Discussion (Imaging)

- Even minor trauma or acute pain in a patient with a fused spinal disorder such as AS or DISH should be evaluated with CT, and if neurologic deficit is present, MR should be performed.
- CT is the imaging of choice to visualize fracture details.
 - Findings include:
 - Horizontal fracture through elements of all three columns:
 - Anterior column: anterior longitudinal ligament, anterior 2/3 of the annulus fibrosus (disk) and/or vertebral body
 - Middle column: posterior longitudinal ligament and posterior 1/3 of the annulus fibrosus (disk) and/or vertebral body
 - Posterior column: posterior ligament complex (interspinous and/or flaval ligaments), posterior portion of the neural arch (facets and/or spinous processes)
 - Coronal and sagittal reconstructions - important due to horizontal orientation of the injury and potential for severe deformity in those planes.

Case Discussion (Imaging cont.)

- **MRI is useful when assessing for ligamentous and cord injury.**
 - Findings may include:
 - Bright T2 signal (edema) surrounding low signal fracture lines
 - Discontinuity of ligaments
 - Injury to the intervertebral disc
 - Spinal cord edema
 - Epidural hematoma
- **MRI or CT Angiography can be performed if concern for vertebral artery injury – a known complication of cervical spine injury.**
 - Findings may include:
 - Dissection
 - Thrombosis

Case Discussion (Treatment)

- Non-operative treatment (i.e. bracing or orthotics) may be used in patients with stable posterior elements and no neurologic deficits.
 - These patients would need long-term follow-up to monitor for development of spinal deformity.
- Surgical fixation to decompress the spinal cord and stabilize the fracture is indicated in patients with neurologic deficits or damage to the posterior elements.
 - This usually involves posterior +/- anterior fusion of the spine.

References

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