AMSER Case of the Month February 2023

43-year-old male with a L3 burst fracture

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Patient Presentation

- History of Present Illness: 43-year-old male presented as level 1 trauma transfer after falling 30 ft off a roof and suffering blunt traumatic injuries. Initial symptoms included low back pain, left ankle pain, and right elbow injury. He denied hitting his head or passing out. Due to the nature of presentation, a trauma call was activated.
- Past Medical History: Bipolar disorder
- Social History: Former smoker
- Medications: No anticoagulation or pertinent medications
- Vital signs: BP: 104/67, HR: 77, RR: 29, SPO2: 97% on RA

Patient Presentation

- Physical Exam:
  - Constitutional: Minor distress, alert, converse, appropriate
  - Neuro: No deficits present
  - MSK:
    - Cervical Collar present, no upper motor neuron deficits present.
    - RUE: Approximate 4 cm open wound at the posterior elbow with visualization of the underlying musculotendinous structures. Pain upon passive flexion and extension 2/2 to elbow deformity. Tenderness to palpation over elbow. Sensation intact to light touch over ulnar, radial, and medial nerve distributions. Radial pulse palpable.
    - LLE: Significant swelling at ankle with obvious deformity. Sensation to light touch in the deep peroneal, superficial peroneal, and tibial distributions. Dorsalis pedis artery palpable
  - Abdomen: Soft, non-tender, non-distended

What Imaging Should We Order?

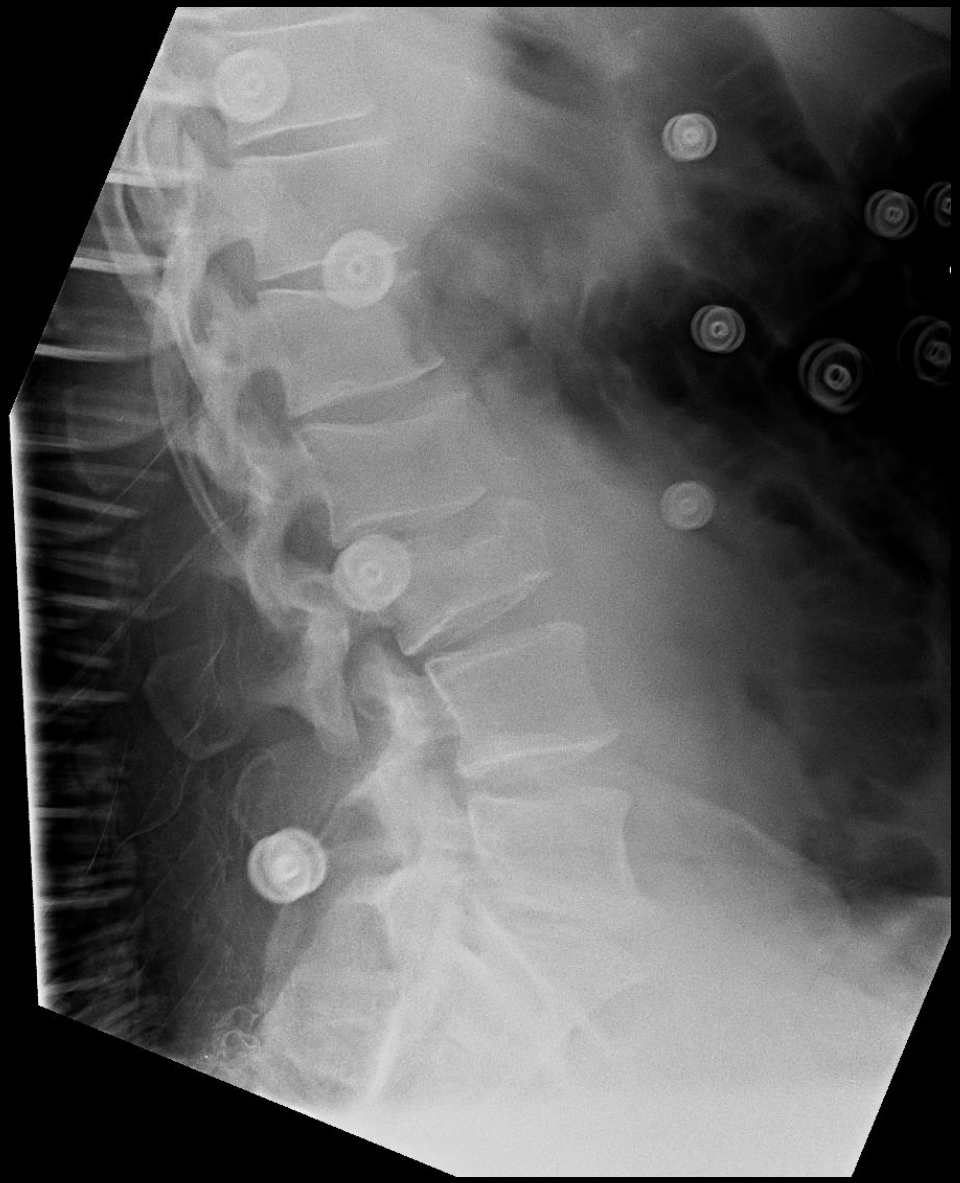
Select the applicable ACR Appropriateness Criteria

Back trauma, initial exam	CT thoracic and lumbar spine without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually appropriate	
	Radiography thoracic and lumbar spine	1-10 mSv ☢☢☢	0.3-3 mSv [ped] ☢☢☢	May be appropriate	
	MRI thoracic and lumbar spine without IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate	
	CT thoracic and lumbar spine with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate	
	MRI thoracic and lumbar spine without and with IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate	
	CT myelography thoracic and lumbar spine	10-30 mSv ☢☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate	
	CT thoracic and lumbar spine without and with IV contrast	10-30 mSv ☢☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate	

This imaging modality was ordered for initial evaluation given trauma protocol.

A subsequent 2vw lumbar spine x-ray was ordered the next day.

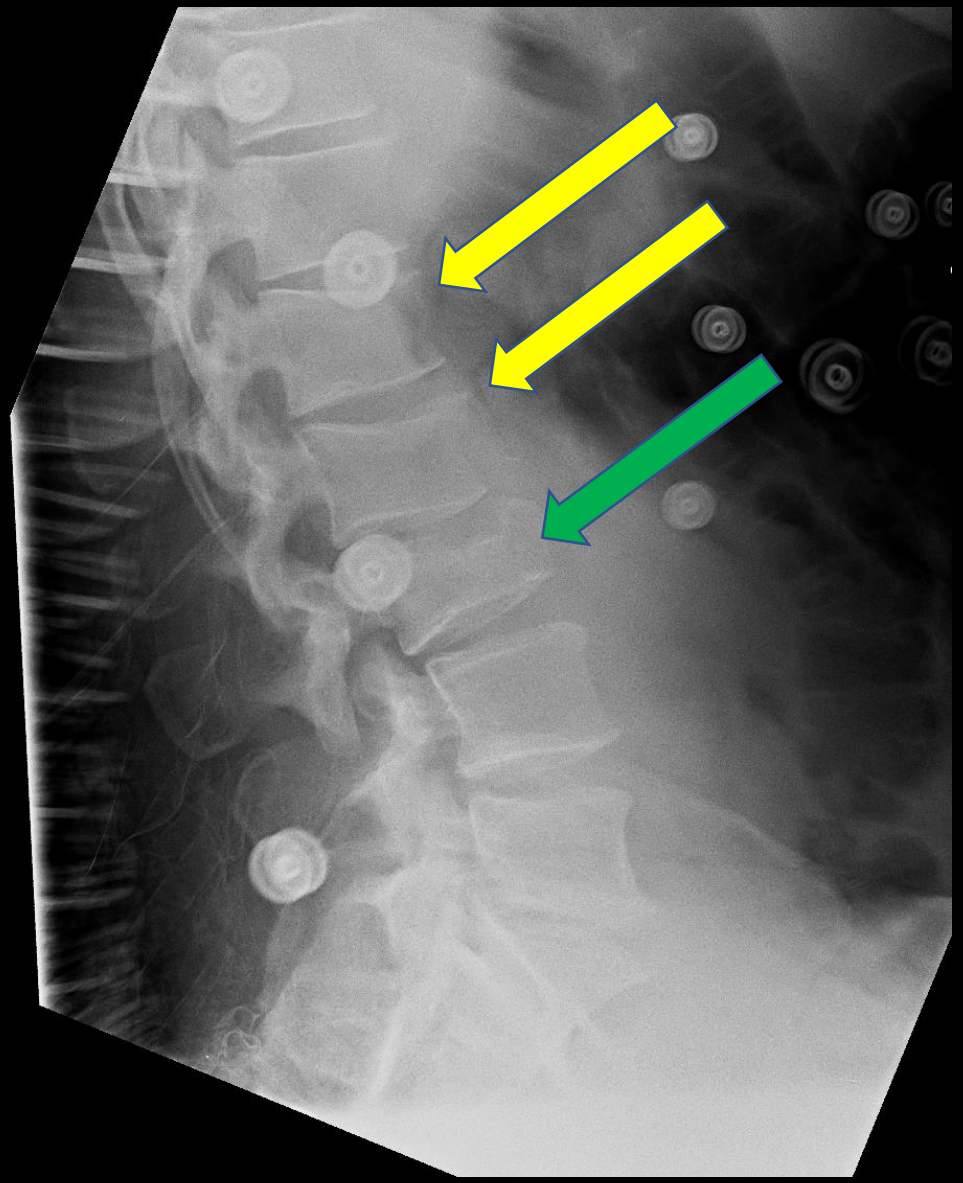
Findings: (unlabeled)



Findings: (labeled)

Yellow Arrows: L1 and L2 endplate fracture deformities.

Green Arrow: L3 burst fracture with 25%-50% loss of height.



Final Diagnosis:

L1 and L2 endplate fractures and L3 burst fracture with facet capsule widening

Mechanism:

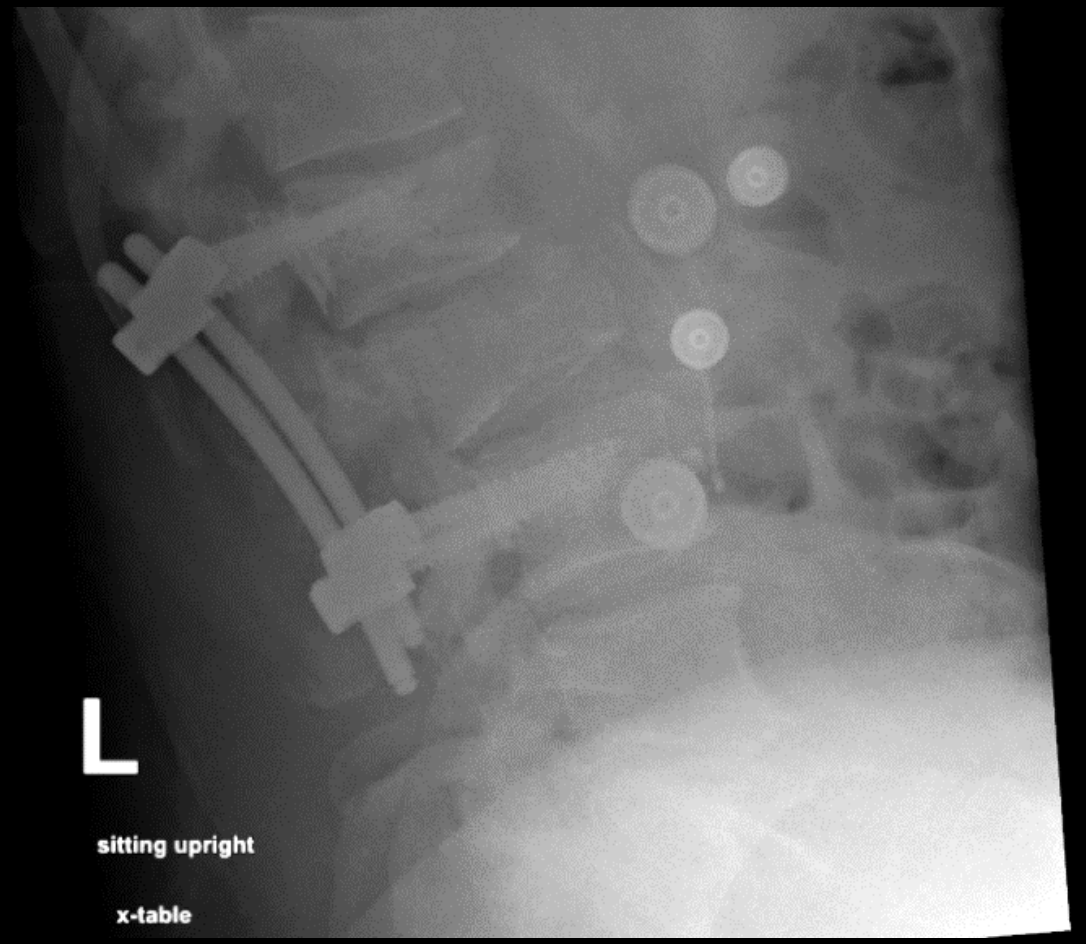
Sudden deacceleration with increased axial load

Treatment:

Spinal decompression and fusion with cement augmentation

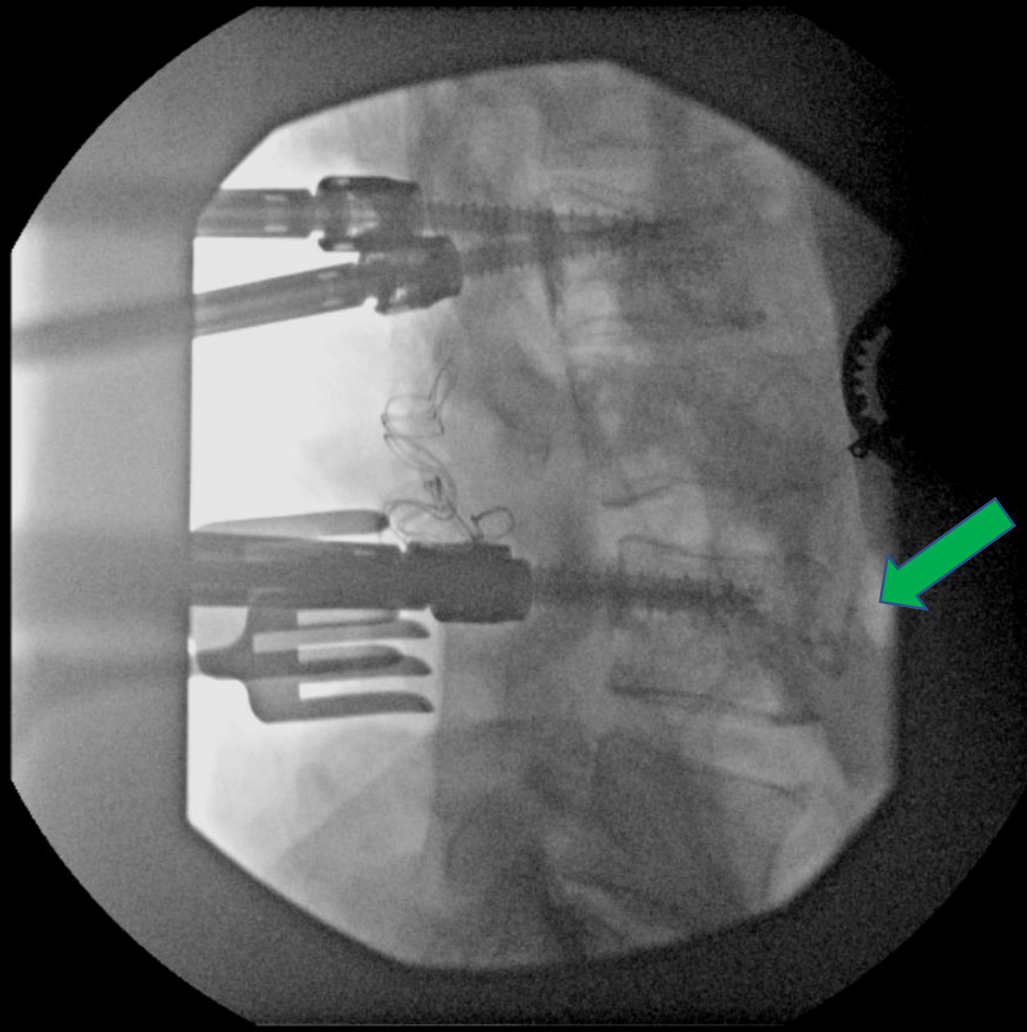
Findings : Unlabeled

Intra-operative stabilization. Lateral fluoroscopic image for procedural planning



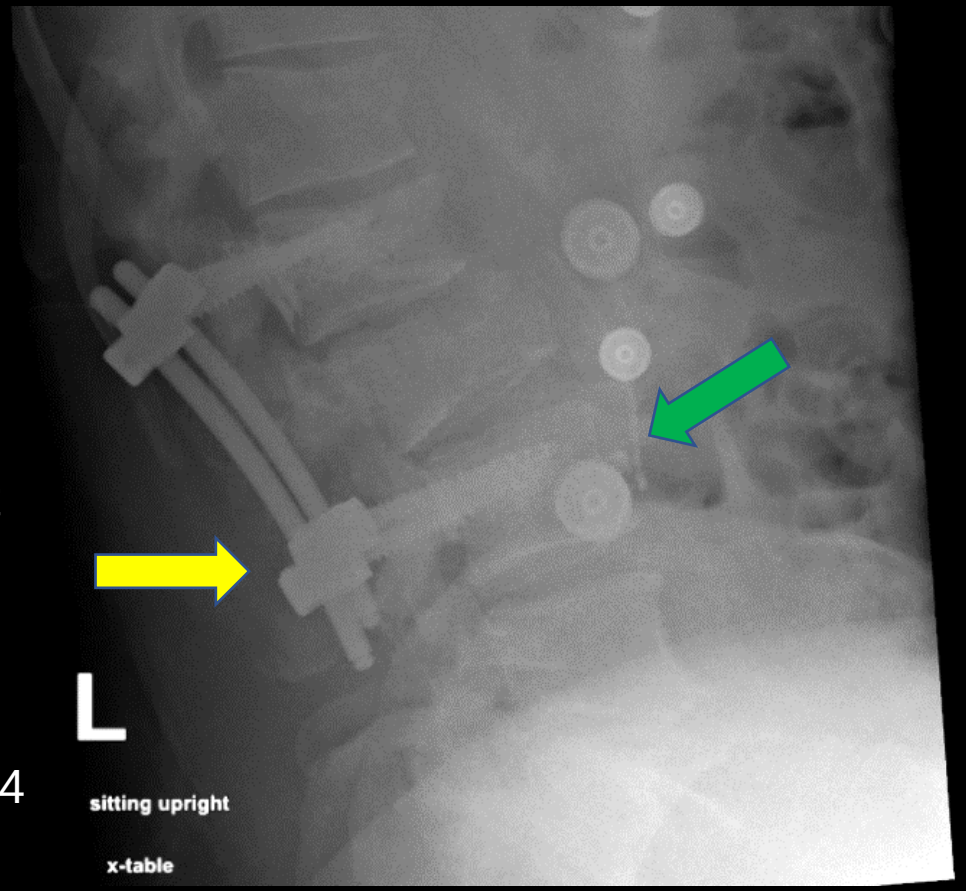
Immediate post-operative lateral radiograph

Findings : Labeled



Green Arrow: New Opacification of prevertebral vein at L3-L4. Not present on pre-operative xray.

Yellow Arrow: L2- L4 fusion with pedicle screw cement augmentation



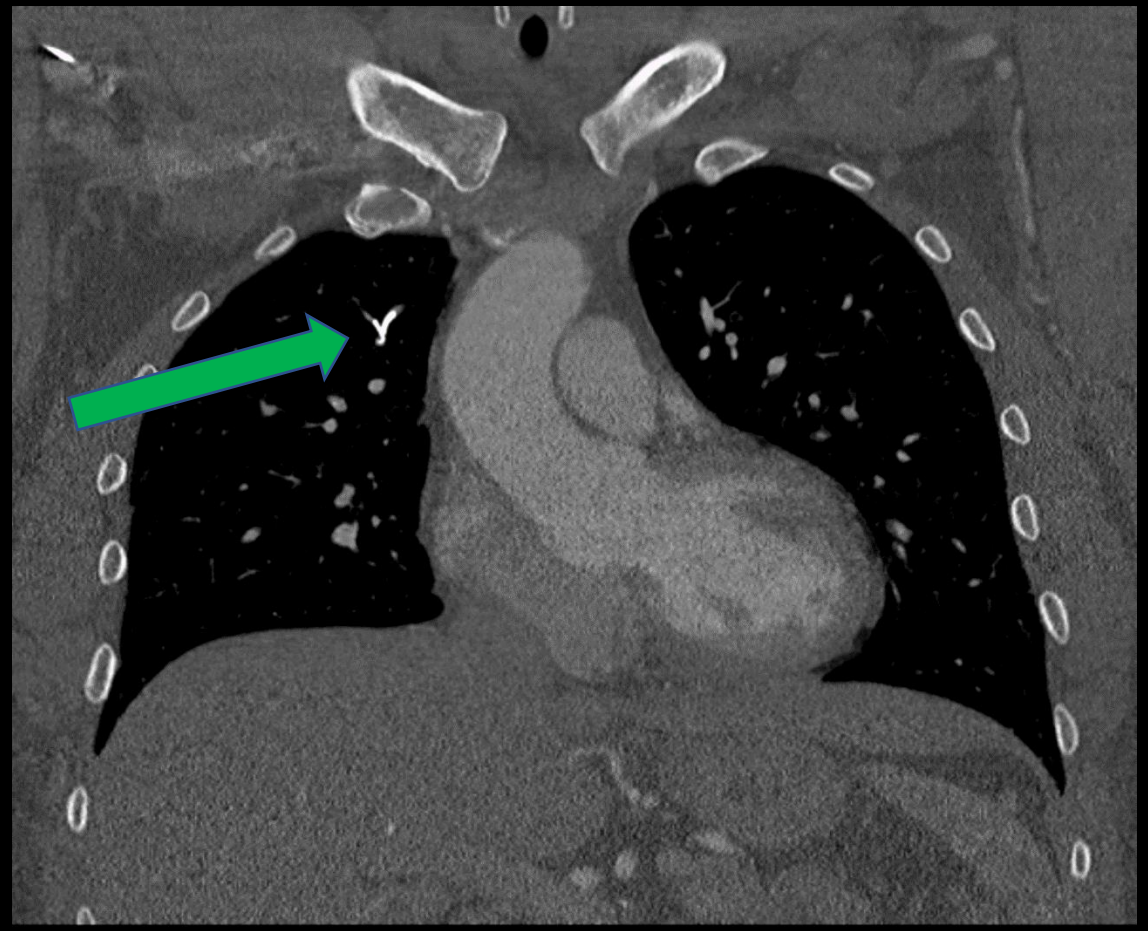
Select the applicable ACR Appropriateness Criteria

Thoracic aorta disease, pre-op planning (TEVAR)	CTA chest abdomen pelvis with IV contrast	30-100 mSv ☢☢☢☢☢	Null	Usually appropriate	
	MRA chest abdomen pelvis with IV contrast	0 mSv O	0 mSv [ped] O	Usually appropriate	
	MRA chest with IV contrast	0 mSv O	0 mSv [ped] O	Usually appropriate	
	CTA chest with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually appropriate	
	MRA chest abdomen pelvis without IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate	
	MRA chest without IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate	
	US duplex Doppler iliofemoral arteries	0 mSv O	0 mSv [ped] O	May be appropriate	
	US echocardiography transesophageal	0 mSv O	0 mSv [ped] O	May be appropriate	
	Aortography chest abdomen pelvis	10-30 mSv ☢☢☢☢	Null	May be appropriate	
	US echocardiography transthoracic resting	0 mSv O	0 mSv [ped] O	May be appropriate	

Ordered by vascular surgery for outpatient follow-up given possible aortic injury found on initial trauma CT chest/abdomen/pelvis.

Findings: Unlabeled

Findings: Labeled



Green Arrows: Hyperdense material within the subsegmental branches of the right upper lobe.

Final Diagnosis

Pulmonary Cement Embolism

Case: PCE

- Epidemiology: Pulmonary Cement Embolism (PCE)
  - Pedicle screw PMMA augmentation
    - Cement leakage into the inferior vena cava or azygos vein with subsequent migration through the pulmonary arteries into the lungs
    - Symptomatic from 1.2% to 1.4%
    - Asymptomatic from 4.2% to 16.3%
- Pathophysiology:
  - Leakages are thought to occur secondary to high pressure during percutaneous vertebroplasty
  - Overflow of bone cement during pedicle placement
  - Highly dependent on the viscosity of the Cement at time of delivery. Rapid injection of low viscous cement is correlated with higher incidence of a PCE

Case: PCE

- Diagnostic Imaging:
  - Echocardiography could demonstrate changes in pulmonary artery pressure and right ventricular dilation.
  - Chest X-ray and CT Scan
    - Maybe visualized as a large tubular, branching, or multiple small densities or opacities.

- Presentation:
  - Asymptomatic: found incidentally on imaging for another concern
  - Symptomatic: dyspnea or tachypnea, tachycardia, cyanosis, chest pain, coughing, hemoptysis, dizziness and sweating

Case: PCE

- Management:
  - Peripheral Cement Embolism:
    - Asymptomatic case:
      - Clinical follow-up
    - Symptomatic:
      - Example treatment plan:
        - 5000 units of heparin and IV push followed by 1000 units/h
        - Pt can be switched to warfarin or factor Xa inhibitors once stable
  - Central Cement Embolism:
    - Asymptomatic:
      - 5000 units of heparin and IV push followed by 1000 units/h
      - Pt can be switched to warfarin or factor Xa inhibitors once stable
    - Symptomatic:
      - Large embolisms can be retrieved using endovascular procedures under fluoroscopy
      - Trapped in the atrium may require emergent CV surgery

References:

- Ignacio, Jose Manuel, and Katrina Hannah Ignacio. “Pulmonary Embolism from Cement Augmentation of the Vertebral Body.” *Asian Spine Journal*, vol. 12, no. 2, 2018, pp. 380–387., https://doi.org/10.4184/asj.2018.12.2.380.

- Kerry, Ghassan, et al. “Cement Embolism into the Venous System after Pedicle Screw Fixation: Case Report, Literature Review, and Prevention Tips.” *Orthopedic Reviews*, vol. 5, no. 3, 2013, p. 24., https://doi.org/10.4081/or.2013.e24.

- Krueger, Antonio, et al. “Management of Pulmonary Cement Embolism after Percutaneous Vertebroplasty and Kyphoplasty: A Systematic Review of the Literature.” *European Spine Journal*, vol. 18, no. 9, 2009, pp. 1257–1265., https://doi.org/10.1007/s00586-009-1073-y.

- Rahimizadeh, Abolfazl, et al. “Symptomatic Pulmonary Cement Embolism after Pedicle Screw Polymethylmethacrylate Cement Augmentation: A Case Report and Review.” *Surgical Neurology International*, vol. 11, 2020, p. 18., https://doi.org/10.25259/sni_592_2019.

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