

Imaging Diagnosis of Thoracic Disease

Case-based Review

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I.



Lung cancer



II.



Mediastinal tumor



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Pleural disease



IV.



Lung transplantation



When to image

- Choose imaging modality according to the clinical question



What to report

- Staging, resectability, biopsy planning, perioperative risk, & urgent intervention



What not to miss

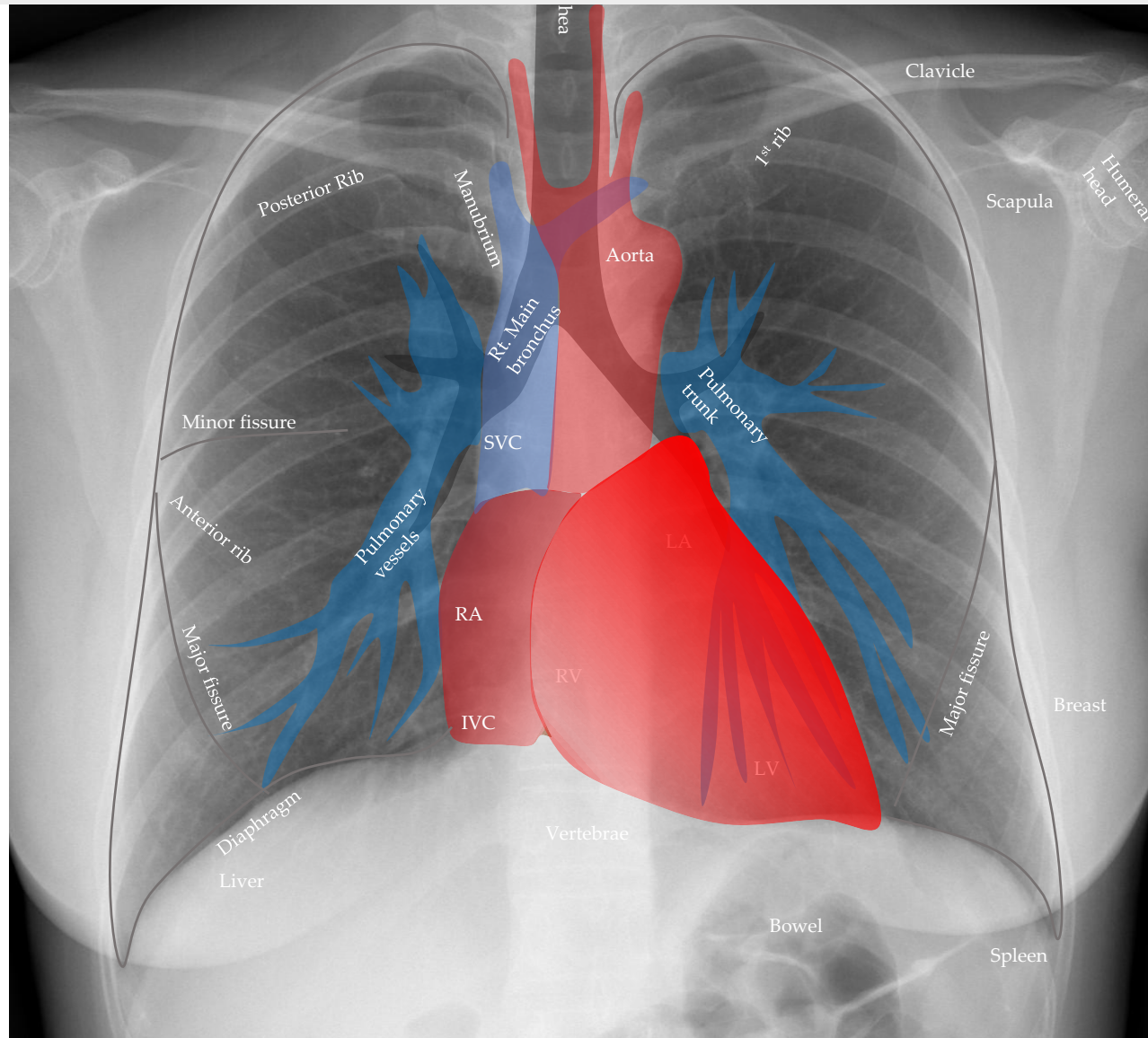
- Recognize early postoperative complication

Case 1

- M69
- C.C: CXR abnormality during health check-up
- 50 PYR

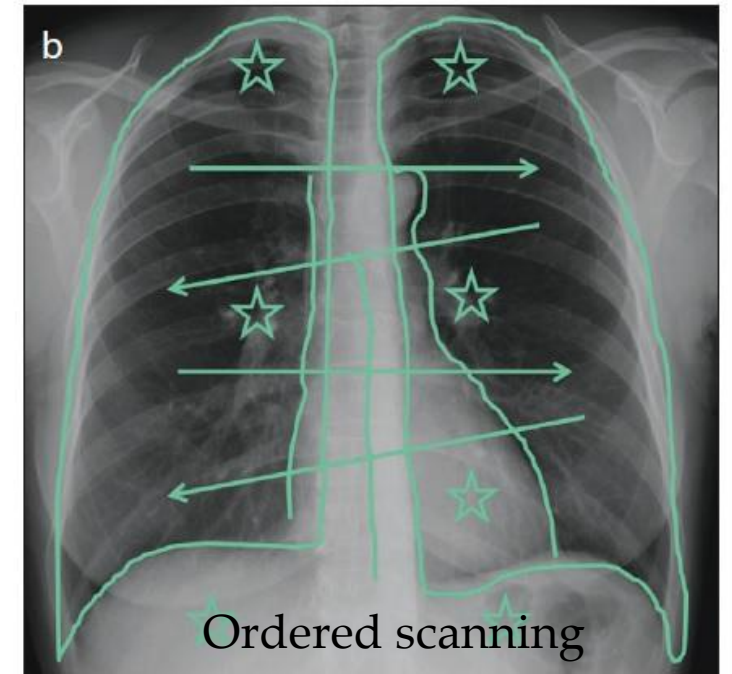
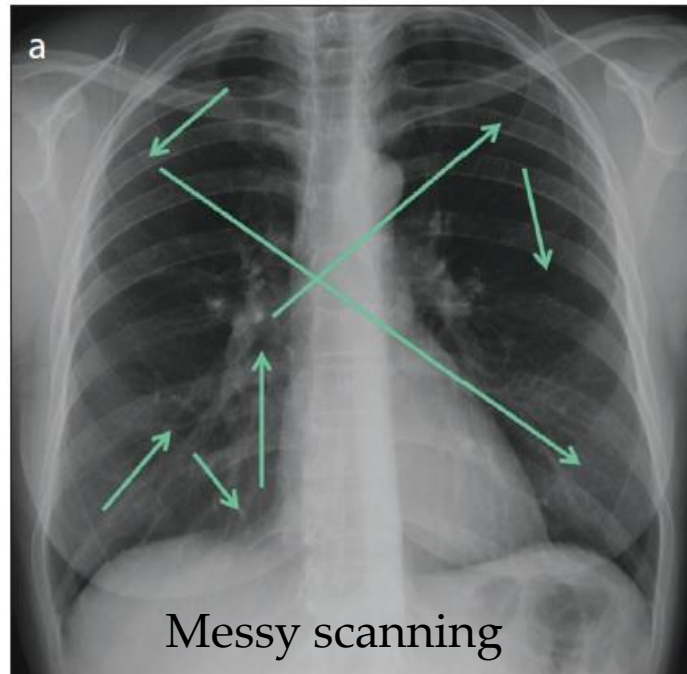


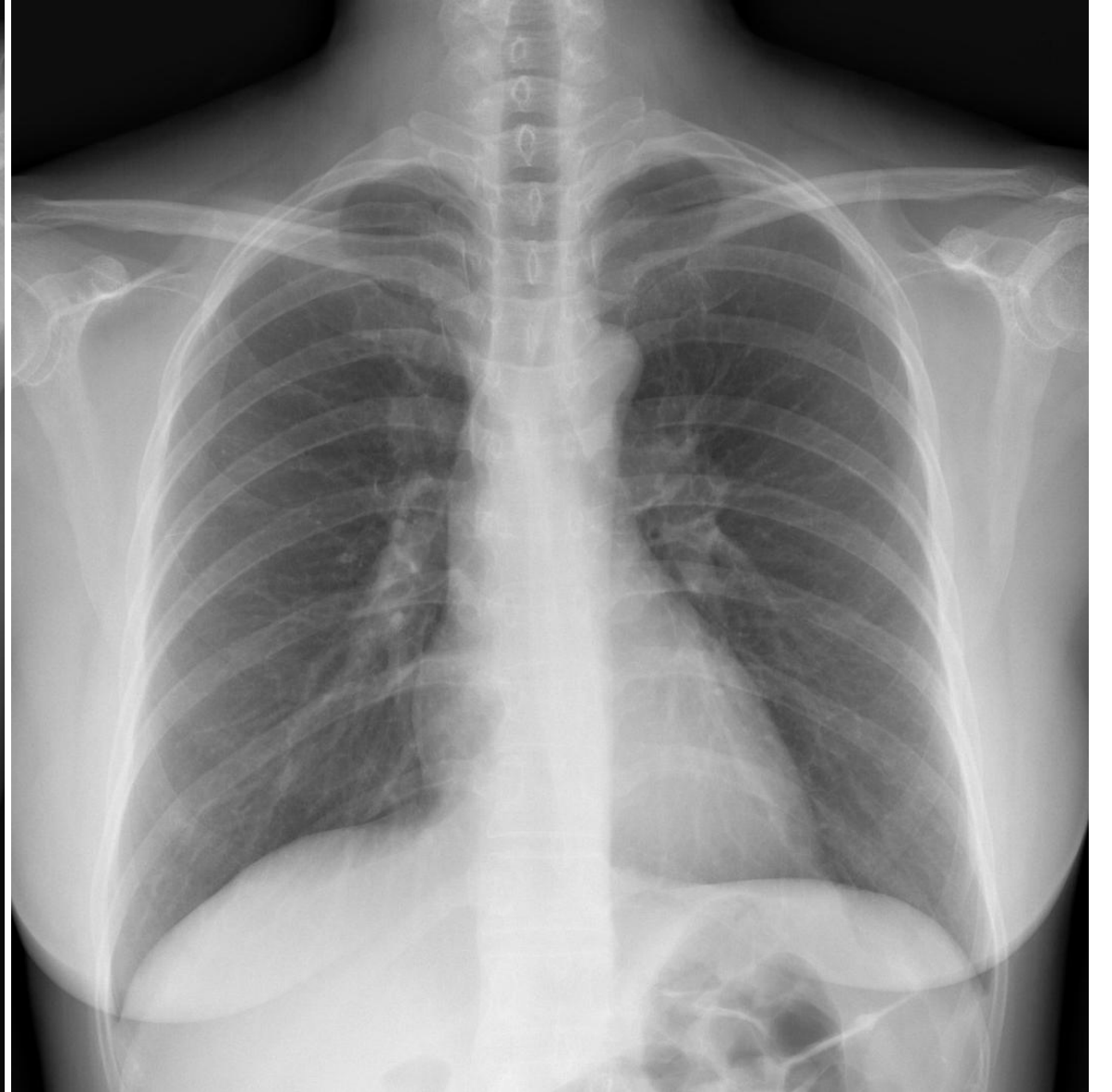
Chest radiograph interpretation is prone to error



Reducing errors in radiographic interpretation

- Technical errors: Creation of a radiographic image with good quality
- Perception errors
 - Spend necessary time to carefully
 - Develop systematic scanning
 - Always check blind zones
 - Use a lateral view image, the i
 - Compare with the previous C
- Cognitive errors
 - Keep up-to-date references on
 - Review patient history carefully

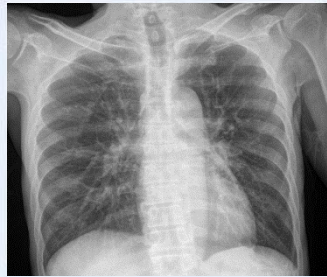




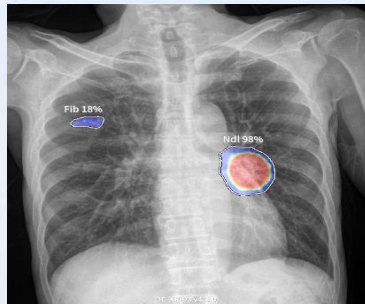
AI for chest radiograph interpretation

AI-CAD

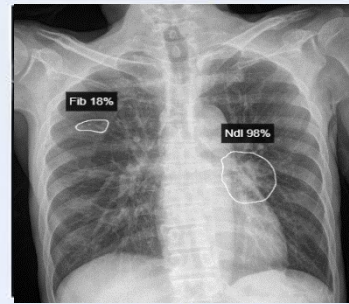
Pre-defined Lesion Detection



Chest X-ray



Heatmap



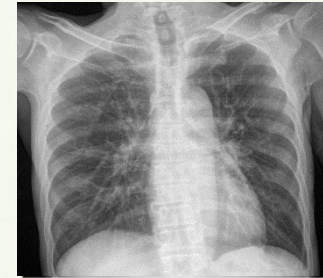
Probability Map

Findings Highlighted

VS

Generative AI

Report Generation



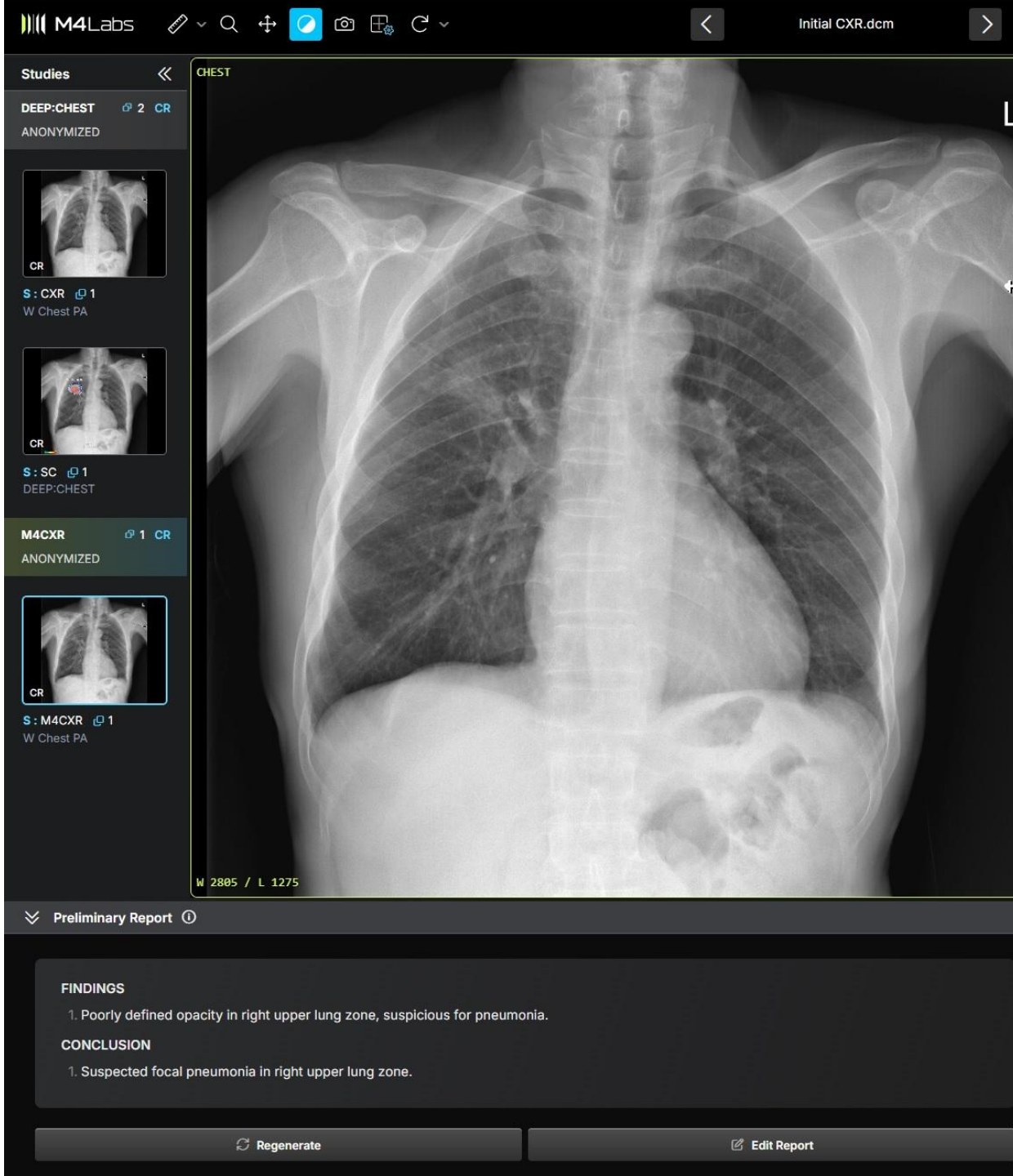
Chest X-ray



AI Report:

"There is a mass-like opacity in the left hilum."

Full Text Report



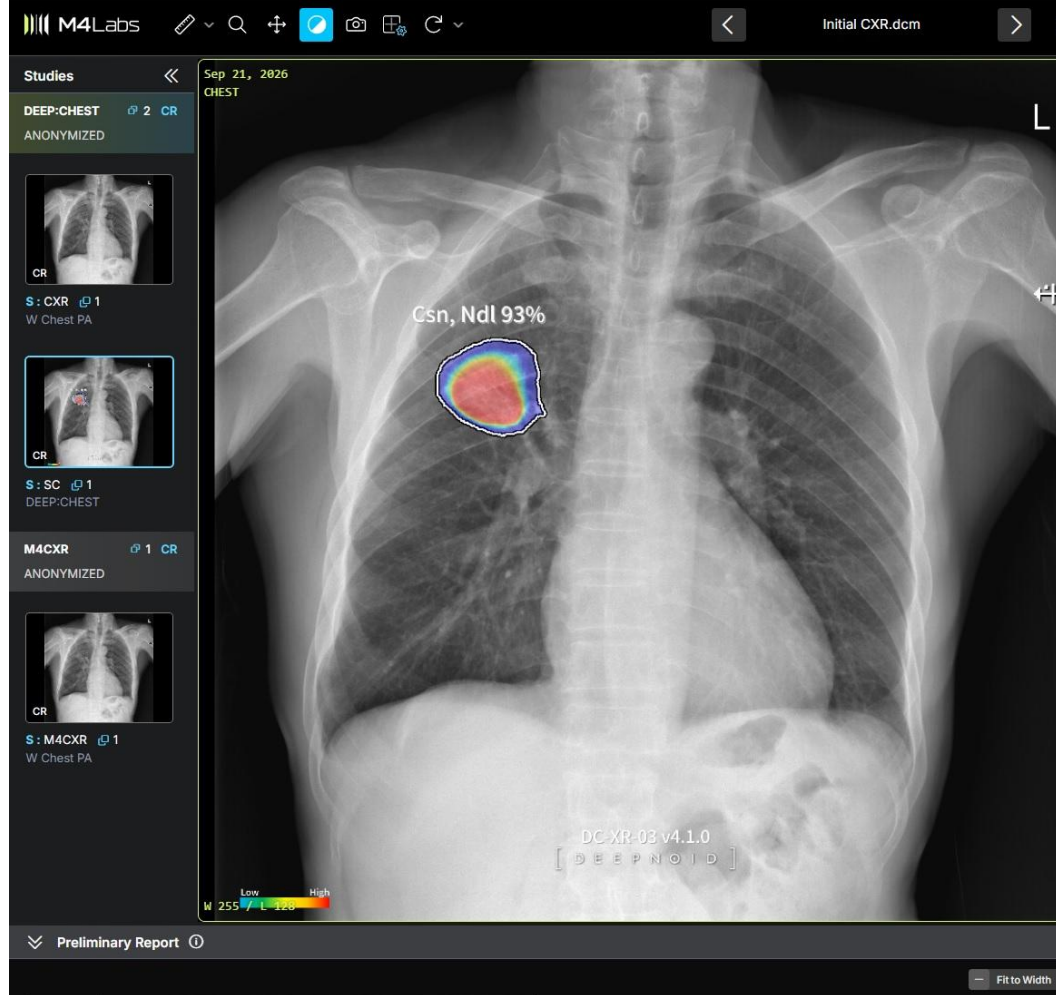
Report-generating AI (Generative AI)

Findings

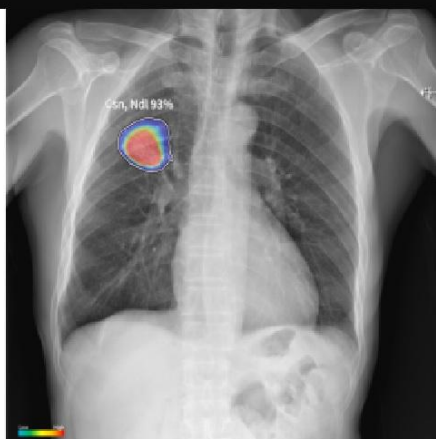
1. Poorly defined opacity in RULZ, suspicious for pneumonia

Conclusion

1. Suspected focal pneumonia in RULZ



AI-CAD



93%

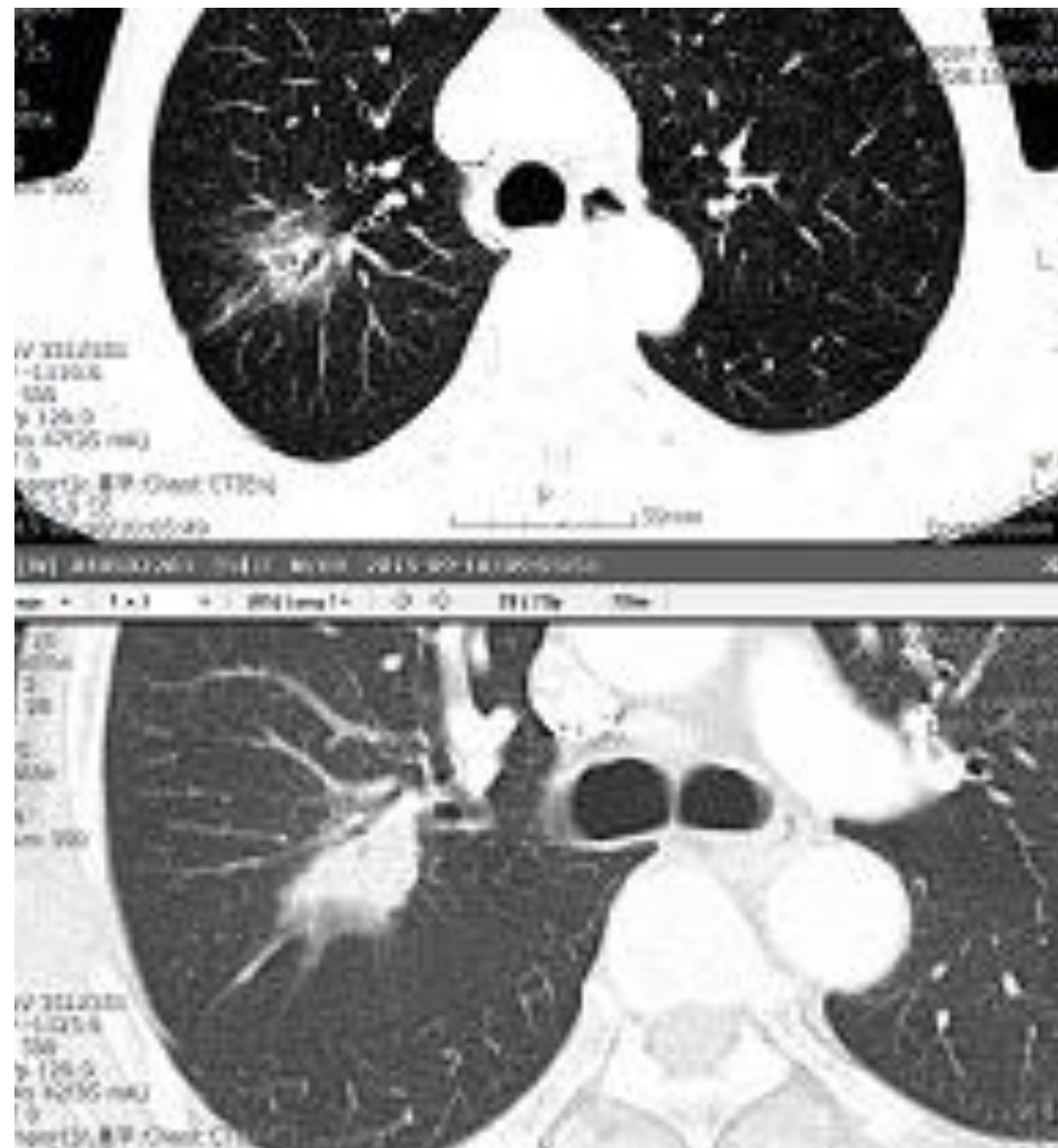
Number of Diseases : 2

CSN	Consolidation	93%
NDL	Nodule/Mass	93%
FIB	Fibrosis	Low
PEF	Plural Effusion	Low
PTX	Pneumothorax	Low

Probability of consolidation, nodule, 93%

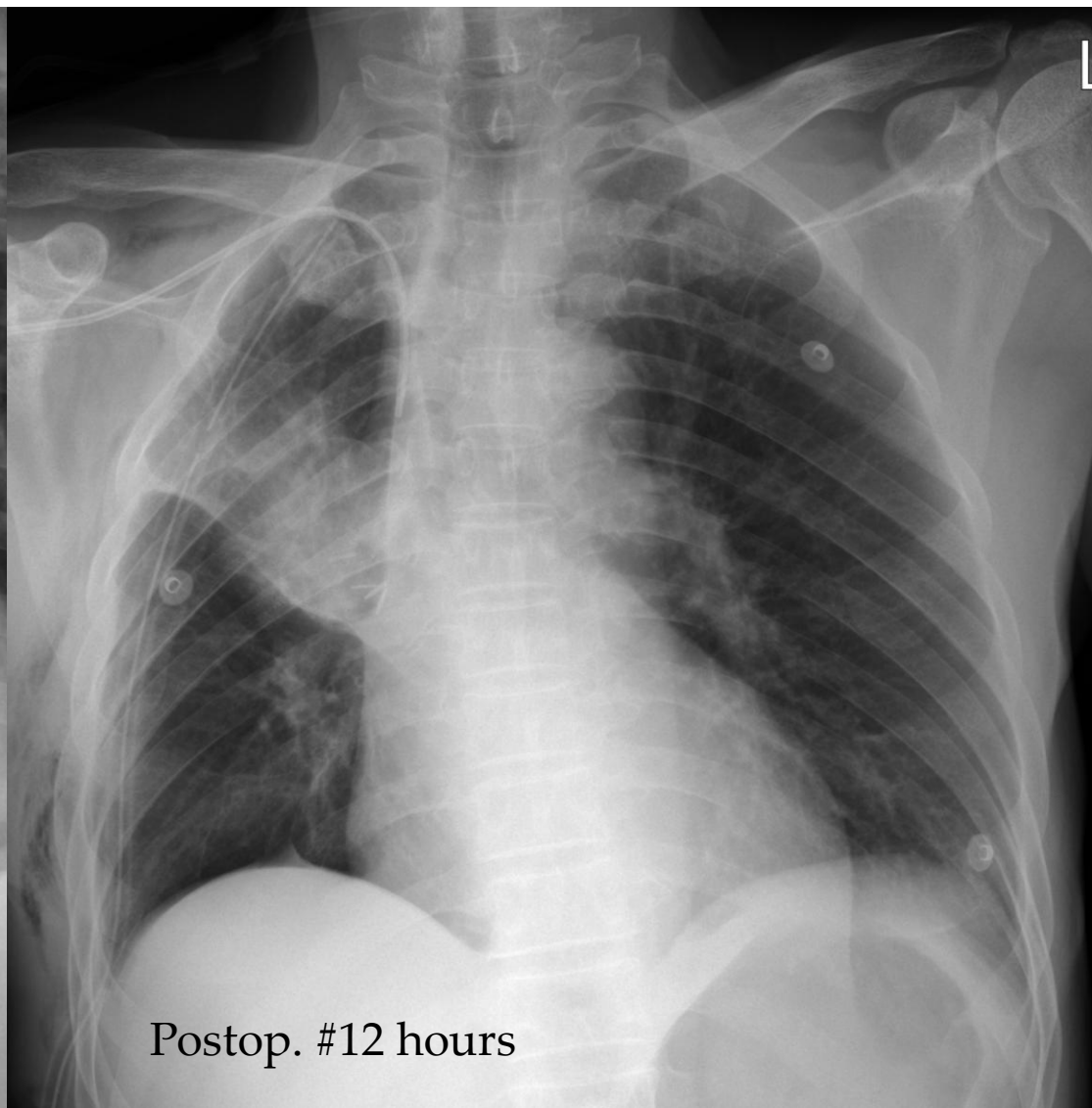
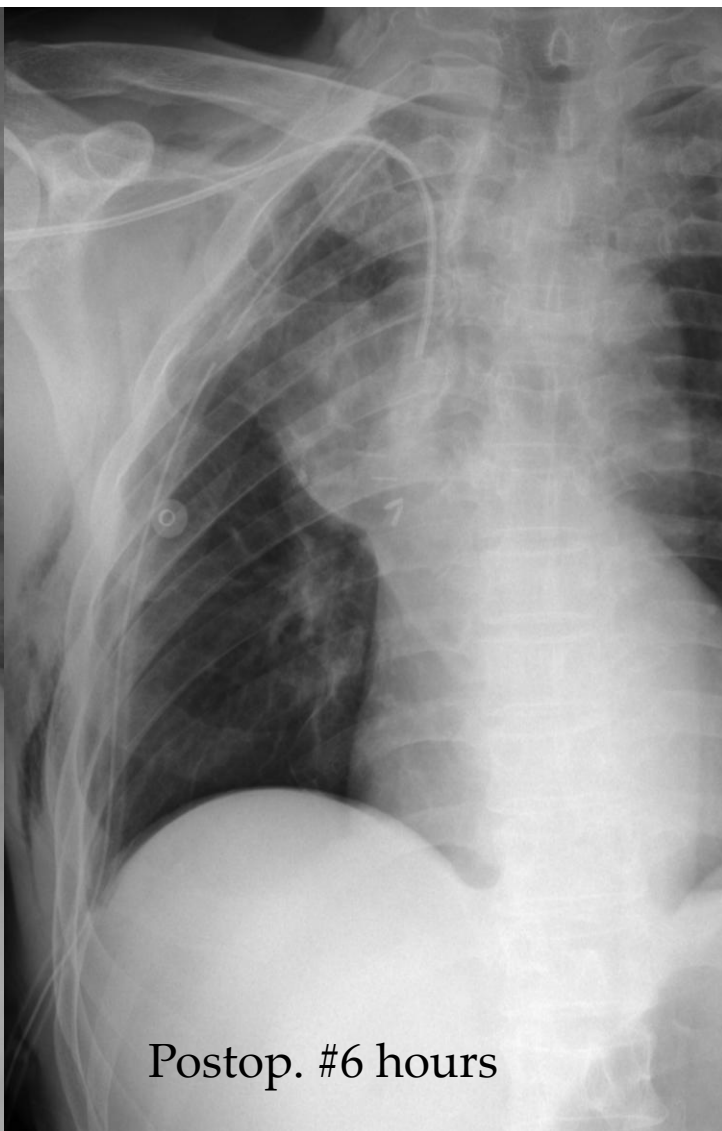
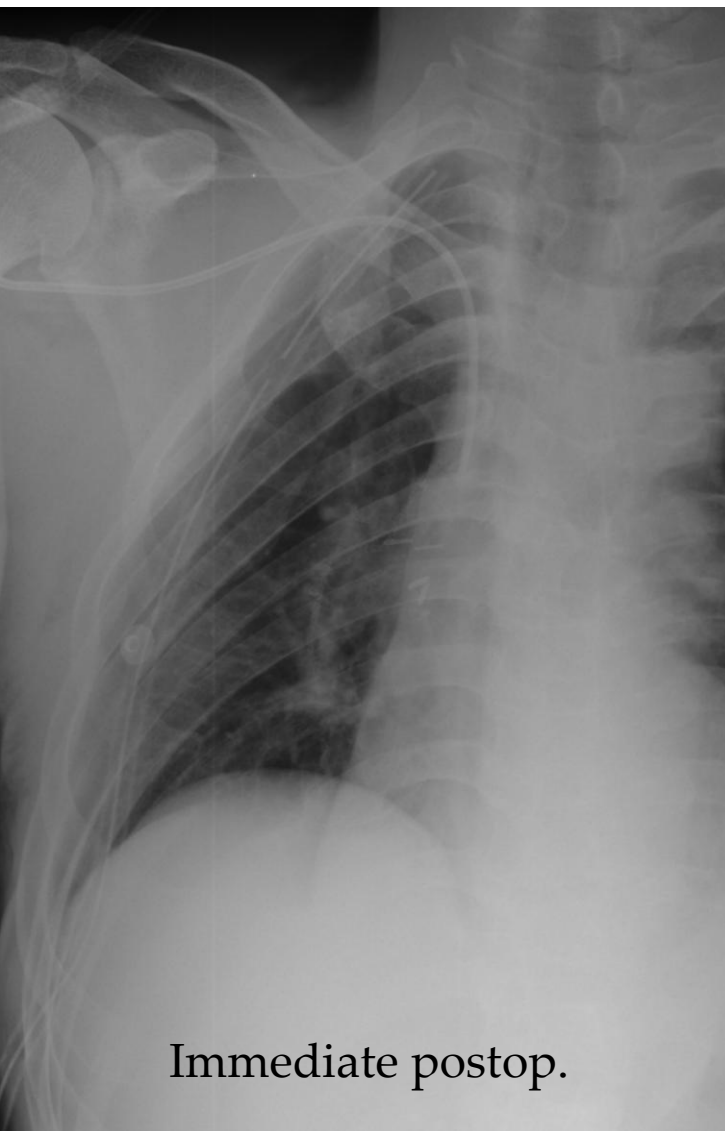
Challenges in the impact of AI on CXR interpretation

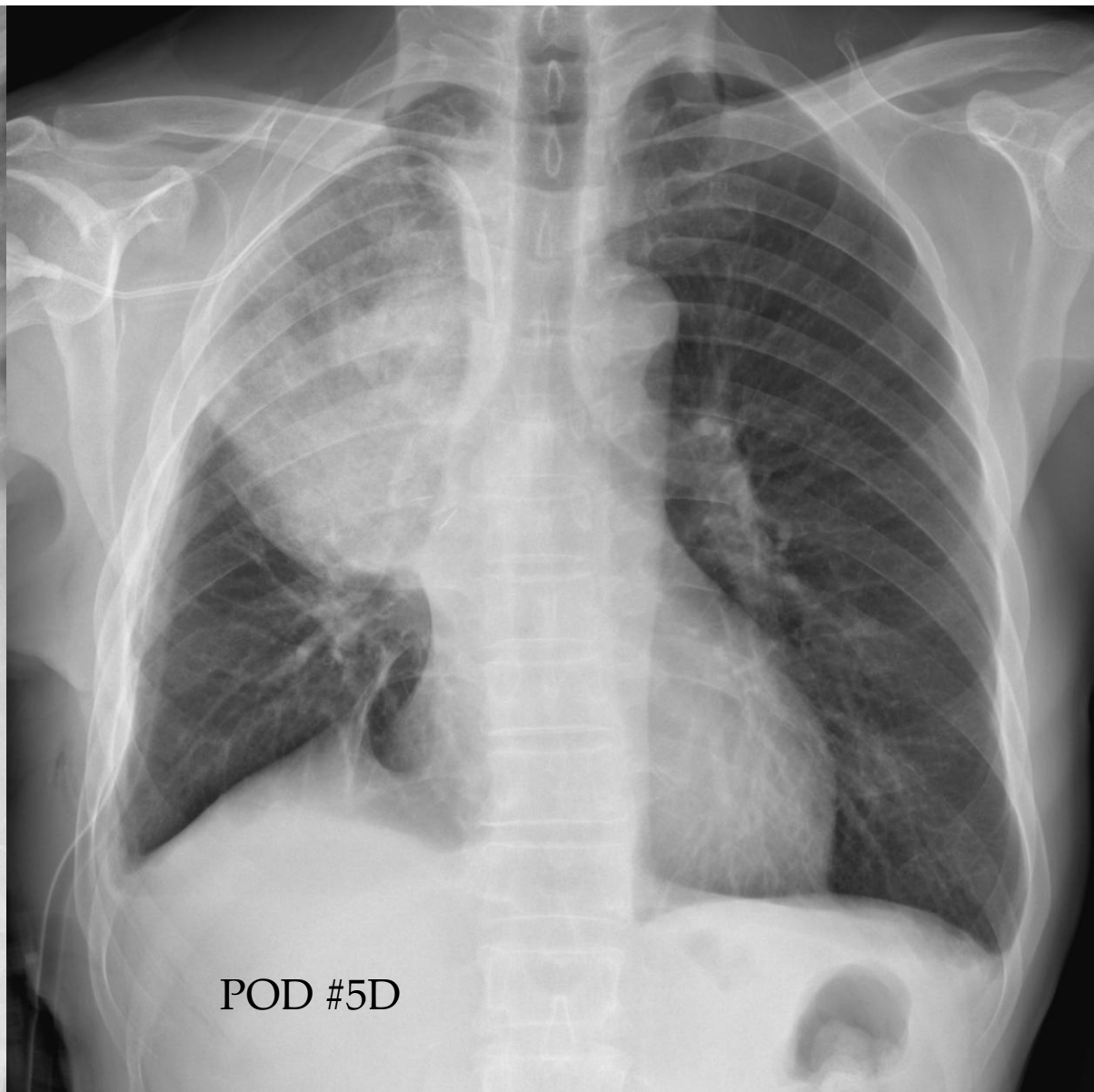
- AI performance may vary depending on:
 - Patient populations
 - Imaging characteristics
- Physicians' behavior to the results of controlled validation studies vs. real-world clinical practice
- Comparative data across different AI software products remains limited



Case 1 con't

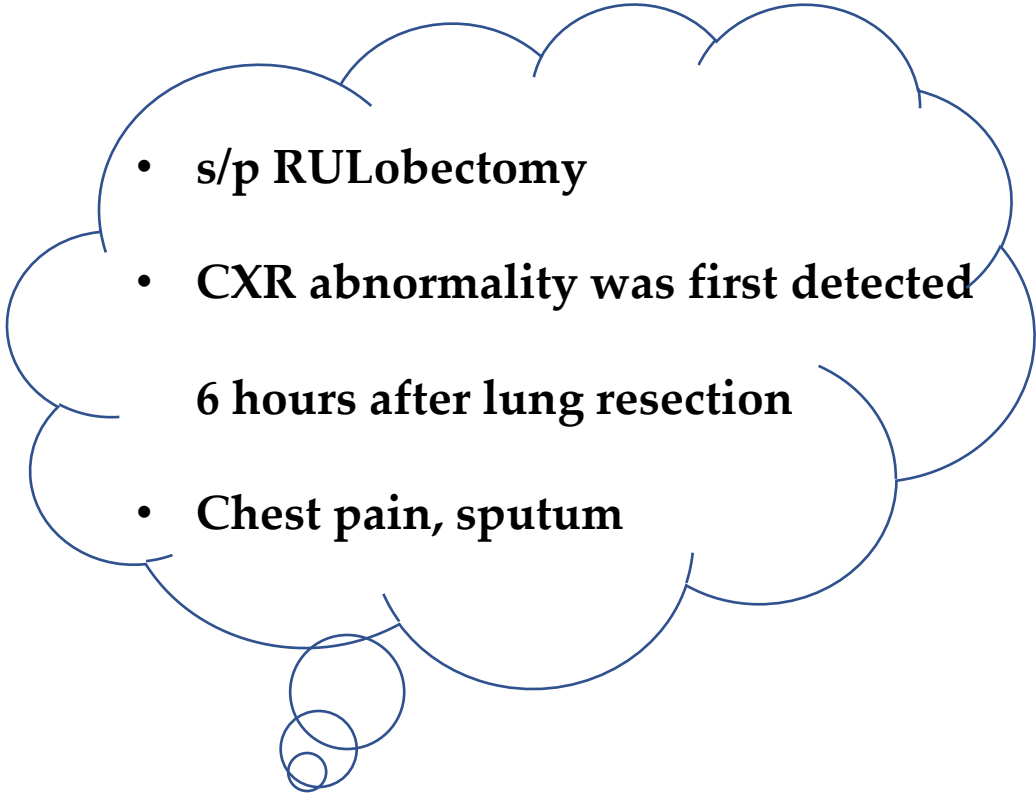
- RULobectomy, adenocarcinoma (pT2N0M0)



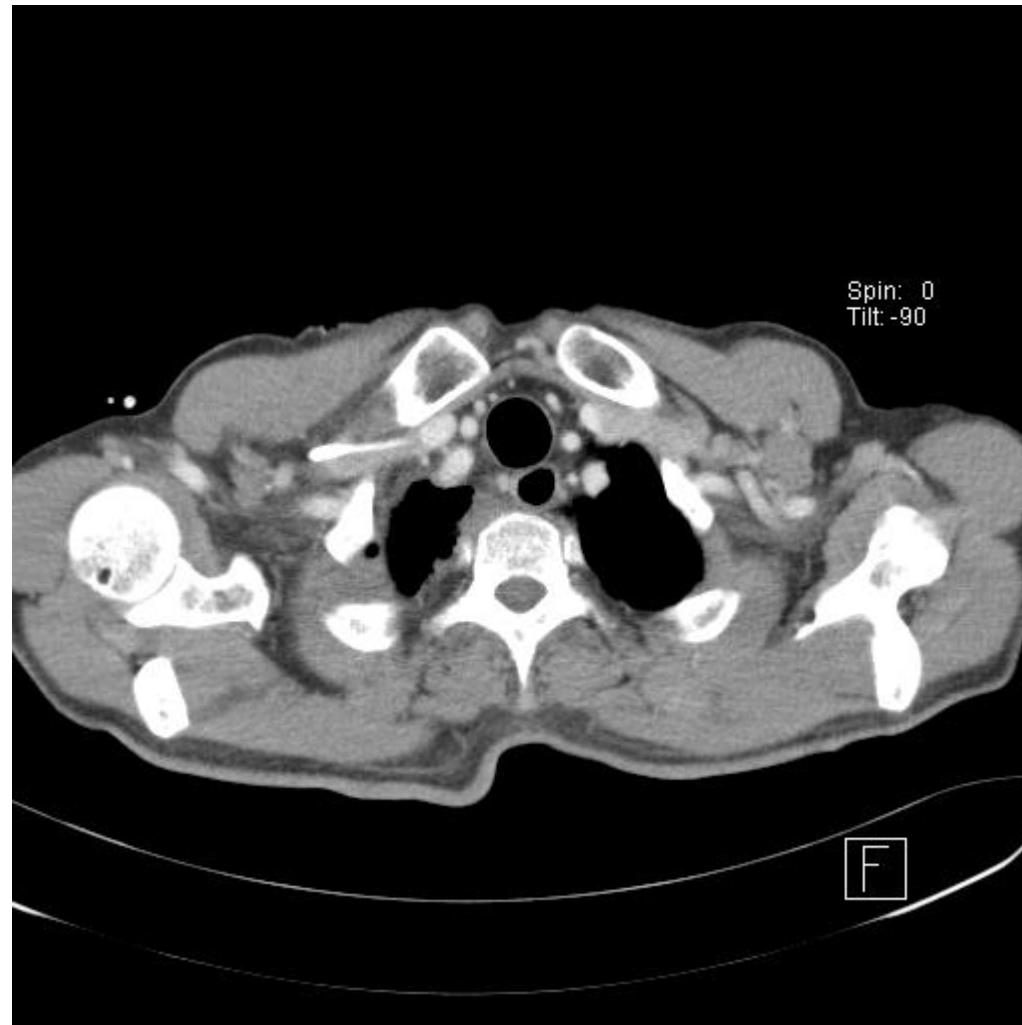


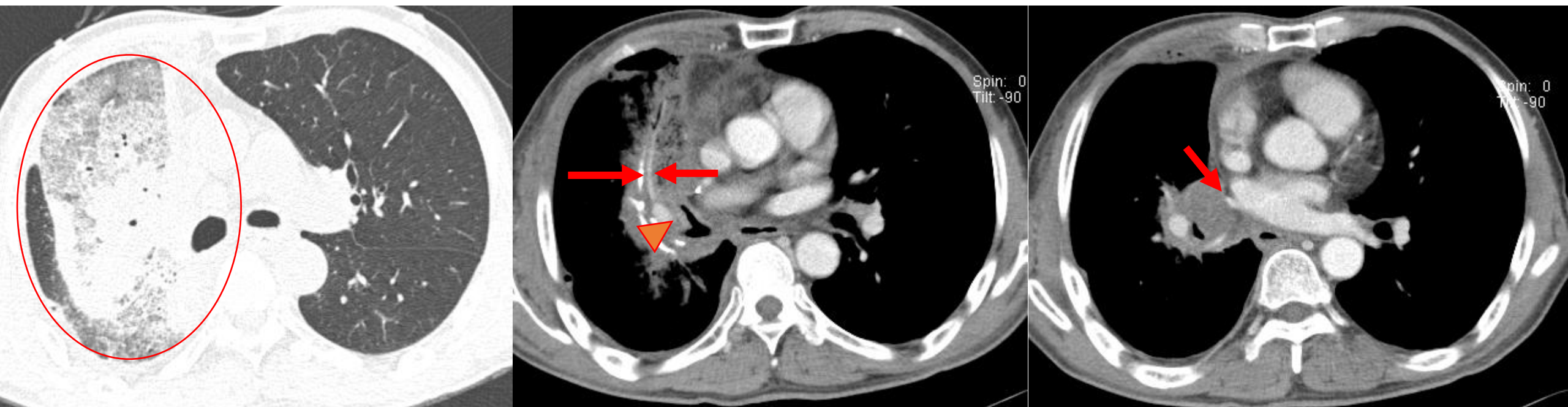
The most likely postop. complication?

- Lobar torsion
- Pulmonary embolism
- Bronchopleural fistula
- Postoperative atelectasis
- Postoperative pneumonia

- 
- s/p RULobectomy
 - CXR abnormality was first detected
6 hours after lung resection
 - Chest pain, sputum

POD #6D





RML torsion with hemorrhagic infarction

Complications following lung resection

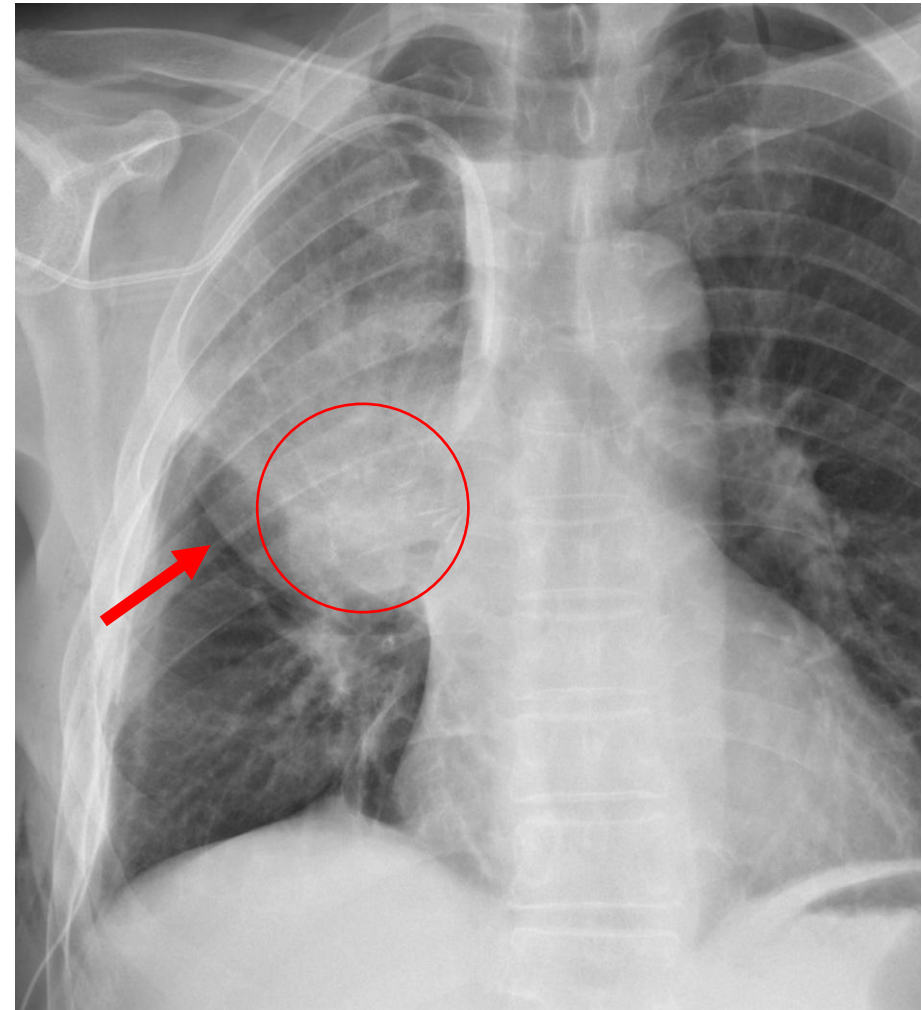
Surgical Procedure	Complications	
	Early	Late
Pneumonectomy	Empyema, cardiac herniation, pulmonary edema, chylothorax, hemothorax, bronchopleural fistula, wound infection, esophagopleural fistula	Postpneumonectomy syndrome, recurrent tumor, esophagopleural fistula
Lobectomy, sleeve lobectomy	Space problems, persistent air leak, postoperative lobar torsion, ischemic necrotizing pneumonia, nonobstructive atelectasis, pulmonary edema, anastomotic dehiscence, hemothorax, bronchopleural fistula, wound infection, esophagopleural fistula	Anastomotic stricture, recurrent tumor, gossypiboma, esophagopleural fistula

Lung torsion

- Torsion of hilar structures, esp. pulmonary veins -> impaired circulation with reflux into venous pathways -> interstitial edema & alveolar exudation -> hemorrhagic infarction
- 0.09~0.4%, RULobectomy, RML torsion (TMC)

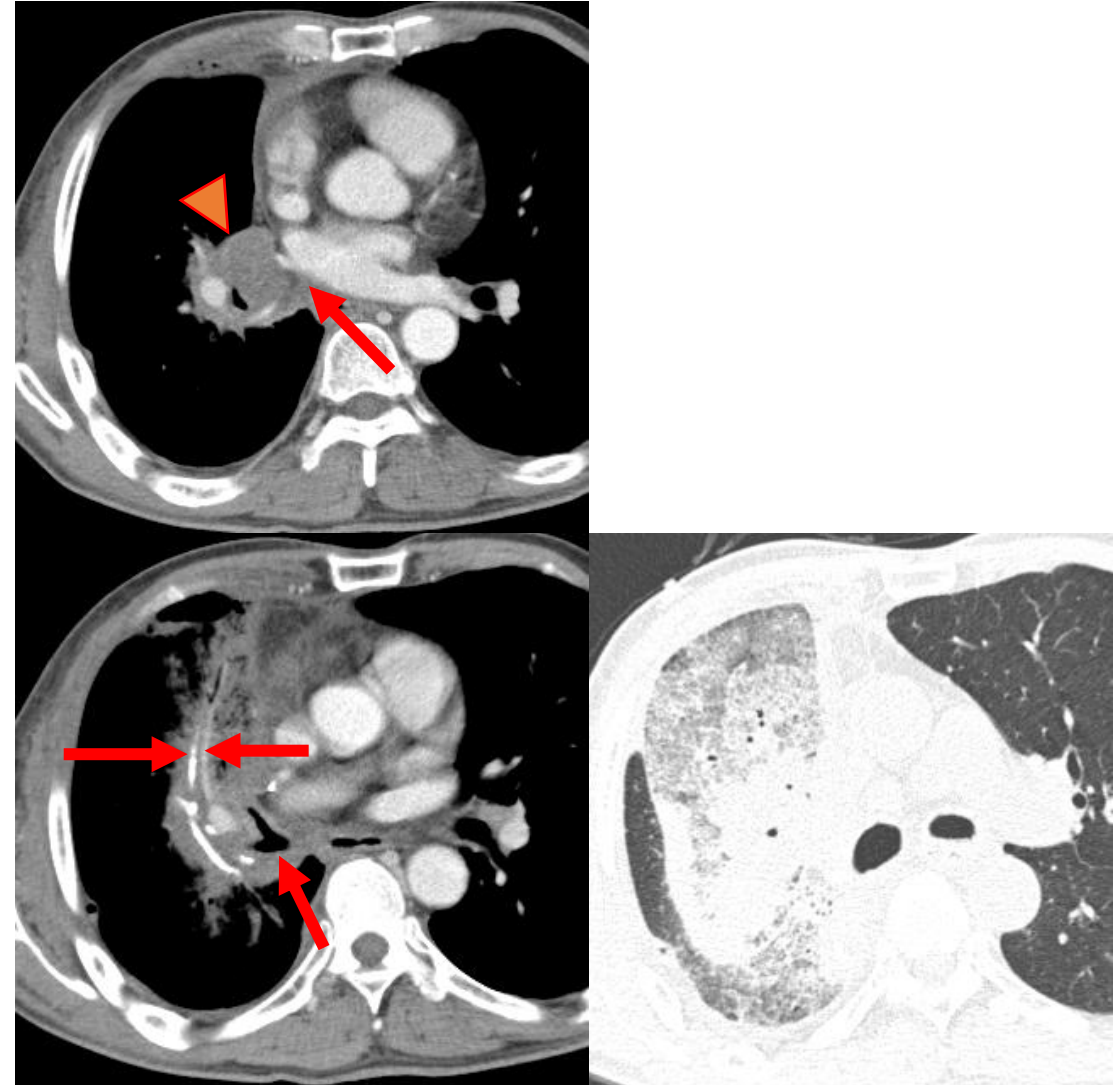
Lung torsion: CXR findings

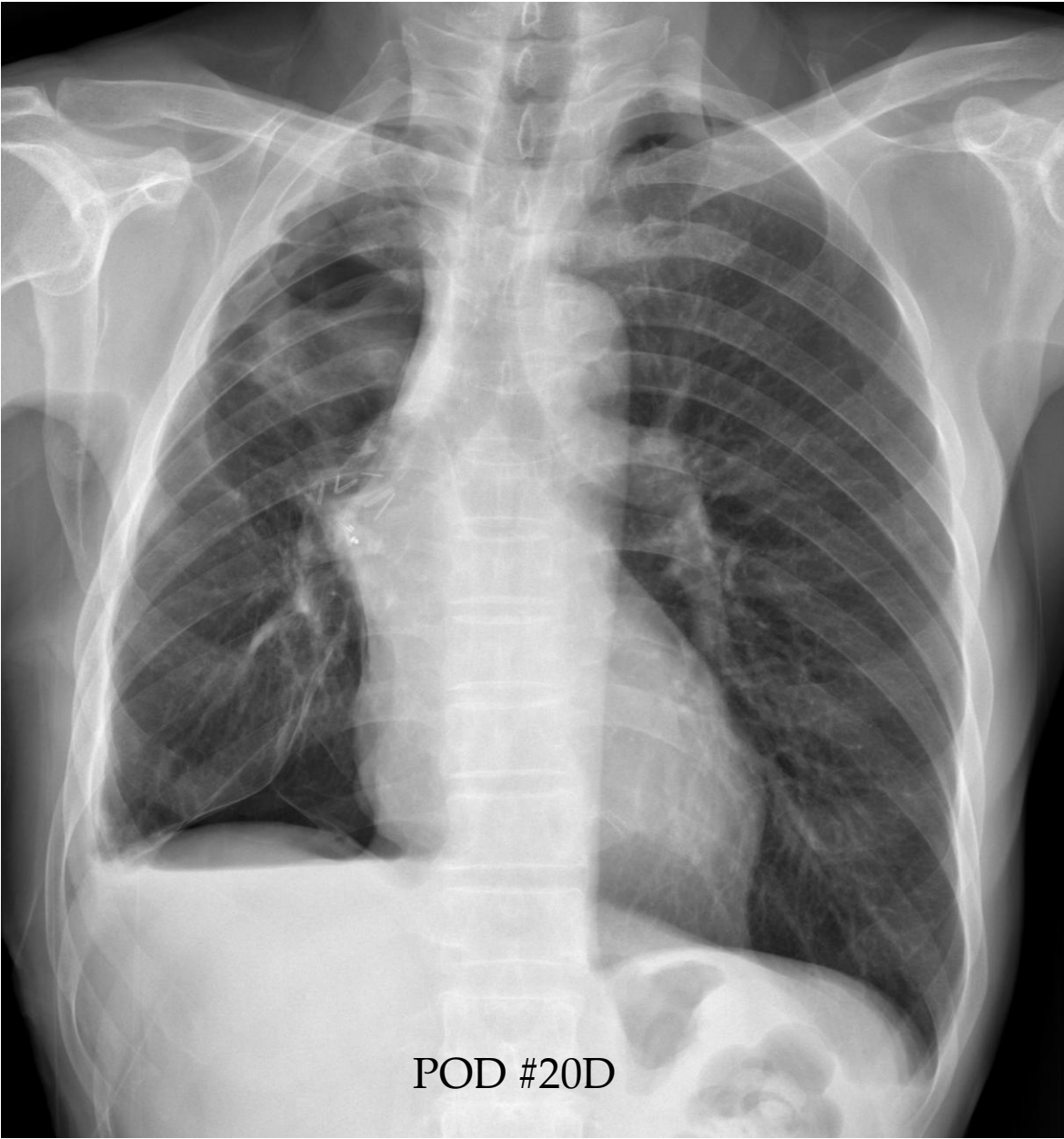
- Rapid opacification of affected lobe
- Hilar enlargement
- Bulging & unusual orientation of neo-fissure



Lung torsion: CT findings

- Amorphous soft-tissue attenuation at hilum
- Tapered obliteration of proximal PA, PV, & accompanying bronchus of involved lobe
- Poorly enhancing consolidation /c increased volume, GGA, interlobular & intralobular interstitial thickenings

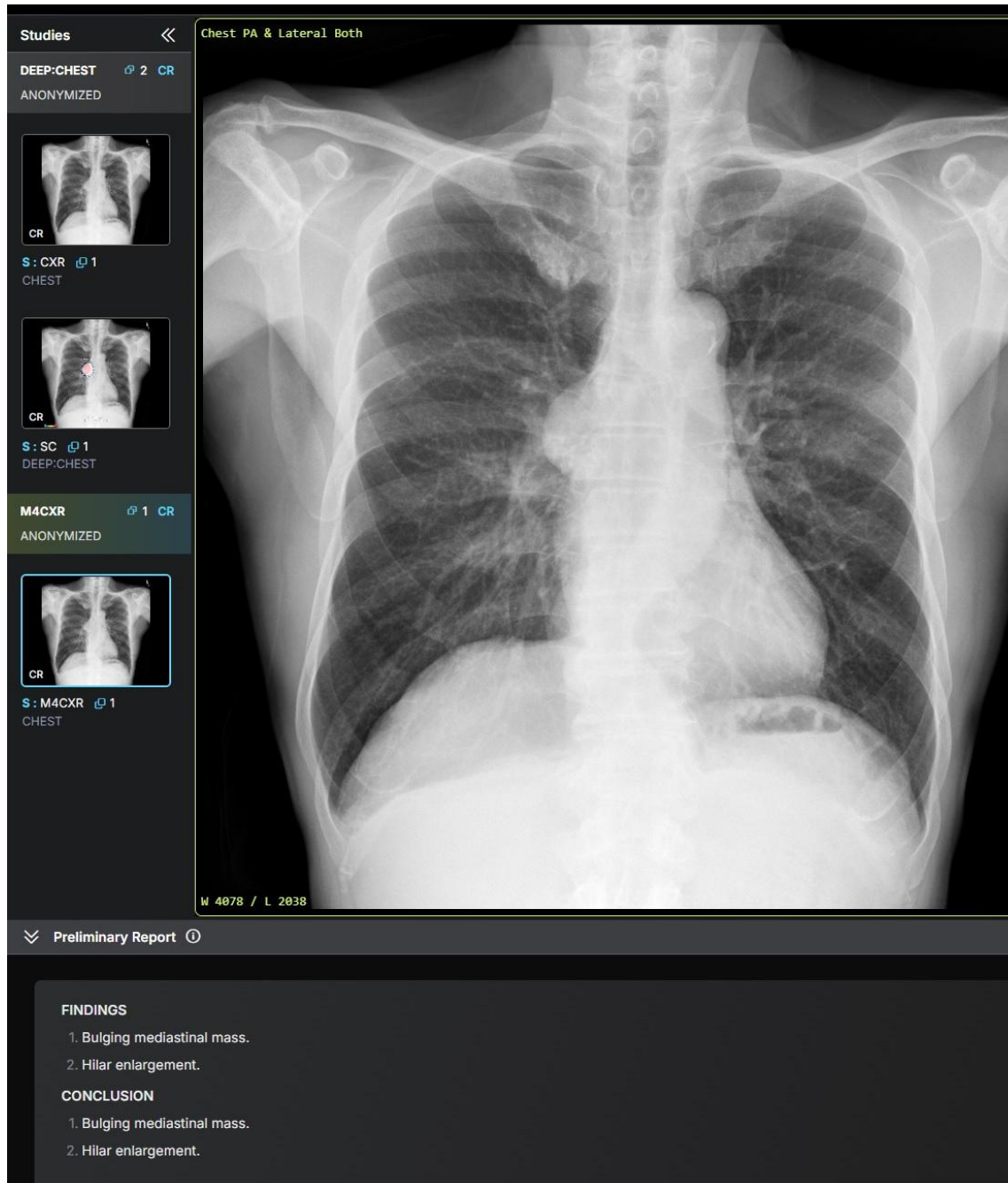




Case 2

- M70
- C.C: CXR abnormality during stomach cancer follow-up
- Lab/F: all WNL





Report-generating AI (Generative AI)

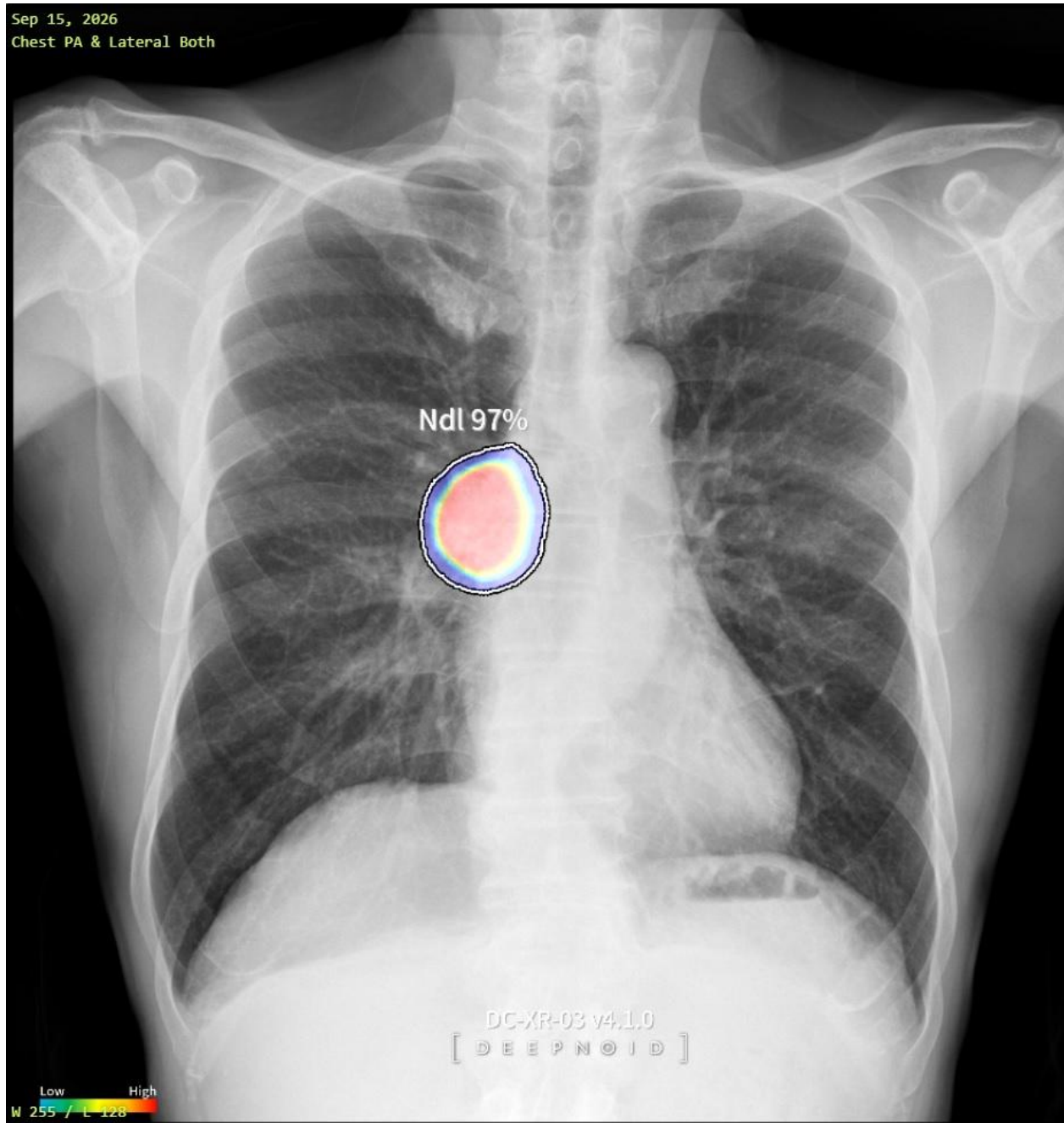
Findings

1. Bulging mediastinal mass
2. Hilar enlargement

Conclusion

1. Bulging mediastinal mass
2. Hilar enlargement

Sep 15, 2026
Chest PA & Lateral Both

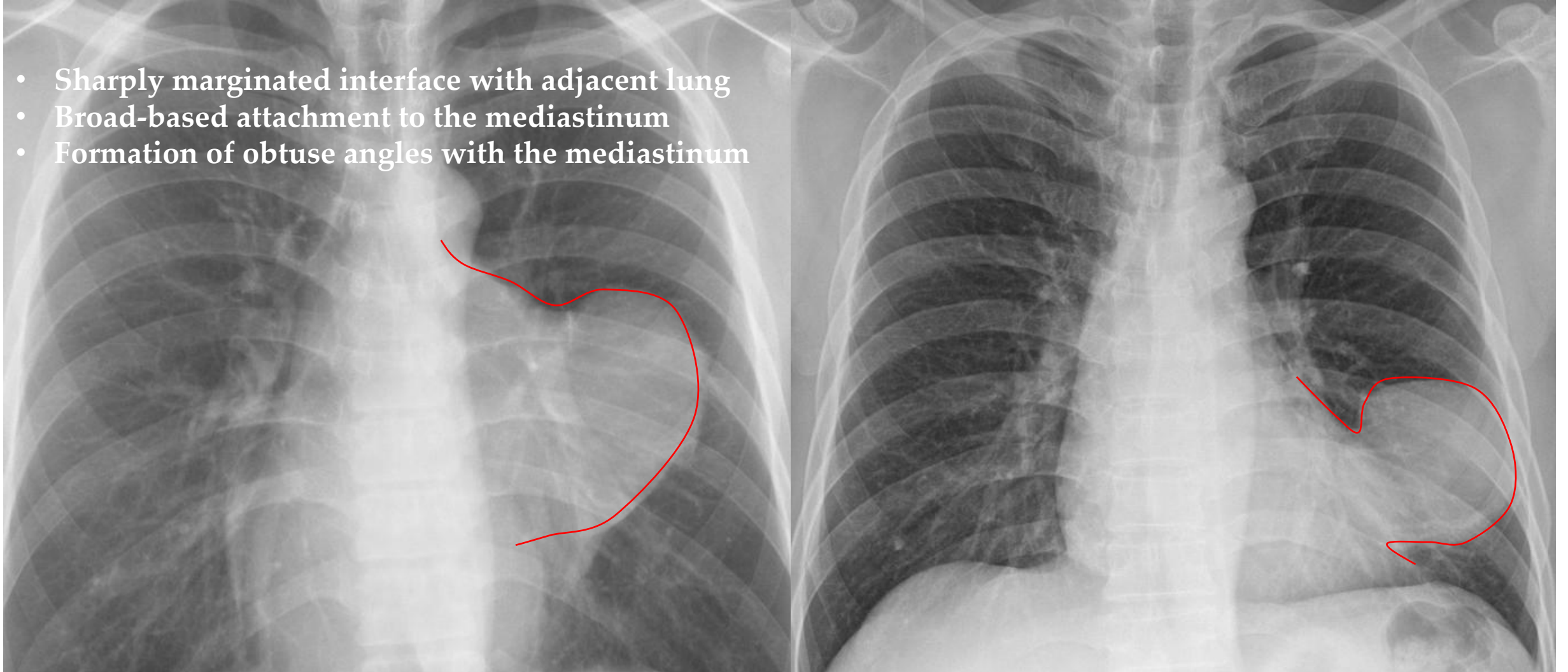


AI-CAD

Probability of nodule, 97%

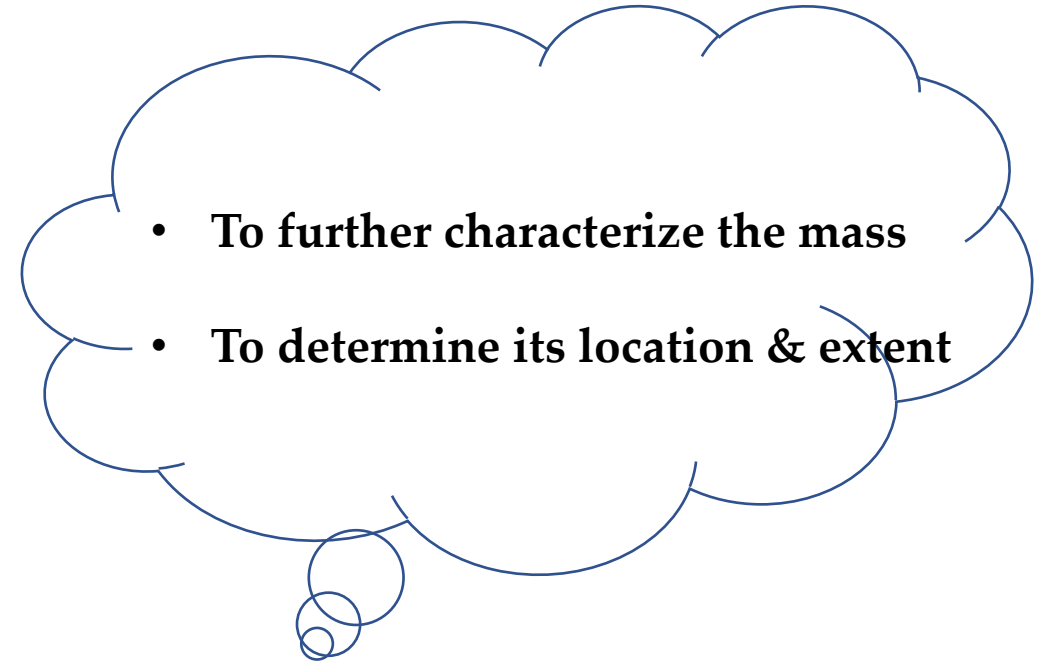
Mediastinal mass vs. Intrapulmonary mass

- Sharply margined interface with adjacent lung
- Broad-based attachment to the mediastinum
- Formation of obtuse angles with the mediastinum



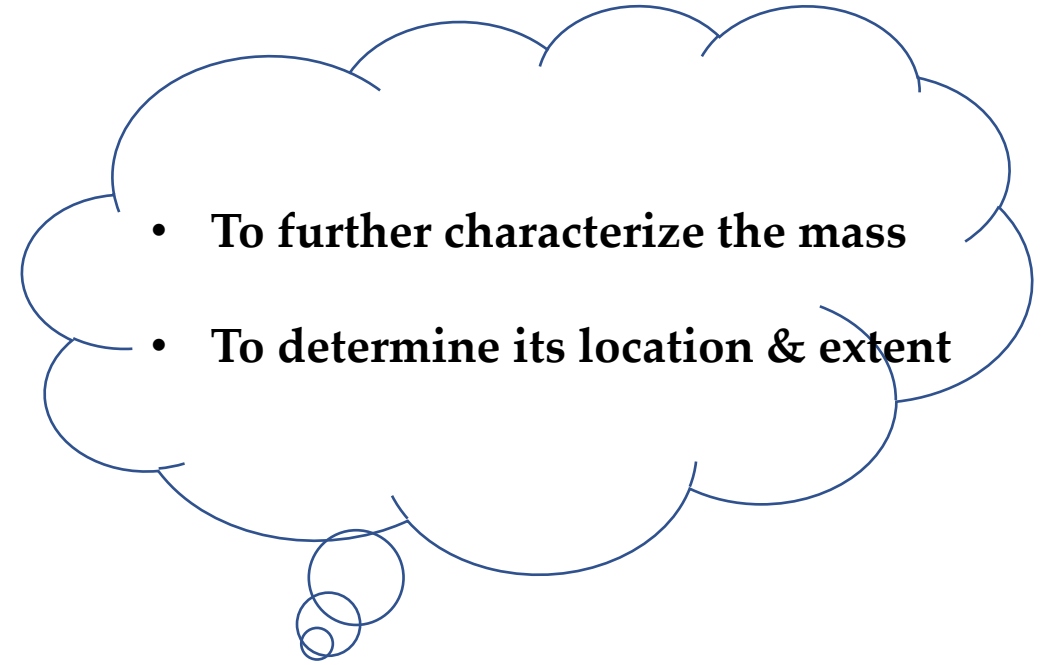
The most appropriate next imaging study

- PET/CT
- Ultrasonography
- Non-enhanced chest CT
- Contrast-enhanced chest CT
- Contrast-enhanced chest MRI

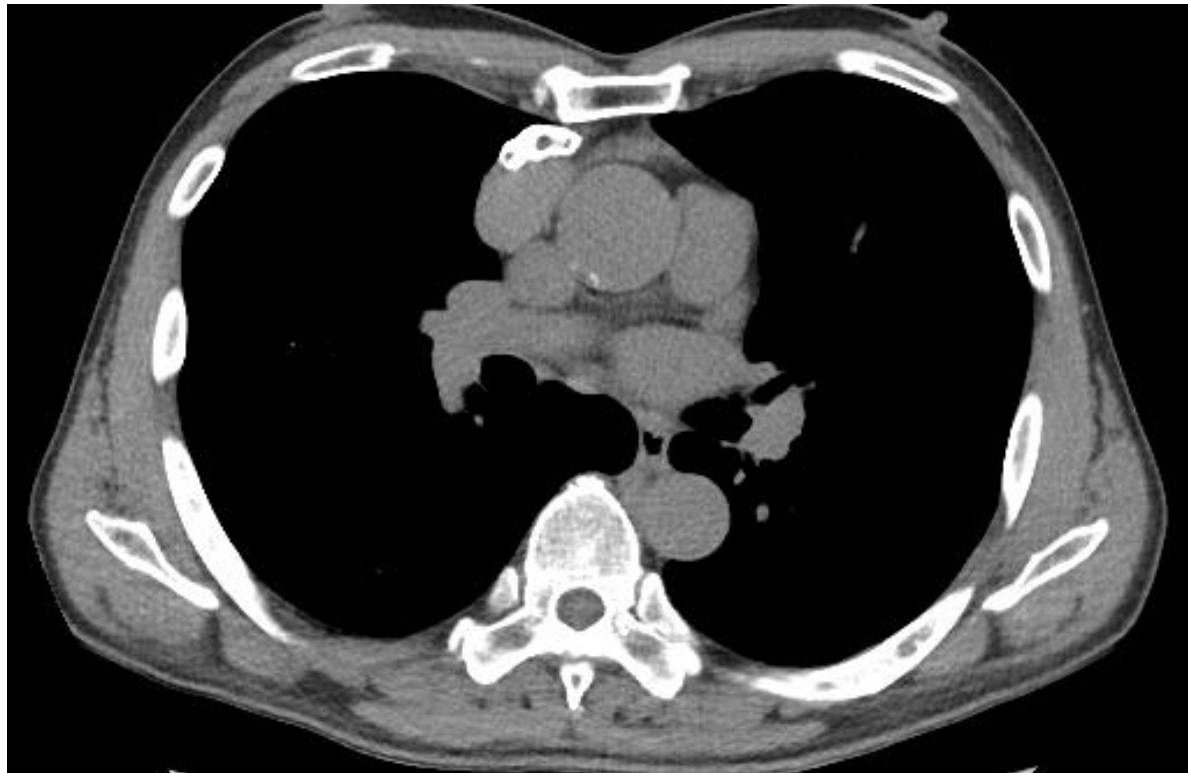


The most appropriate next imaging study

- PET/CT
- Ultrasonography
- Non-enhanced chest CT
- Contrast-enhanced chest CT
- Contrast-enhanced chest MRI



Non-enhanced chest CT



Contrast-enhanced chest MRI

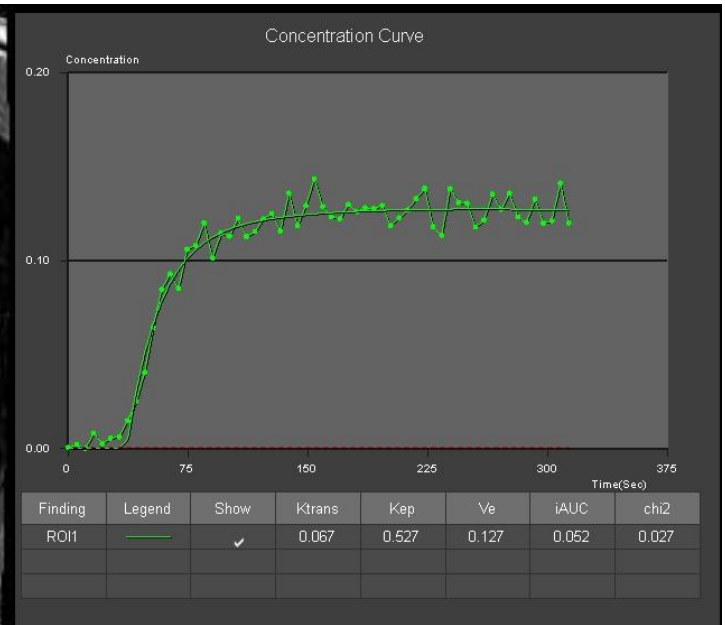
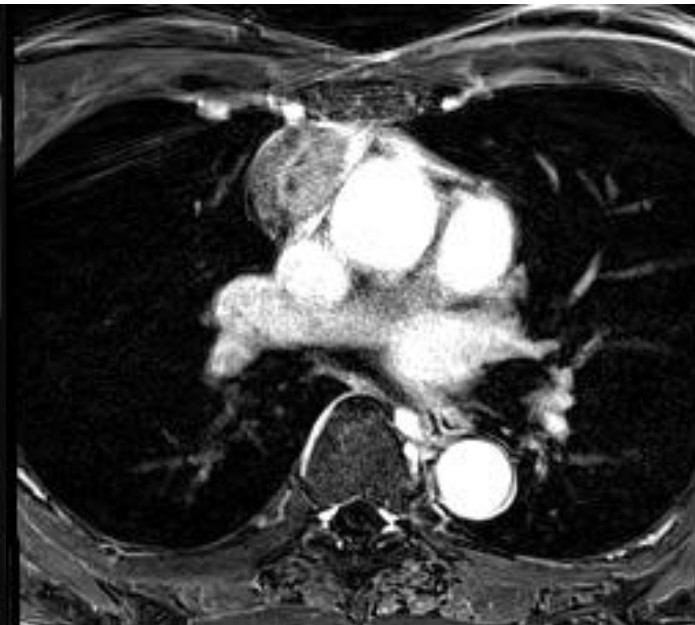
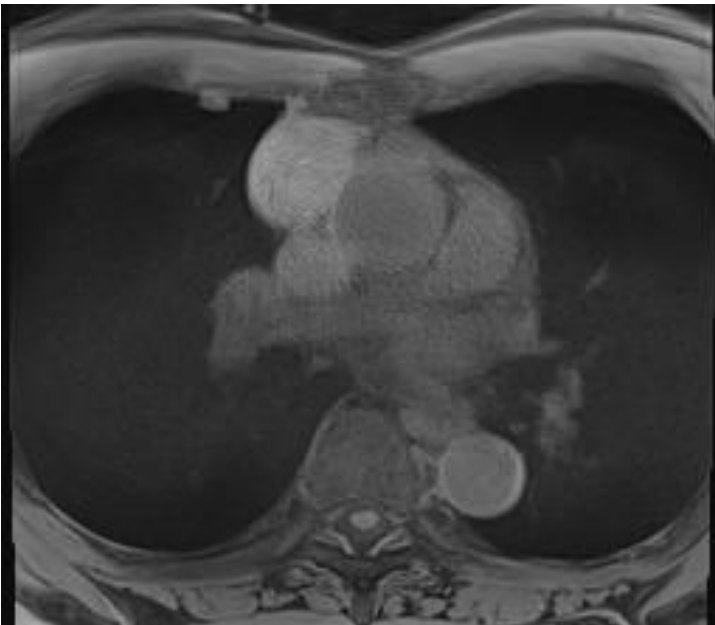
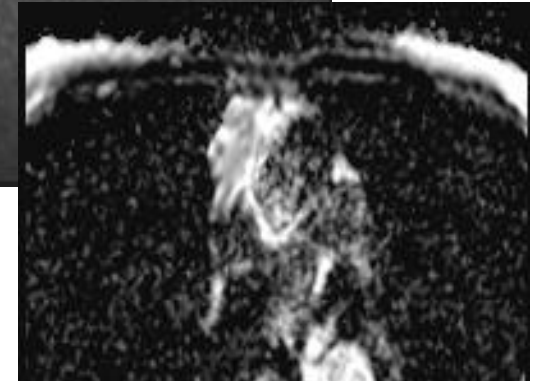
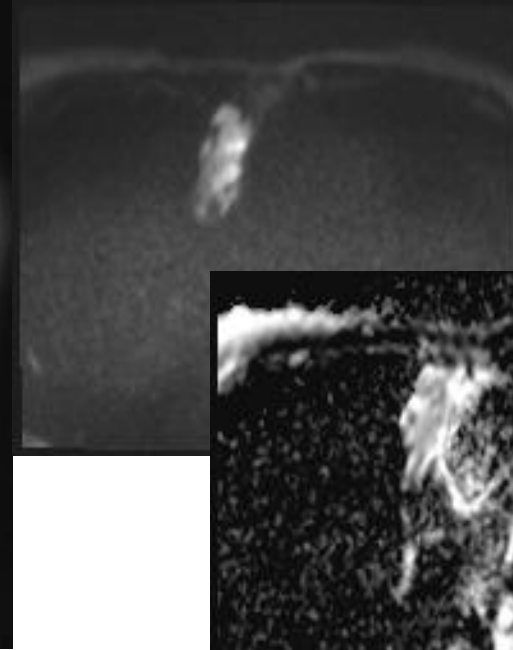
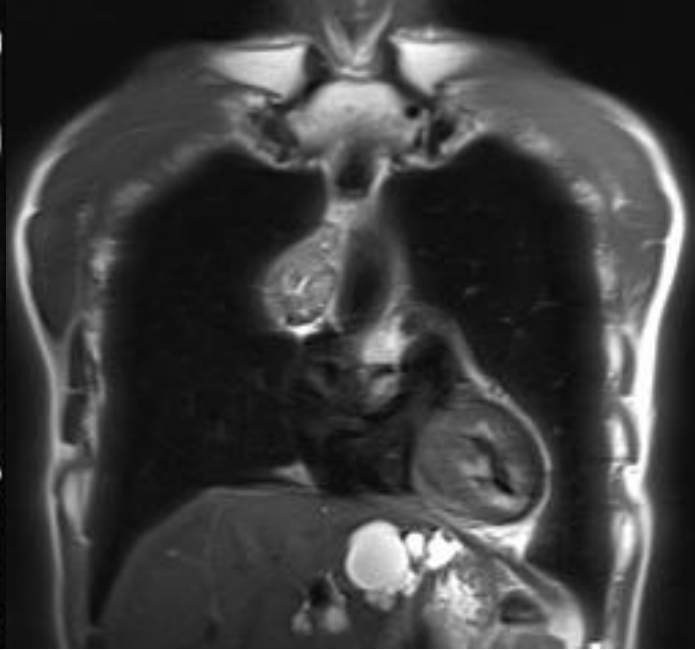
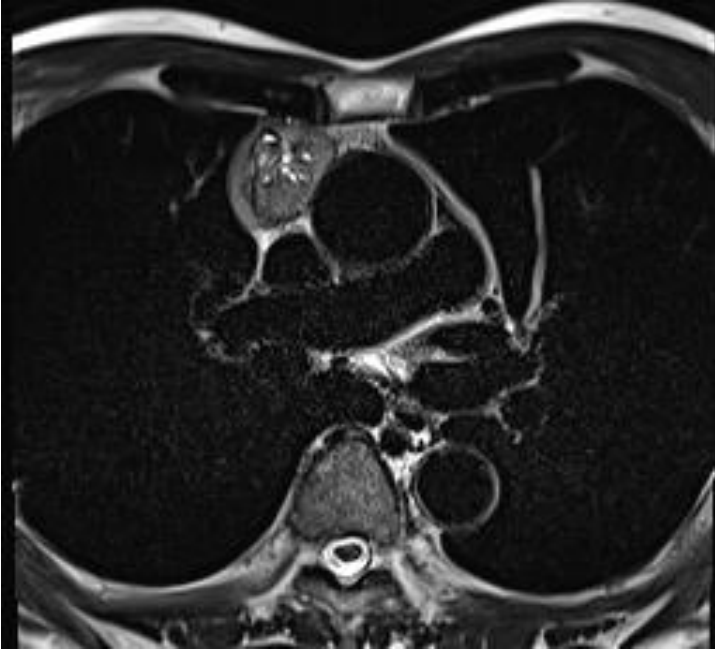


Table 1. Representative Pulse Sequences for Chest Magnetic Resonance Imaging

Jeong YJ et al. insights into imaging

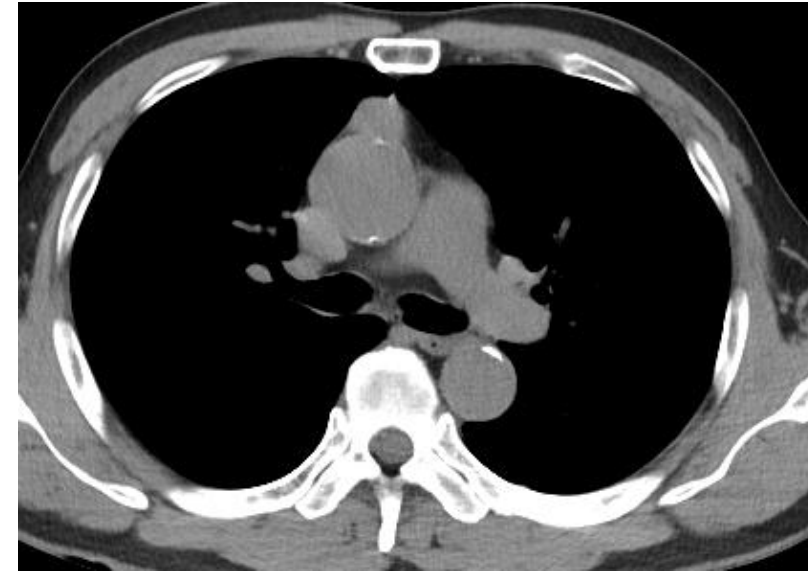
Sequences	Vendor-specific techniques	Plane	ST, mm	ECG	Respiration	FS	Uses
T2W SSFSE*	SSFSE, HASTE, UFSE	Axial / Coronal	≤ 5	+	Multiple BH	−	Rapid anatomic overview; fluid/cystic component; tumor–structure interface
T2W radial acquisition†	PROPELLER, BLADE, <u>MultiVane</u>	Axial / Coronal	≤ 5	+	RG	−	Motion-robust T2 imaging; large lesion or whole-chest evaluation
T2W STIR/ T2W SPAIR†	FAST STIR, TURBO STIR, STIR TSE/ SPAIR, ASPIR	Axial / Coronal	≤ 3	+	Multiple BH	+	Fat-suppressed T2 lesion conspicuity; edema, chest wall, pleural, diaphragmatic, or marrow involvement
T1W SE*	TSE, FSE	Axial / Coronal / Sagittal	≤ 5	−	FB	−	Baseline anatomy; hemorrhagic, proteinaceous, or fatty content
Dual echo T1W GRE†	In- and opposed-phase	Axial	≤ 5	−	BH	−	Microscopic intravoxel fat; thymic hyperplasia vs thymic tumor
T1W GRE with DIXON†	LAVA FLEX, DIXON, <u>mDixon</u>	Axial	≤ 5	−	FB	+	Water–fat separation; microscopic lipid and macroscopic fat; uniform fat-suppressed imaging
PD 3D ultrashort GRE†	ZTE 3D or 4D, 3D UTE, spiral VIBE	Axial	≤ 3	−	RG	+	Lung parenchymal lesion visualization; reduced susceptibility artifact
ECG-gated <u>bSSFP</u> †	FIESTA, <u>TrueFISP</u> , BFFE	Four-chamber view	≤ 5	+	BH	−	Cine assessment of cardiovascular interface and sliding motion
Real-time <u>bSSFP</u> †	FIESTA, <u>TrueFISP</u> , BFFE	Coronal	≤ 5	−	FB	−	Free-breathing dynamic motion assessment
SS-EP DWI, SSFSE DWI*	SS- or MS-EPI DWI, DWI-HASTE	Axial	≤ 3	+/−	Multiple BH or RG	−	Cellularity assessment; solid viable tumor component; ADC mapping
T1W 3D fast GRE pre/post-CE* (with or without <u>DCE</u>)*	LAVA, <u>StarVIBE</u> , THRIVE	Axial / Coronal / Sagittal	≤ 3	−	FB with RG or BH	+	Enhancement, local invasion, viable tumor, treatment response, and enhancement kinetics

Table 2. CT Limitations, MRI Solutions, and Targeted Sequences in Thoracic Oncology

Jeong YJ et al. insights into imaging



CT limitations	MRI solutions	Key MRI sequences
Indeterminate cystic vs solid lesion : High-attenuation cyst may mimic a solid tumor	Characterize simple or complicated cysts and solid components	T2W SSFSE / STIR, DWI/ADC, CE-T1W with subtraction
Indeterminate fat-containing lesion : Microscopic fat not visible on CT	Detect microscopic and macroscopic fat; thymic hyperplasia vs tumor	In-/opposed-phase T1W, Dixon water-/fat-only
Nonspecific soft-tissue mass : Limited tissue characterization	Assess cellularity, vascularity, necrosis, and viable tumor	DWI/ADC, CE-T1W with subtraction, DCE MRI
Contact vs true invasion of mediastinal tumor : Broad contact may lead to over- or understaging	Distinguish true invasion from abutment, compression, or adhesion using tissue planes and sliding motion	T2W SSFSE, CE-T1W, cine bSSFP
Indeterminate pulmonary lesion : Tissue characterization or contrast-enhanced CT unavailable	Characterize malignancy, distinguish lung cancer from PMF or other benign mimics	UTE/ZTE or PD imaging, T2W, DWI/ADC, DCE MRI
Uncertain local T staging : Determine pleural, mediastinal, chest-wall, esophageal, or diaphragmatic invasion	Refine T staging and resectability in lung cancer, esophageal cancer, thymic tumors, and mesothelioma	T2W/STIR, CE-T1W, cine bSSFP, targeted MRA
Limited nodal or distant staging information : Size-based nodal assessment and indeterminate metastatic lesions	Characterize suspicious nodes and selected distant metastases	STIR, DWI/ADC, whole-body MRI / DWI
Indeterminate post-treatment abnormality : Residual mass, wall thickening, fluid, fibrosis, or radiation change	Distinguish viable residual tumor from necrosis, fibrosis, inflammation, or postoperative change	T2W, DWI/ADC, CE-T1W with subtraction ± DCE



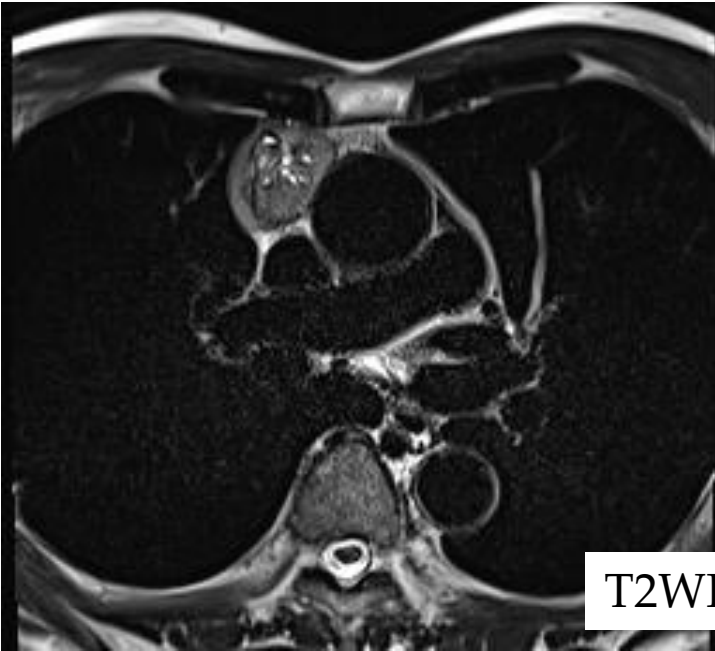
Malignancy?

Cellularity

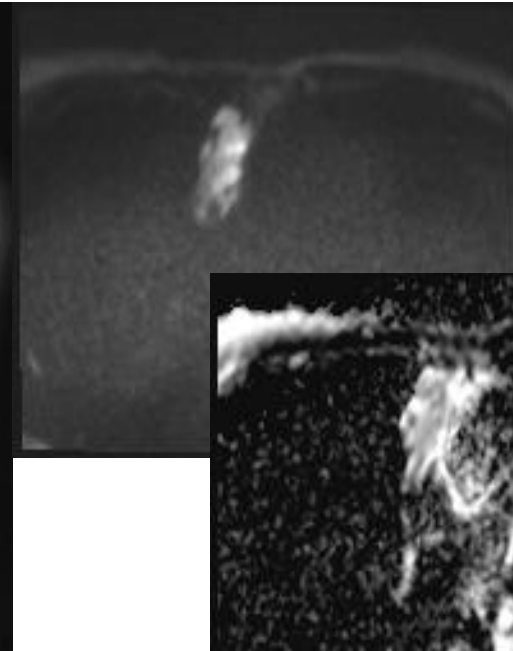
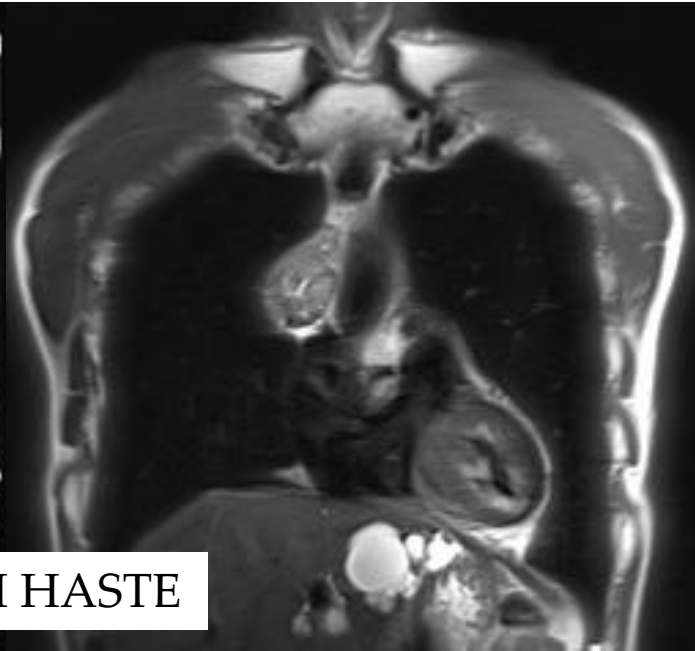
DWI
ADC value

Vascularity

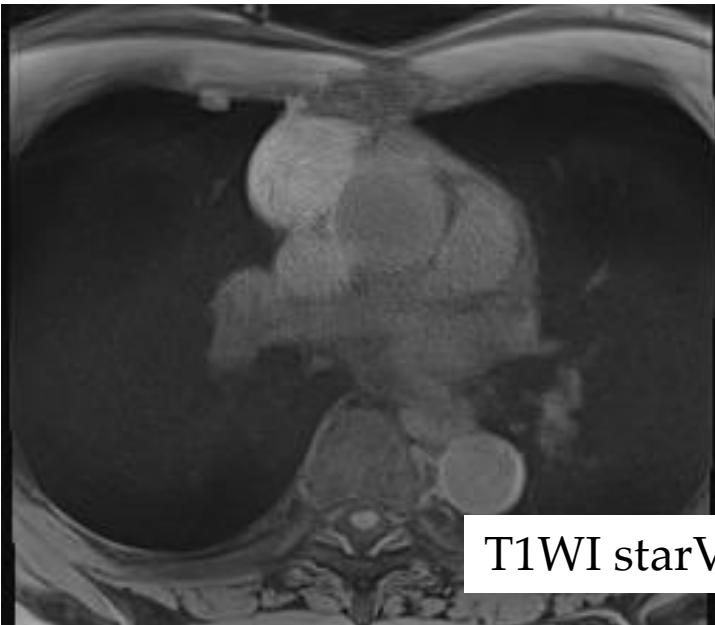
Dynamic contrast enhancement
TIC pattern, Pharmacokinetics



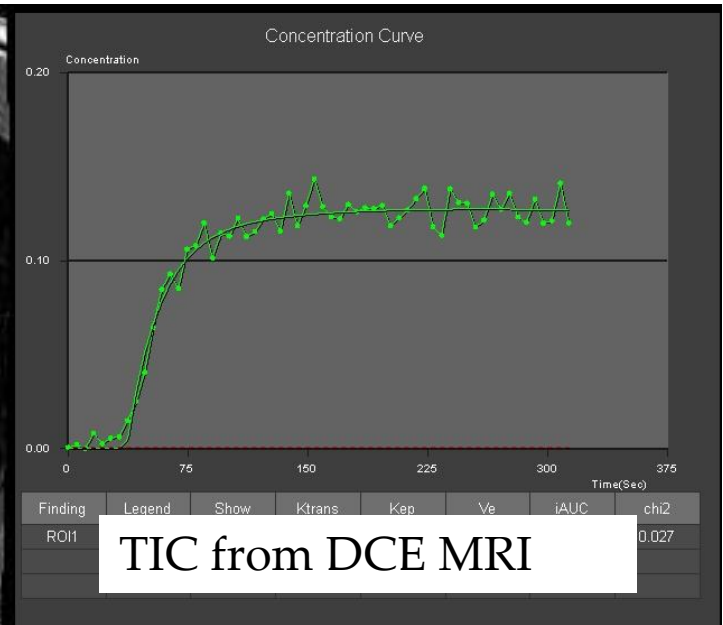
T2WI HASTE

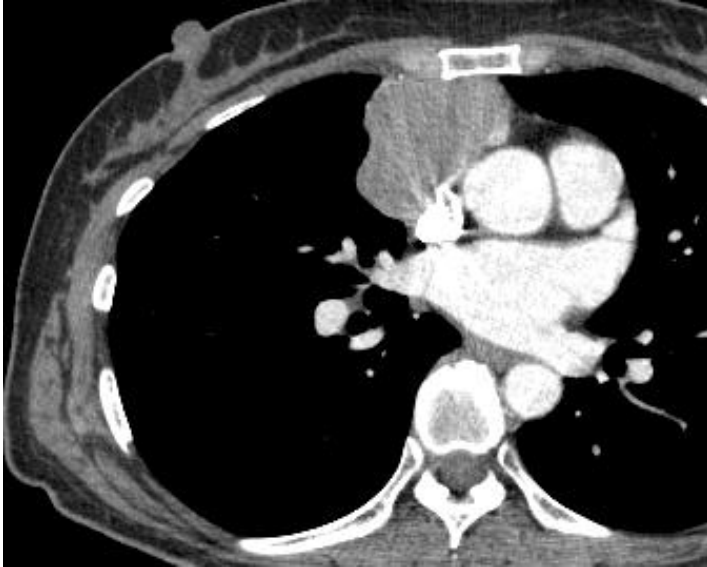


DWI/ADC map



T1WI starVIBE /c CE





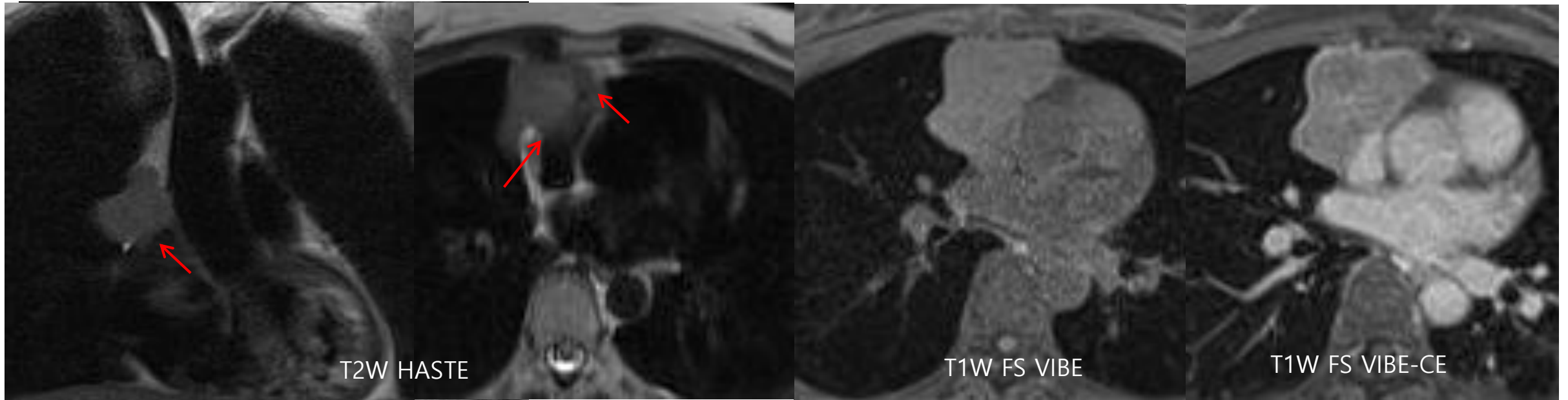
Invasion?

Fat plane

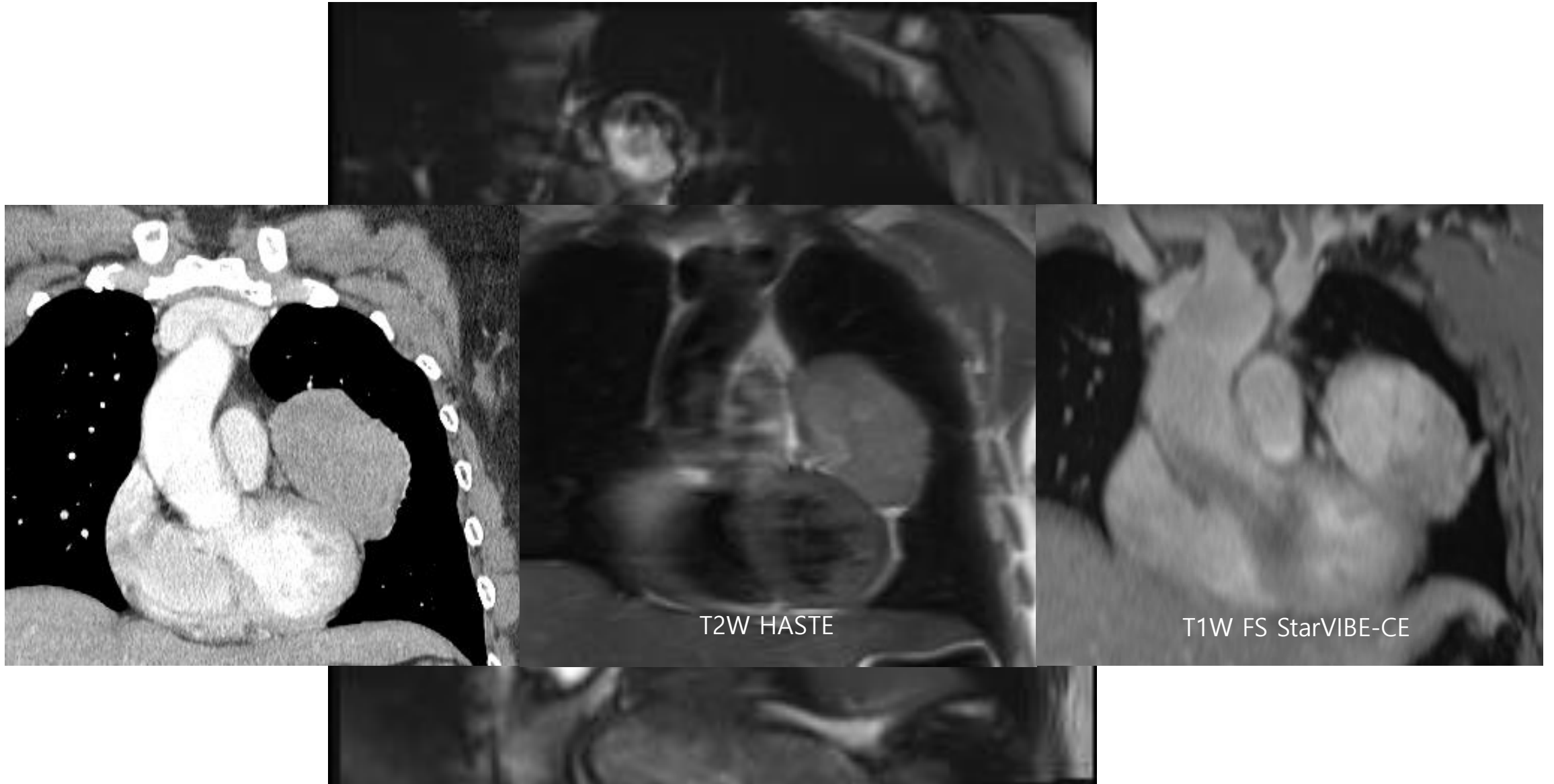
T2 SSFSE
Post-contrast fast GRE

Sliding motion

bSSFP



A 50-year-old woman with **thymic epithelial tumor (B2)** in which SVC and RA anterior wall invasion was suspected on CT & T2 HASTE images. When direct invasion is not detected, MRI can be used to evaluate for obliteration of a fat plane between a tumor and adjacent structures or surfaces. Direct invasion is best shown on post-contrast fast GRE images, but it may also be detectable on non-enhanced images, including bSSFP and T2W SSFSE.



A 58-year-old woman with a thymic epithelial tumor (WHO classification, AB)

Case 2 Con't. Diagnosis

DIAGNOSIS

Thymus, RATS thymectomy :

Thymoma, WHO type B1,

1) size : 5.3x3.5x2.4cm

2) grossly and microscopically encapsulated (Modified Masaoka Stage I)

3) no evidence of lymphovascular invasion

4) resection margin, free of tumor.

#Immunohistochemistry [F]

panCK,p40: for epithelial cells

CD3,CD20,CD99,CD5,TdT: for lymphocytic cells

GROSS :

Thymus and thymic mass

- A product of RATS thymectomy, weight 73.5g and dimensions 16.9x6.8x

- Mass: dimensions 5.3x3.5x2.4cm

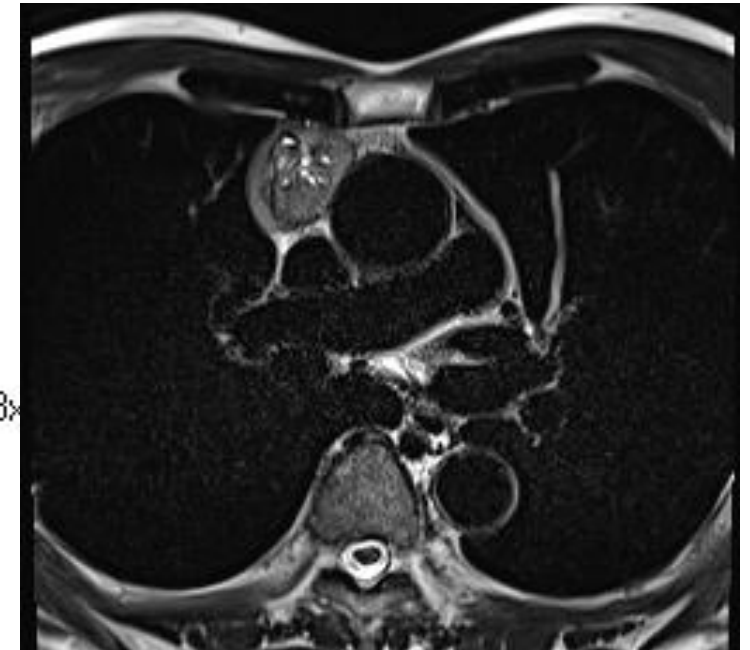
- Cut surface: yellow white solid mass, capsule, hemorrhagic

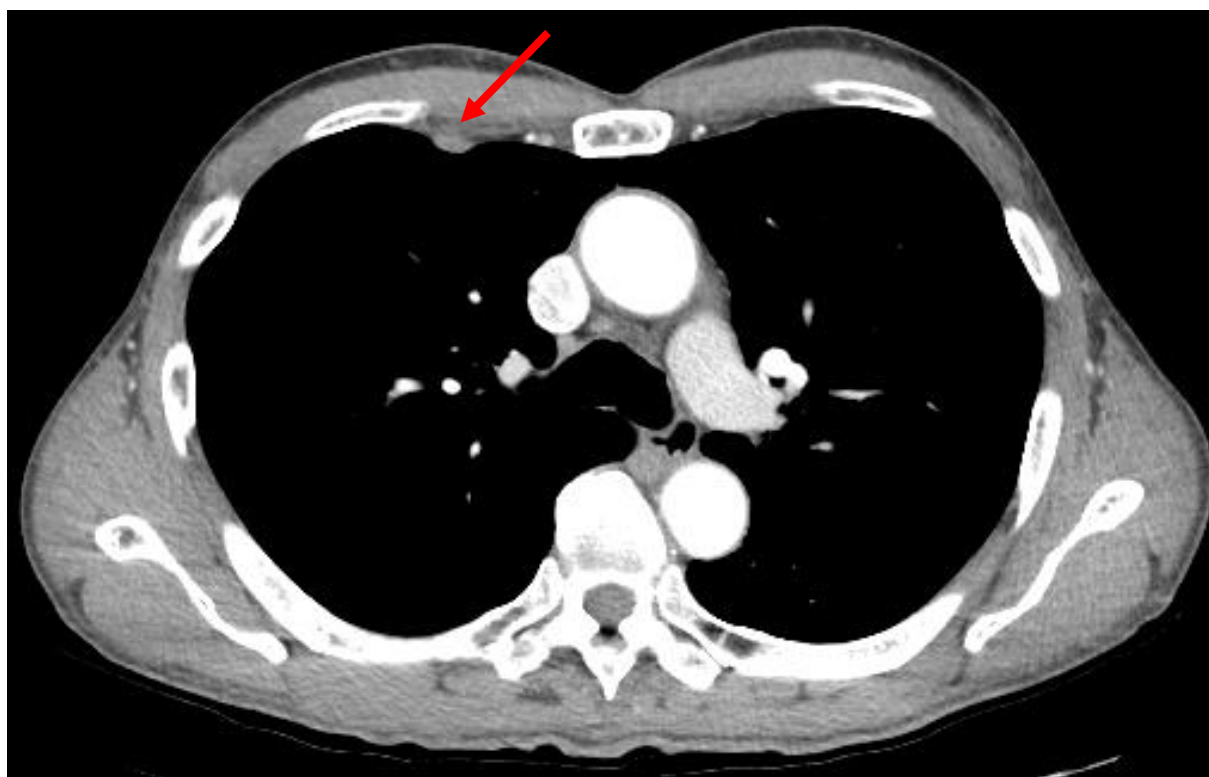
- Distance - abutting to resection margin

- A well-defined calcification lesion, dimensions 2.4x2.3x1.7cm

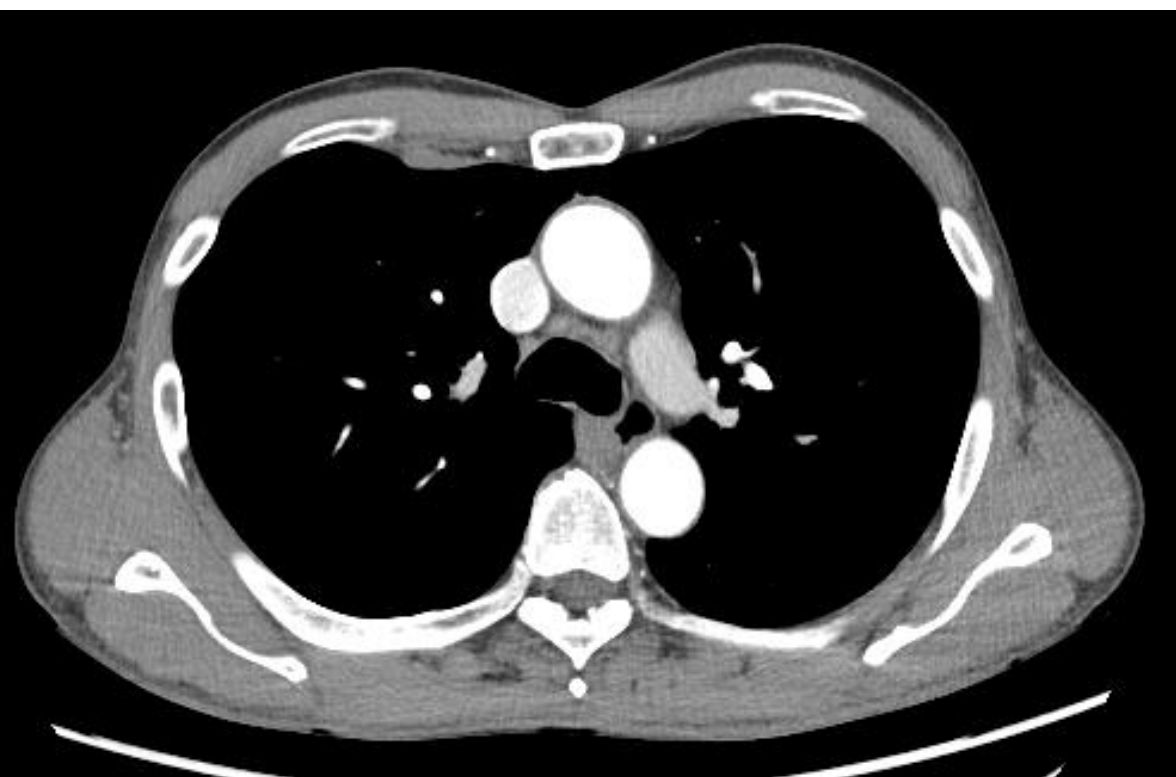
- Distance - abutting to resection margin

Sections are blocked according to slide keys(after decalcification).





POD #4M



POD #7M

MRI as a Problem-Solving Tool in Thoracic Oncology

Used selectively when CT is limited and when additional tissue characterization, local staging, or response assessment will change management

CT limitation

MRI problem solving

MR sequences

Why MRI helps

Superior soft-tissue contrast

Determine tissue type

Multiplanar assessment of tissue planes and local invasion

Assess functional information

Assess tumor cellularity and vascularity

Dynamic information

Determine local invasion

No ionizing radiation

Major thoracic applications

Mediastinal tumor diagnosis

Cystic vs solid, fat, hemorrhage, necrosis, fibrosis, adjacent invasion

Thoracic tumor staging

T staging of TET, lung cancer, esophageal cancer, mesothelioma

Treatment response assessment

Viable tumor vs inflammation or fibrosis/necrosis

Useful sequences

Anatomic imaging

T1-weighted, T2-weighted, in-/opposed-phase, contrast-enhanced T1WI

Functional imaging

DWI, DCE

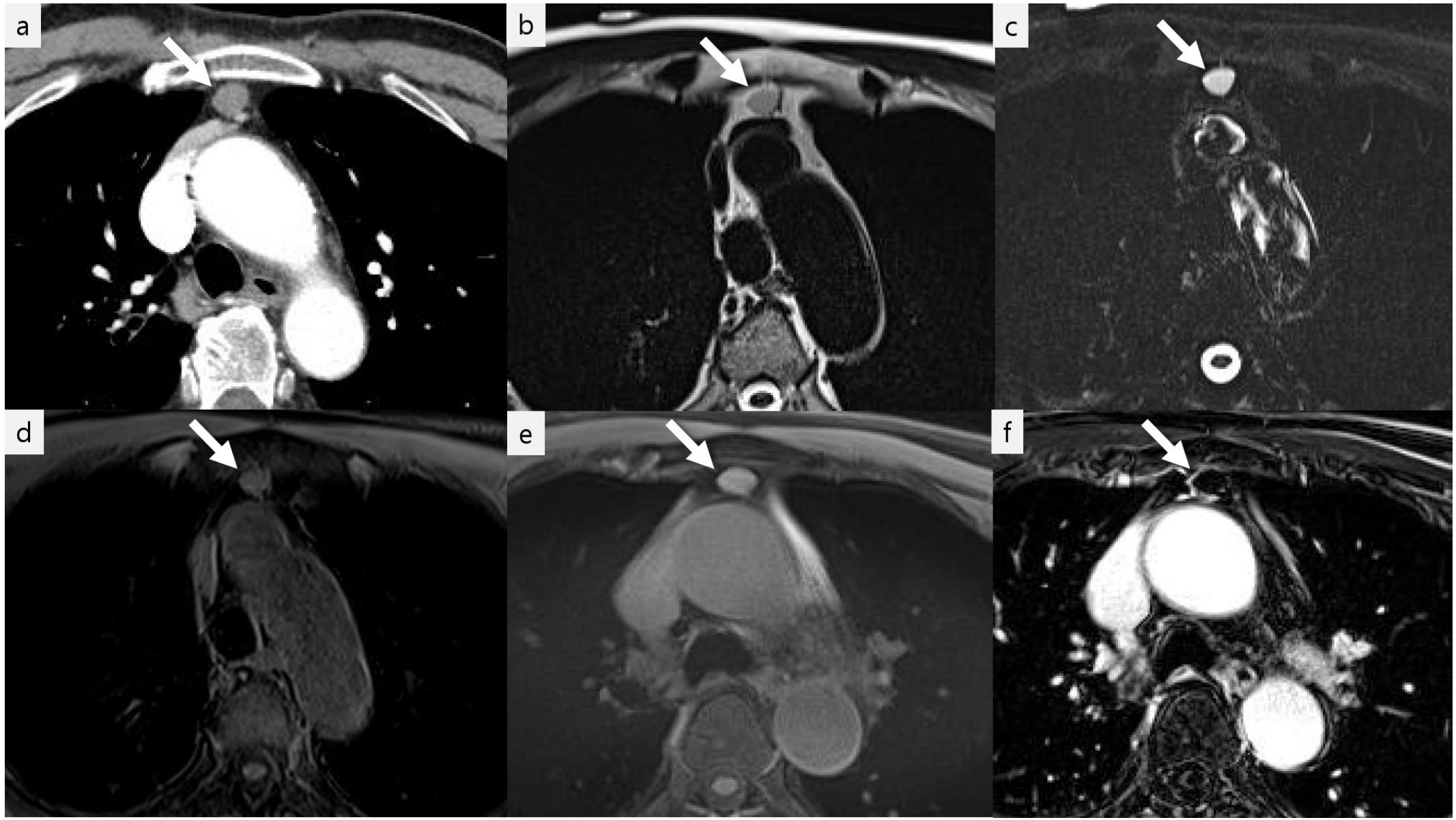
Cine imaging

ECG-gated cine or real-time cine imaging (bSSFP)

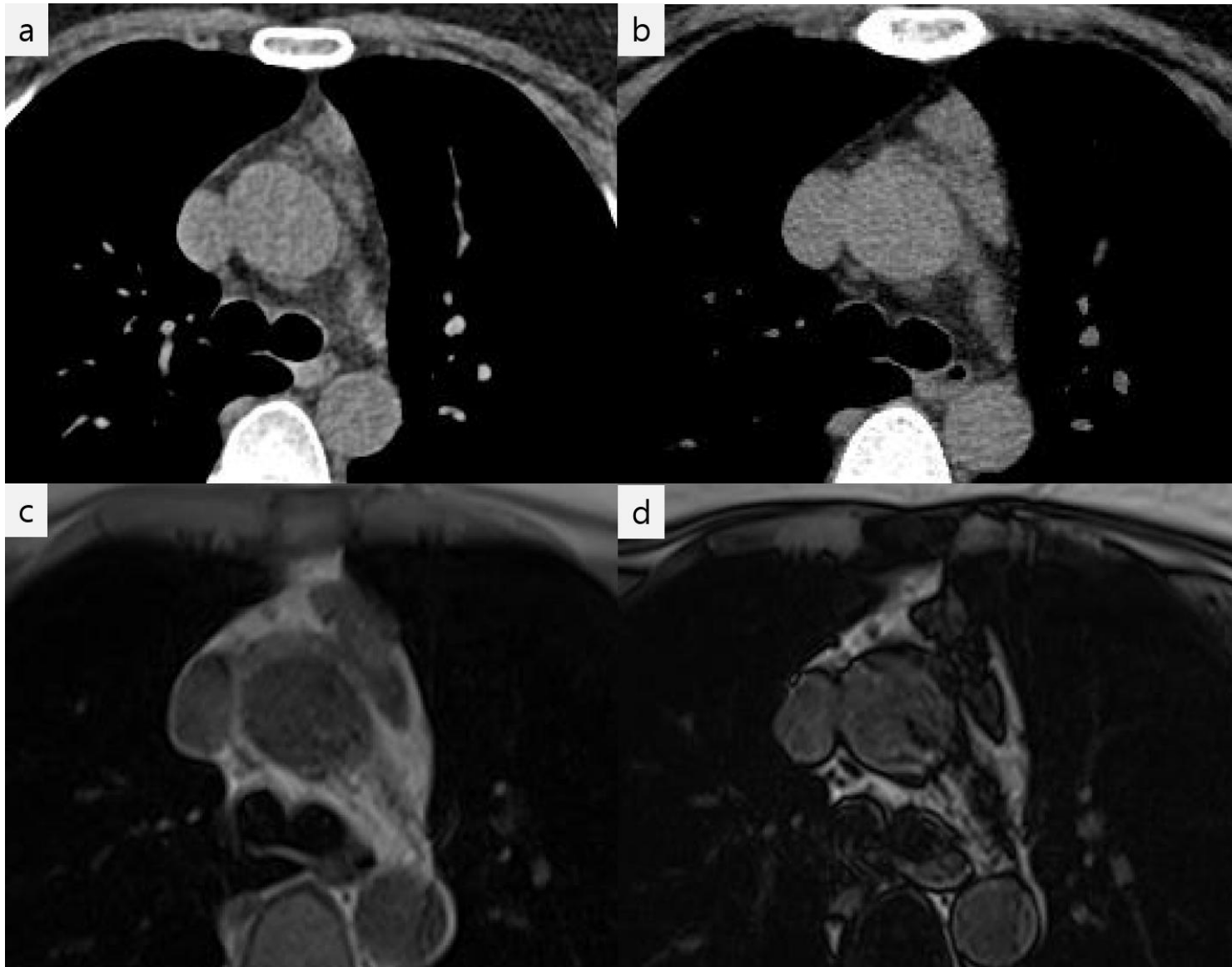
Protocol principle

Select pulse sequences according to the clinical question to minimize examination time

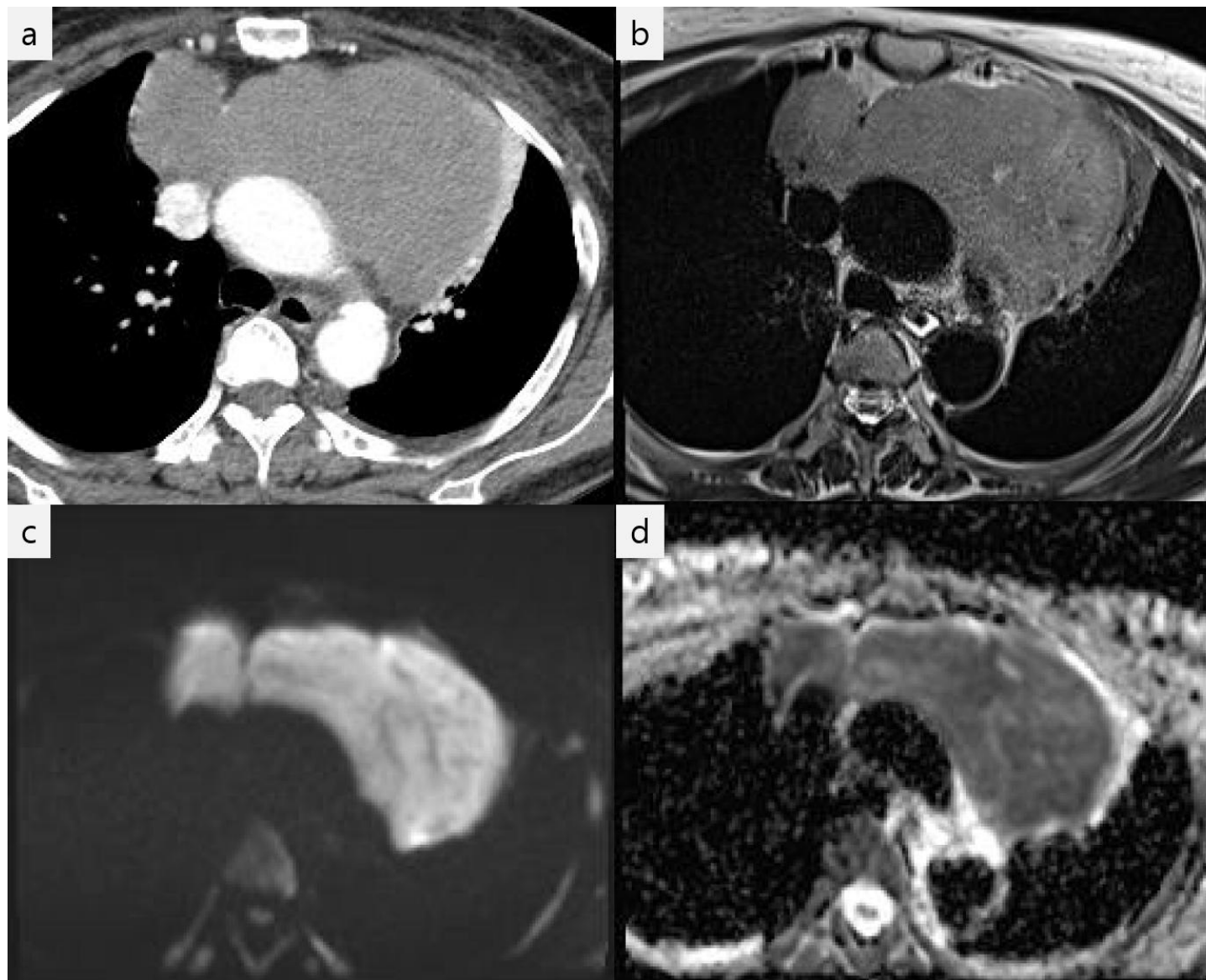
Tailor the chest MRI protocol to the specific clinical need, using the sequences most likely to answer the focused oncologic question.



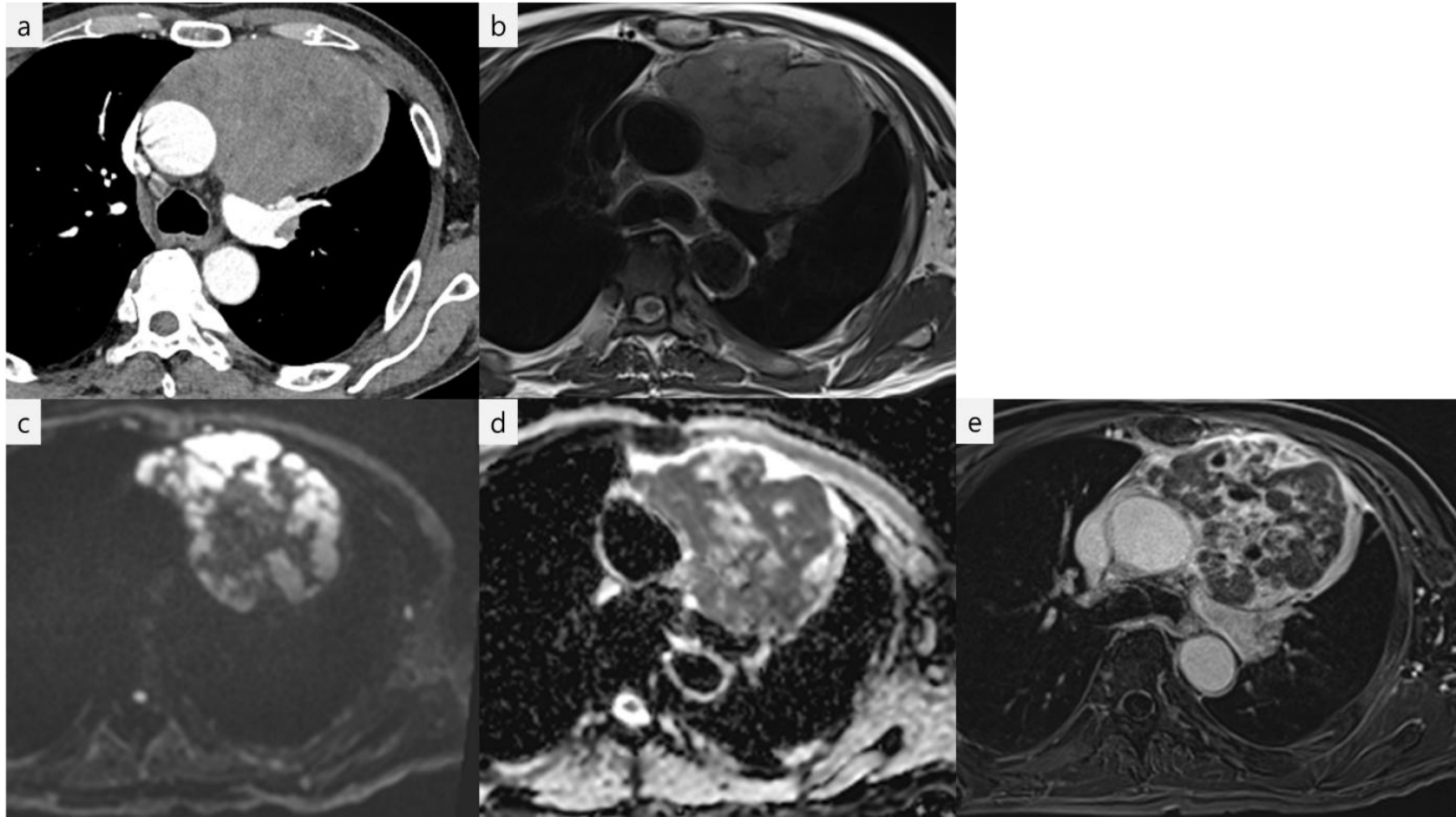
A 72-year-old man with a thymic cyst



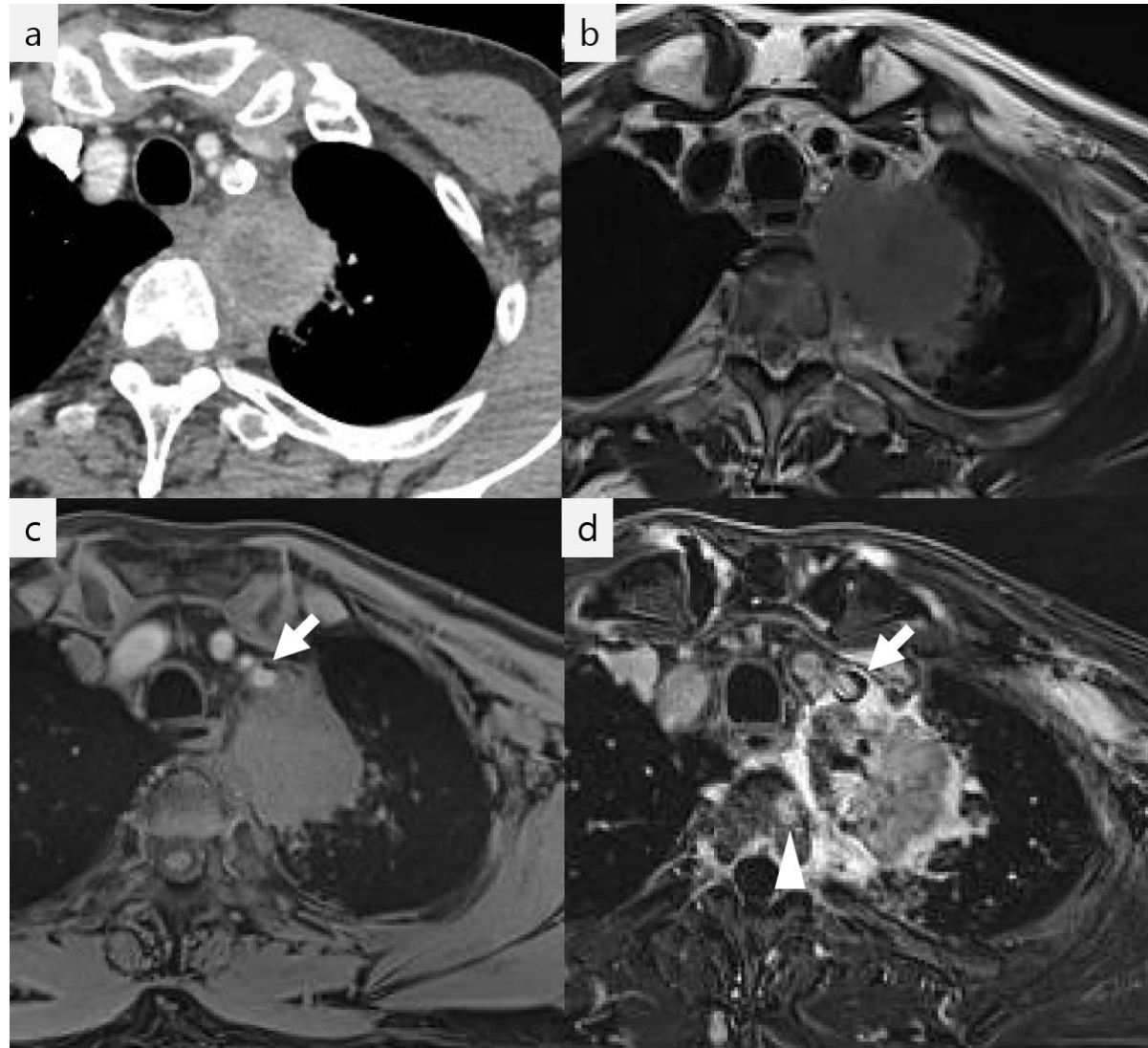
A 40-year-old woman with thymic hyperplasia



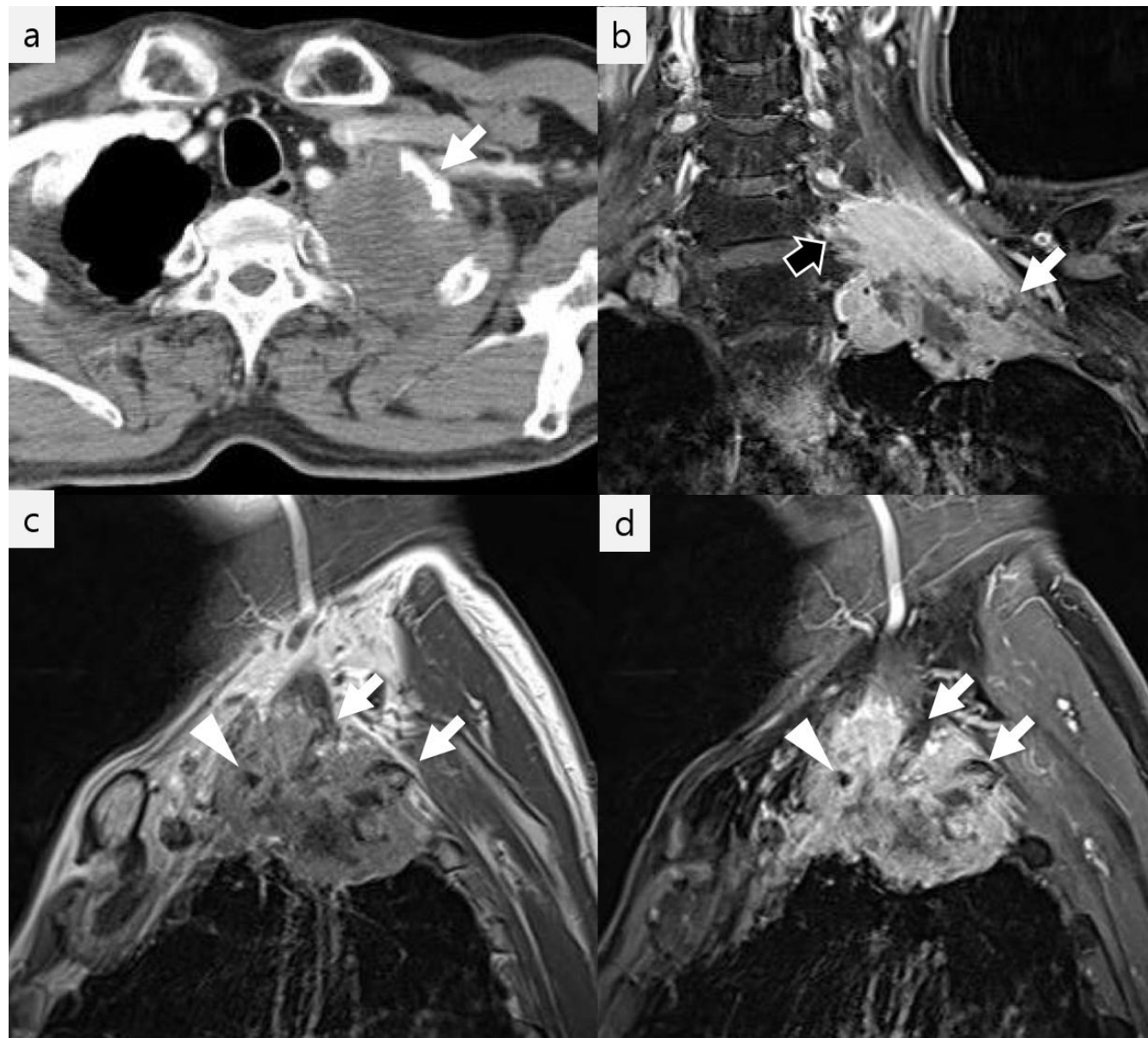
A 74-year-old woman with diffuse large B-cell lymphoma



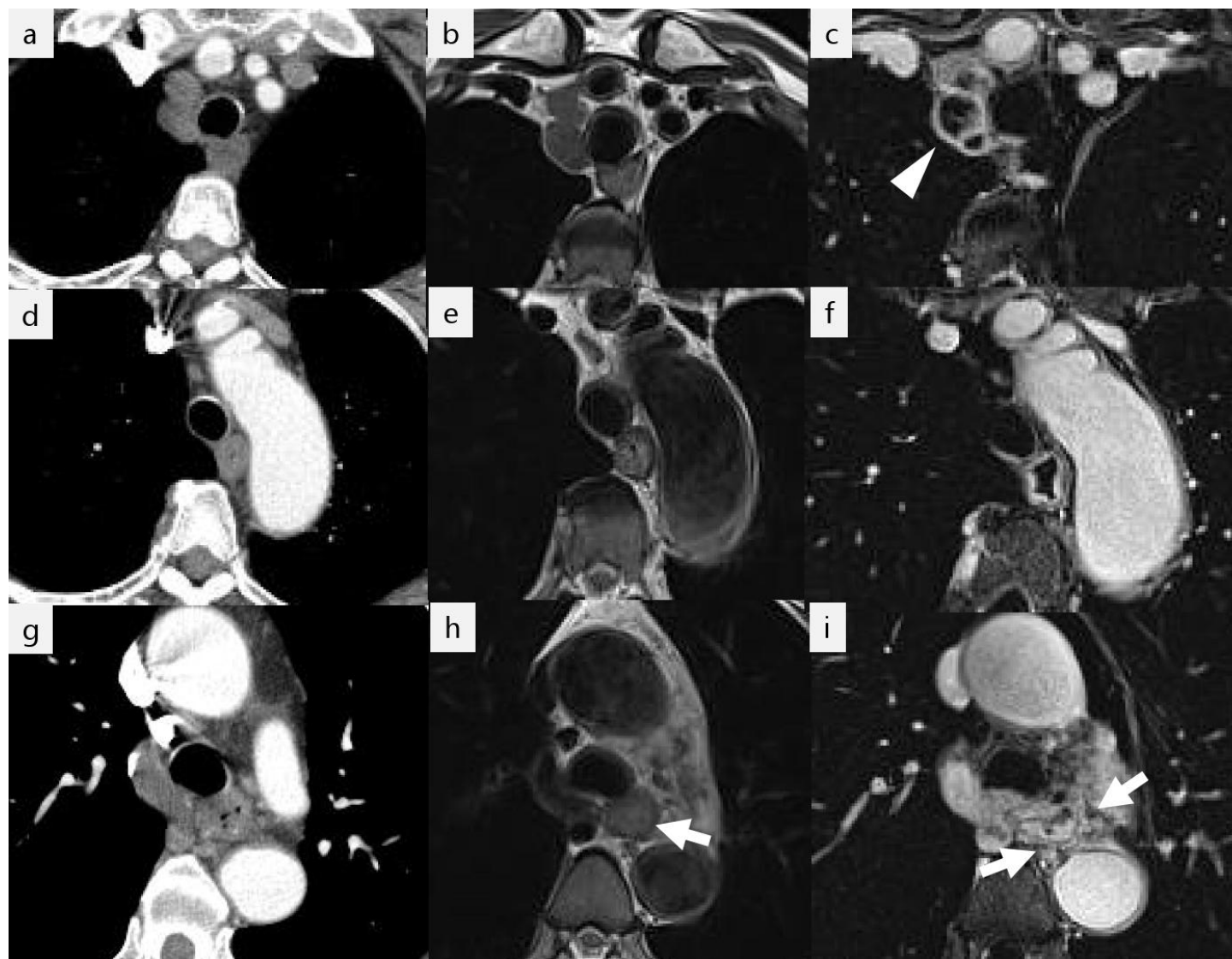
An 82-year-old man with thymic carcinoma



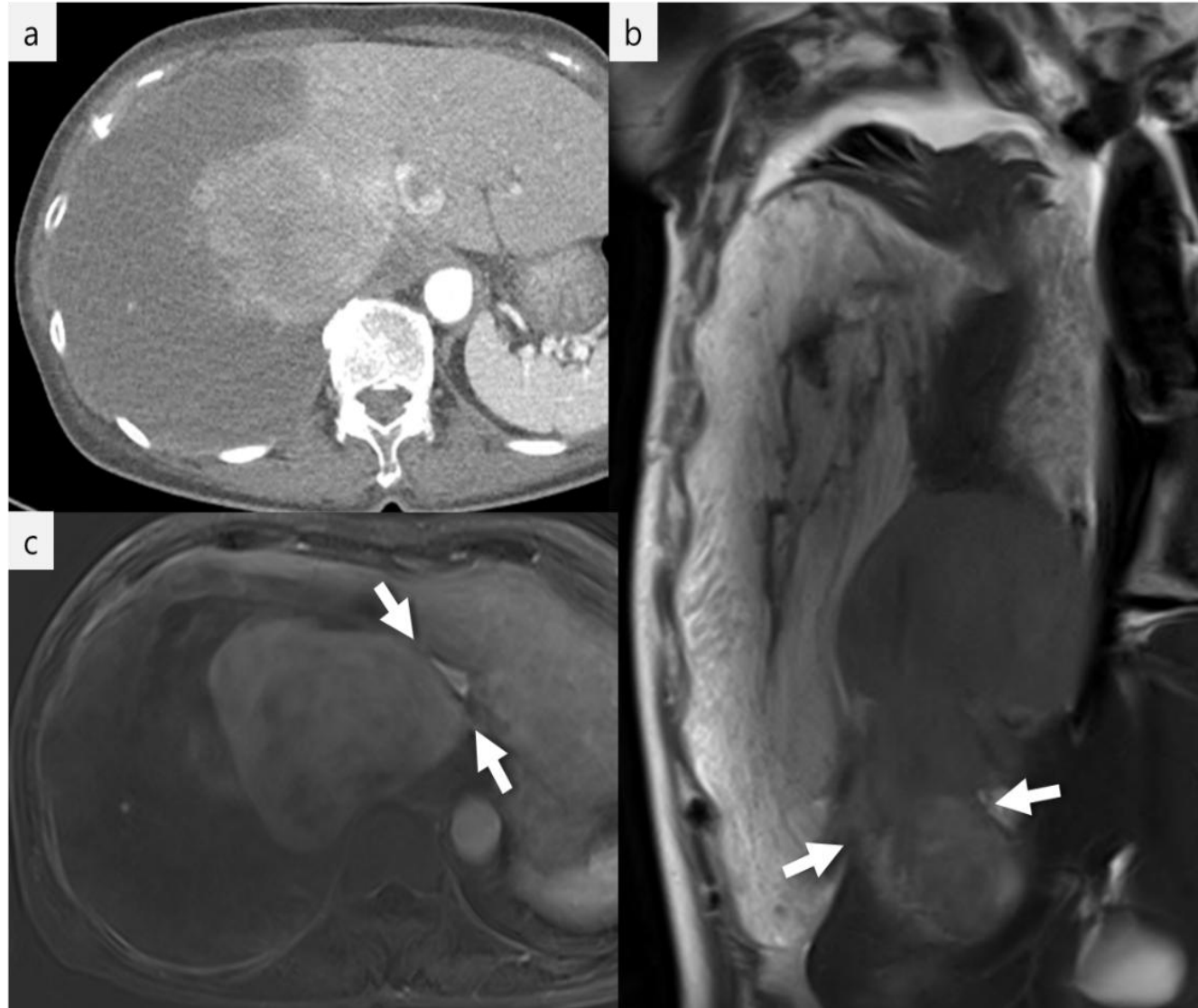
A 67-year-old man with lung cancer



A 72-year-old man with left apical lung cancer



A 63-year-old woman with esophageal cancer

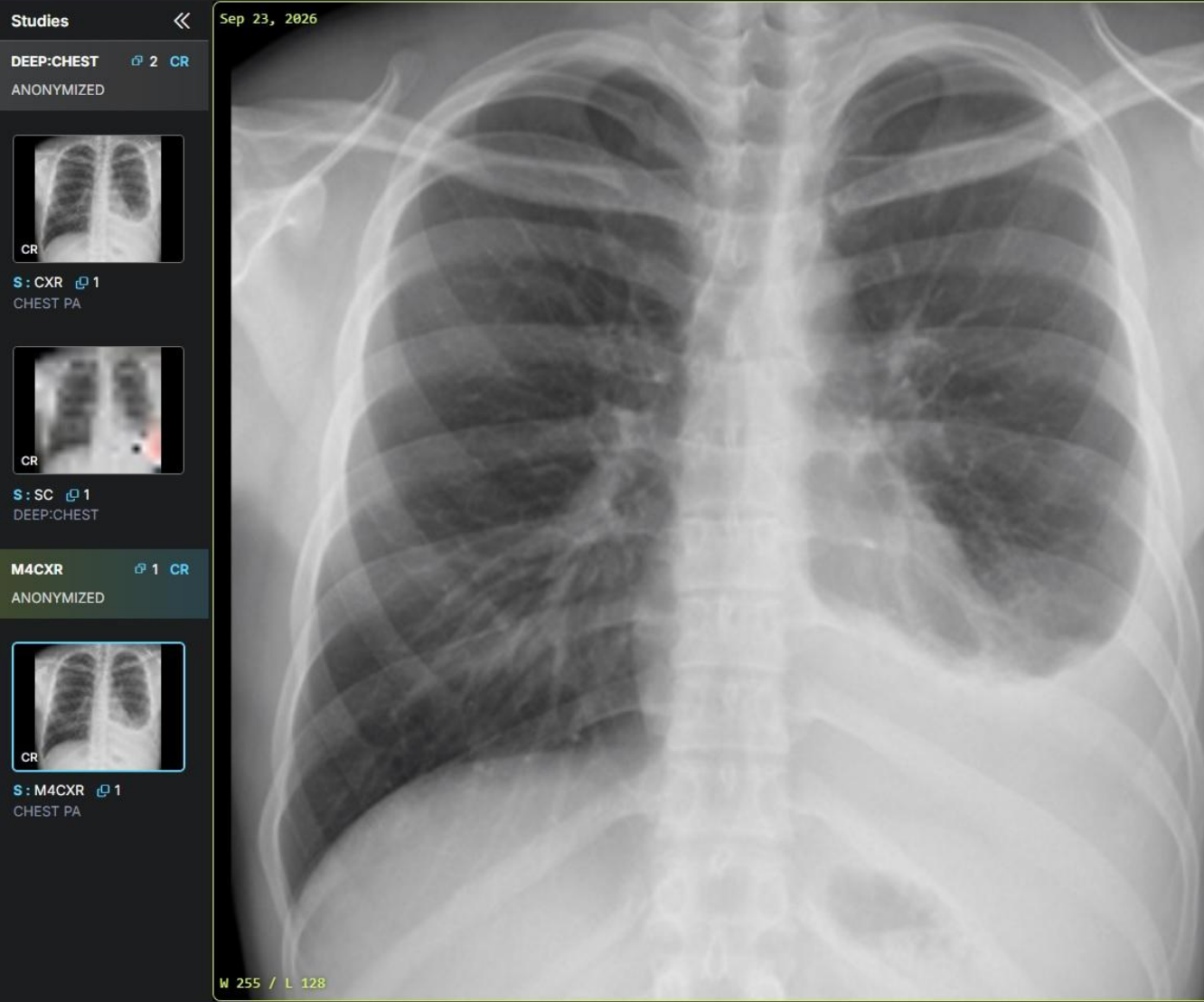


A 63-year-old woman with mesothelioma

Case 3

- M30
- C.C: Chest pain





Report-generating AI (Generative AI)

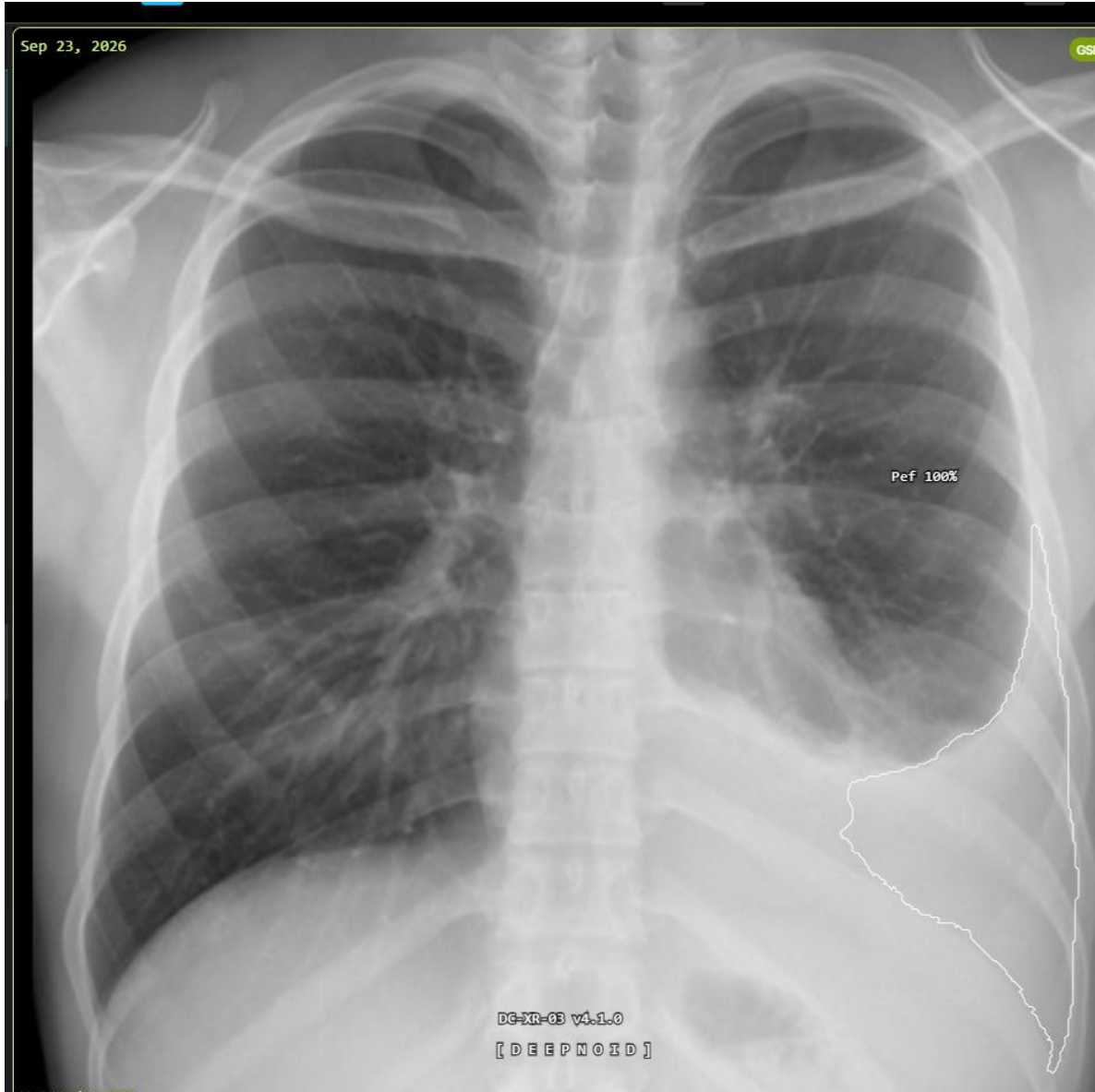
Findings

1. Left pleural effusion

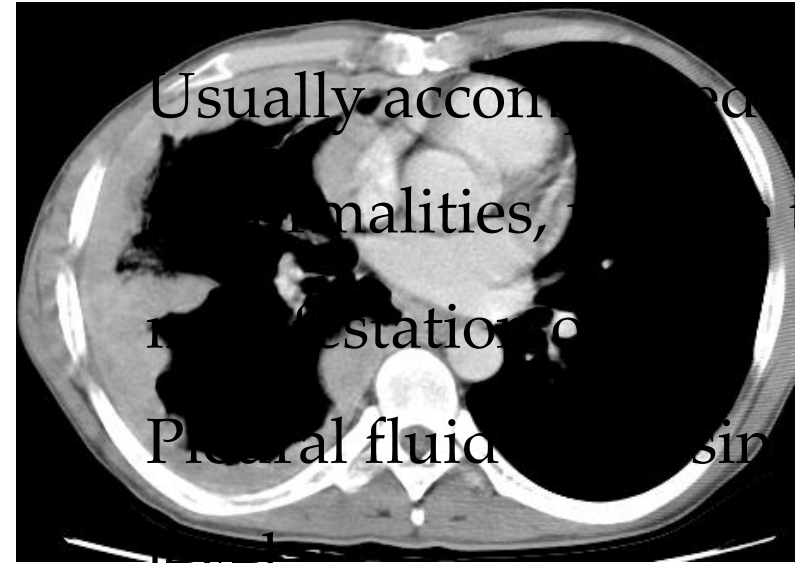
Conclusion

1. Left pleural effusion

AI-CAD



Probability of pleural effusion, 100%



Usually accompanied by parenchymal abnormalities, but can be the sole imaging manifestation of TB

Pleural fluid adenosine deaminase (ADA) level

- Elevated in TB pleurisy
- Sensitivity 0.92, specificity 0.90
- CT
 - Smooth thickening of visceral & parietal pleural surfaces separated by a variable amount of fluid (split pleura)



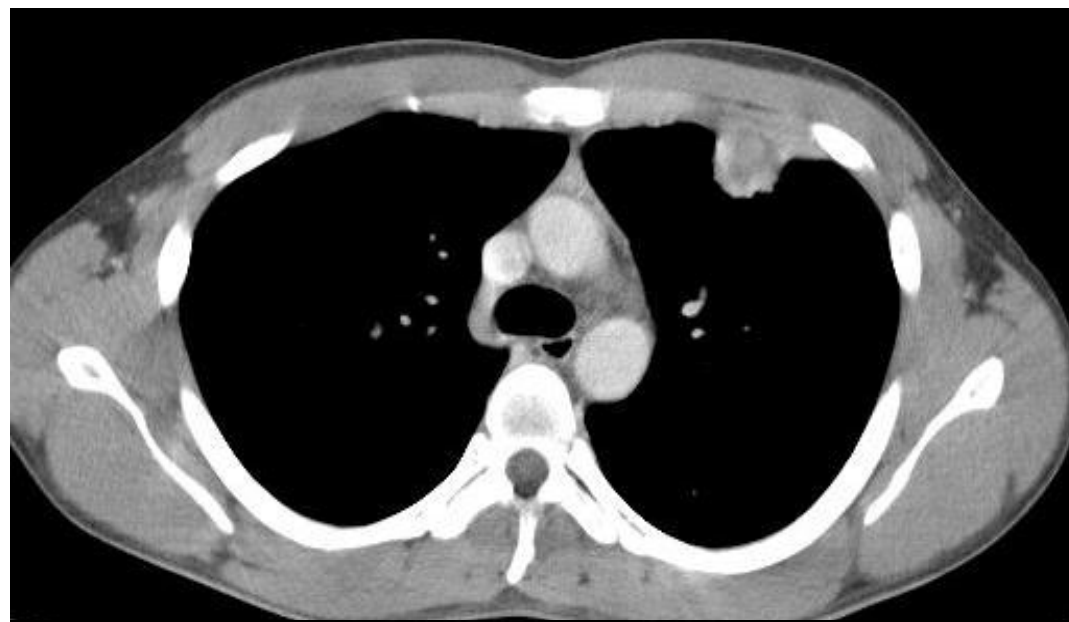
Initial



After 3 months Tx



After 4 months Tx



Paradoxical reaction

(3) 역설적 반응(paradoxical reaction)

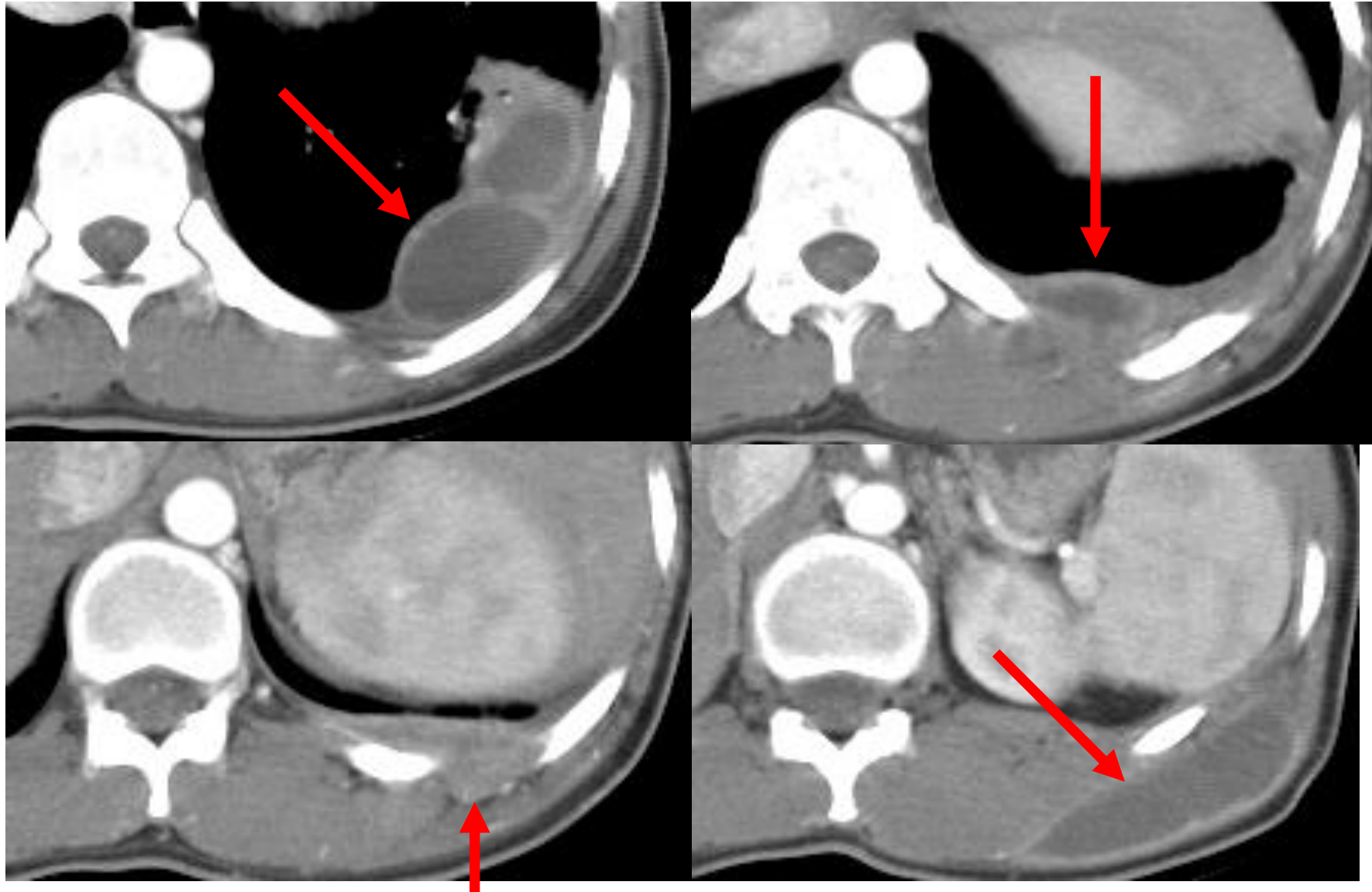
결핵치료를 하는 도중에 치료 실패가 아니면서 면역반응이 증가되어 일시적으로 임상증상 및 방사선 소견이 악화될 수 있는데 이를 역설적 반응이라고 부른다. 이러한 반응은 HIV 감염인에서 잘 나타나지만 HIV에 감염되지 않은 결핵환자에서도 관찰될 수 있다. 고열, 림프절염의 악화 또는 새로운 림프절염의 발생, 중추신경계 병변의 악화, 폐결핵 병변의 악화, 흉수의 증가 등이 일시적으로 나타나며 시간이 지나면 소실되며 치료 방침을 바꿀 필요가 없다. 환자가 항결핵제들을 적절히 복용하고 있고 추구 객담도말 및 배양검사에서 음성이고 다른 질환의 가능성이 거의 없을 경우 역설적 반응으로 잠정 진단하고 결핵 치료 처방을 변경하지 말고 임상경과를 관찰할 수 있다.¹ 최근에 시행된 458명의 흉막결핵을 대상으로 한 국내의 다기관 연구에 따르면 흉막결핵의 16%에서 역설적 반응이 나타나고 발생시기는 결핵 치료 2개월 이후이며 기존 흉수의 악화가 가장 흔한 형태인 것으로

Paradoxical subpleural nodules in TB pleurisy

- Development of new subpleural lung nodules, after 3-12 wks anti-TB medication, while pleural effusion shows responses to therapy
- Occurs in 81 (26%) of 349 pts
- Mechanism; immune reconstitution or hypersensitivity to tuberculo-protein
- Eventually nodules disappear /c continued therapy
- Should not be regarded as treatment failure

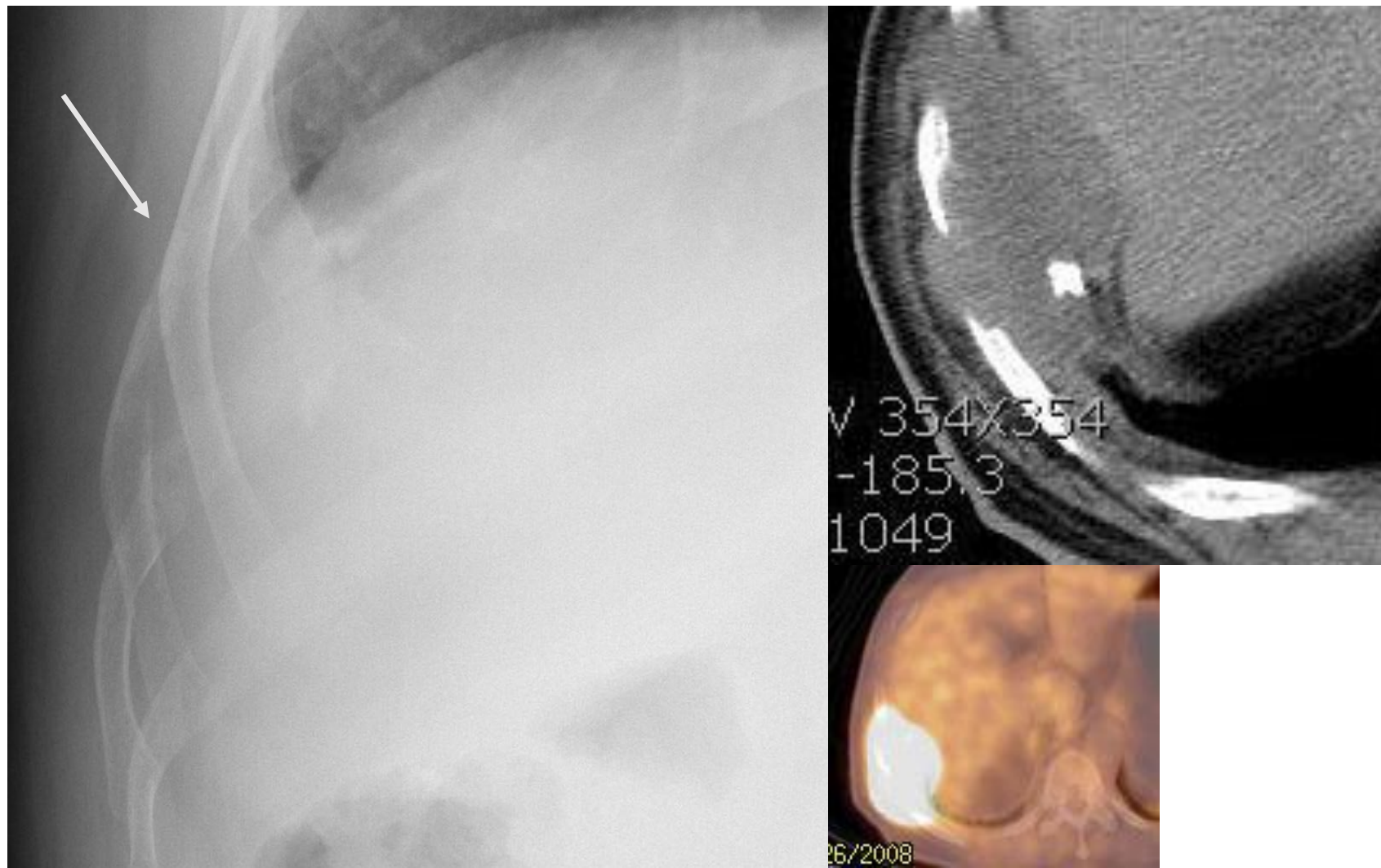
Case examples of TB-related pleural disease

Pleural and chest wall TB (Empyema necessitatis)



Results from leakage of TB empyema through parietal pleura & discharge of its contents into chest wall or pericardium, vertebral column or esophagus

1. Malignant lymphoma, squamous cell carcinoma, mesothelioma, MFH, liposarcoma
2. R/F: increased opacity in the thoracic cavity, soft tissue bulging & blurring of fat planes in chest wall, destruction of bone near the empyema, extensive medial deviation of calcified pleurae, enhanced soft tissue mass



3 months later

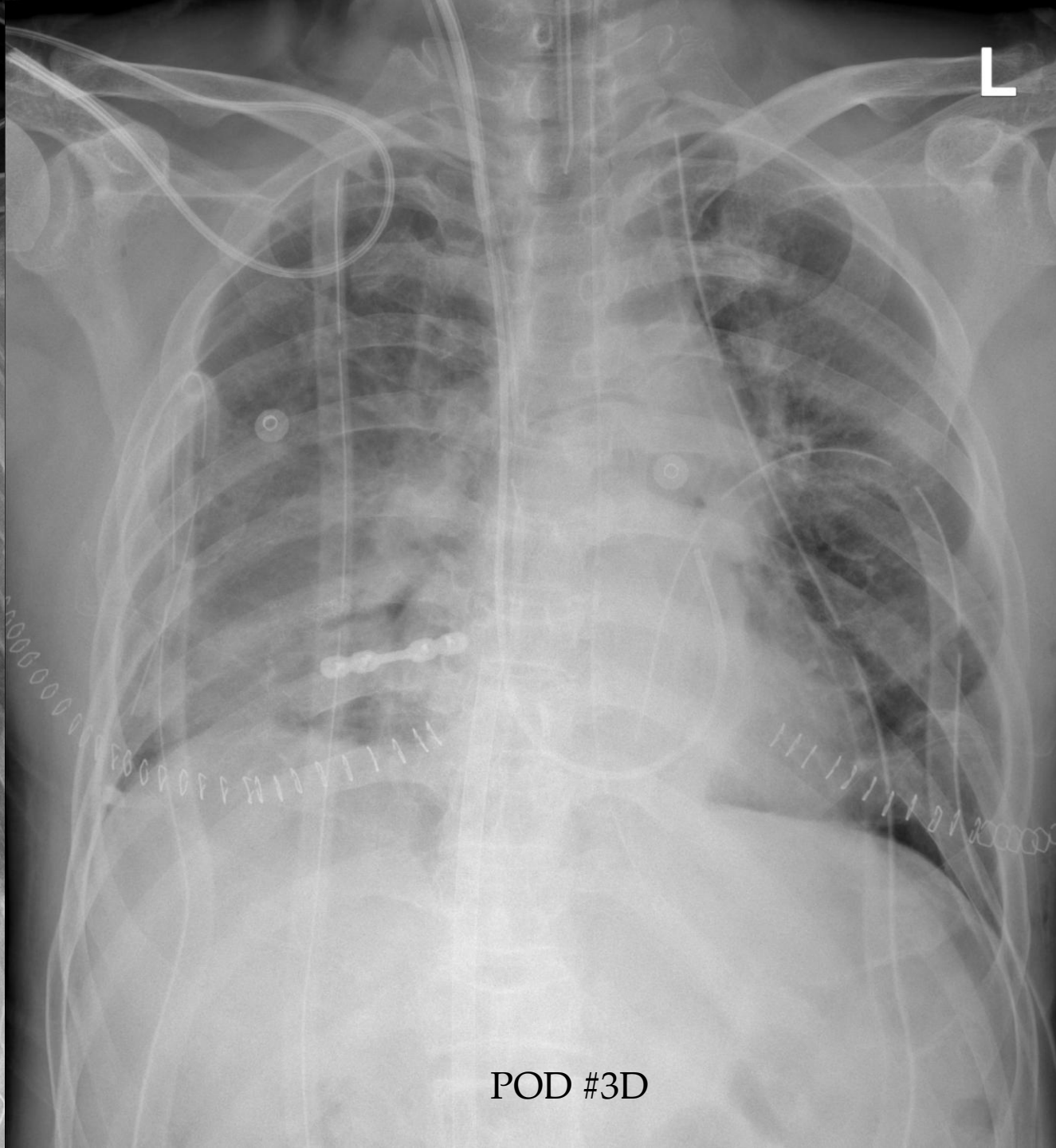
1. Air in the pleural space
2. A changing air-fluid level
3. Sites of communication between pleural space & airway or parenchyma



Case 4

- M57
- C.C: Dyspnea





Complications of lung transplantation

Table 1: Surgical, Medical, and Immunologic Complications of Lung Transplantation

Complication	Timing Following Surgery	Imaging Feature	Reference
Surgical complication			
Size mismatch	Immediate	Atelectasis Pleural effusions Pneumothorax	(5)
Vascular anastomosis			
Venous stenosis	Hours to days	Focal narrowing, poststenotic dilatation	(9)
Arterial stenosis	Days to weeks	Focal narrowing, poststenotic dilatation	
Pulmonary torsion	Hours to days	Swirling course of bronchi and vasculature	(7,8)
Bronchial dehiscence	Days to weeks	Bronchial wall irregularity and defects Persistent unexplained pneumothorax and pneumomediastinum	(14)
Bronchial stenosis	2–9 months	Luminal narrowing (with respect to normal bronchial diameter)	(19)
Hemothorax	Days to weeks	Fluid collections and pleural effusion with blood attenuation	(23)
Chest wall infection with mediastinal involvement	Days to weeks	Fat stranding Obliteration of fat planes Mediastinal fluid Mediastinal gas	(26)

Complications of lung transplantation

Medical complication			
Primary graft dysfunction	Hours to days	Ground-glass opacities Interlobular septal thickening Bronchial wall thickening	(36,37)
Pulmonary embolism	Anytime	Pulmonary artery filling defect Wedge-shape peripheral consolidation or ground-glass opacities	(24)
Tracheobronchomalacia	2–4 months	Luminal narrowing (during expiration compared with inspiration)	(14)
PTLD	1 month–anytime thereafter	Single or multiple homogeneously attenu- ating nodules Fluorodeoxyglucose PET/CT avidity	(46,49)
Primary disease recurrence	Months to years	Findings suggestive of original disease (ie, granulomas for sarcoid)	(50)
Lung cancer	Anytime	Growing nodules or masses	(56)

Complications of lung transplantation

Immunologic complication			
Hyperacute	Minutes to hours		
HLA-ABO incompatibility		Diffuse consolidative opacities Rapid progression is a distinguishing feature	(61,62)
Acute	Weeks to months		
ACR		Volume loss Pleural and septal thickening Pleural effusion Improvement with steroids	(72)
AMR		Ground-glass opacities Air trapping at expiratory thin-section CT	(72)
Chronic	Months to years		
BOS		Air trapping at expiratory thin-section CT	(82,85)
RAS		Acute phase: lower lobe–predominant ground-glass and consolidative opacities Subacute and chronic phase: upper lobe– predominant fibrosis	(76,87)
ARAD		Air trapping at expiratory thin-section CT Centrilobular nodules	(76,87)
AFOP		Ground-glass opacities and consolidation Lobar and bronchovascular distribution No reversed halo sign	(92)

Note.—ACR = acute cellular rejection, AFOP = acute fibrinous and organizing pneumonia, AMR = antibody-mediated rejection, ARAD = azithromycin-responsive allograft dysfunction, BOS = bronchiolitis obliterans syndrome, HLA = antihuman leukocyte antigen, PTLTD = posttransplant lymphoproliferative disease, RAS = restrictive allograft syndrome.

Surgical Cx: Size mismatch

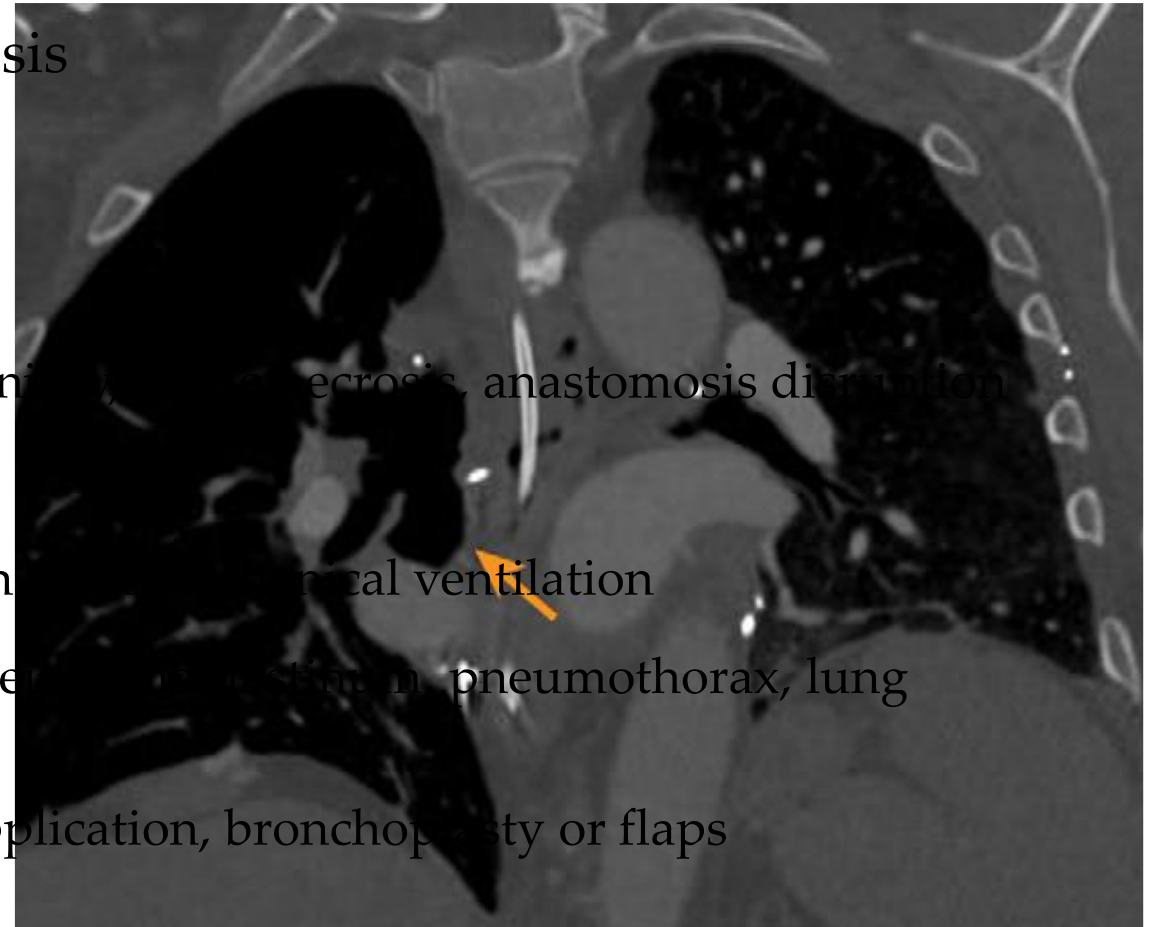
- Size mismatch btw donor & recipient lungs
- Potential cause of airway flow limitation
- Imaging findings
 - Large donor lung: atelectasis
 - Small donor lung: pleural effusion, pneumothorax
- Prevention: lobectomy (RML or lingula)

Surgical Cx: Vasculature anastomotic Cx

- Common in patients /c small chest cavities & fibrotic disease
- Pulmonary venous stenosis & thrombosis
 - 1~15%, in first 24~48 hours
 - Pulmonary edema & venous congestion
- Pulmonary arterial stenosis
 - 2%, within 2 weeks
 - Hypoxia, pulmonary HT
- Torsion of BV pedicle
 - Rare, 1~4 days
- Treatment
 - Depends on severity
 - Close monitoring~ surgical correction (angioplasty /c or /s stent placement)

Surgical Cx: Airway anastomotic Cx

- 20%, bronchial dehiscence, bronchial stenosis
- Bronchial dehiscence
 - 1~10%, 2~4 weeks after transplantation
 - Ischemia of donor bronchi -> bronchial wall infarction, necrosis, anastomosis disruption
 - Risk factors: infection, acute rejection
 - Dyspnea, persistent air leak, inability to wean from mechanical ventilation
 - Bronchial wall irregularity & wall defects, pneumonia, emphysema, pneumothorax, lung collapse
 - Airway stents, fibrin & cyanoacrylate glue application, bronchoplasty or flaps



Surgical Cx: Airway anastomotic Cx

- Bronchial stenosis
 - 4~24%%, 2~9 months after transplantation
 - Bronchial ischemia, primary graft dysfunction, acute rejection, anastomotic infection, anastomotic dehiscence
 - Dyspnea, cough, recurring postobstructive pneumonia, wheezing
 - Clinically significant stenosis > 50%
 - FU, balloon dilatation, stent placement, mitomycin injection, laser Tx, etc

Surgical Cx: Chest wall & pleural Cx

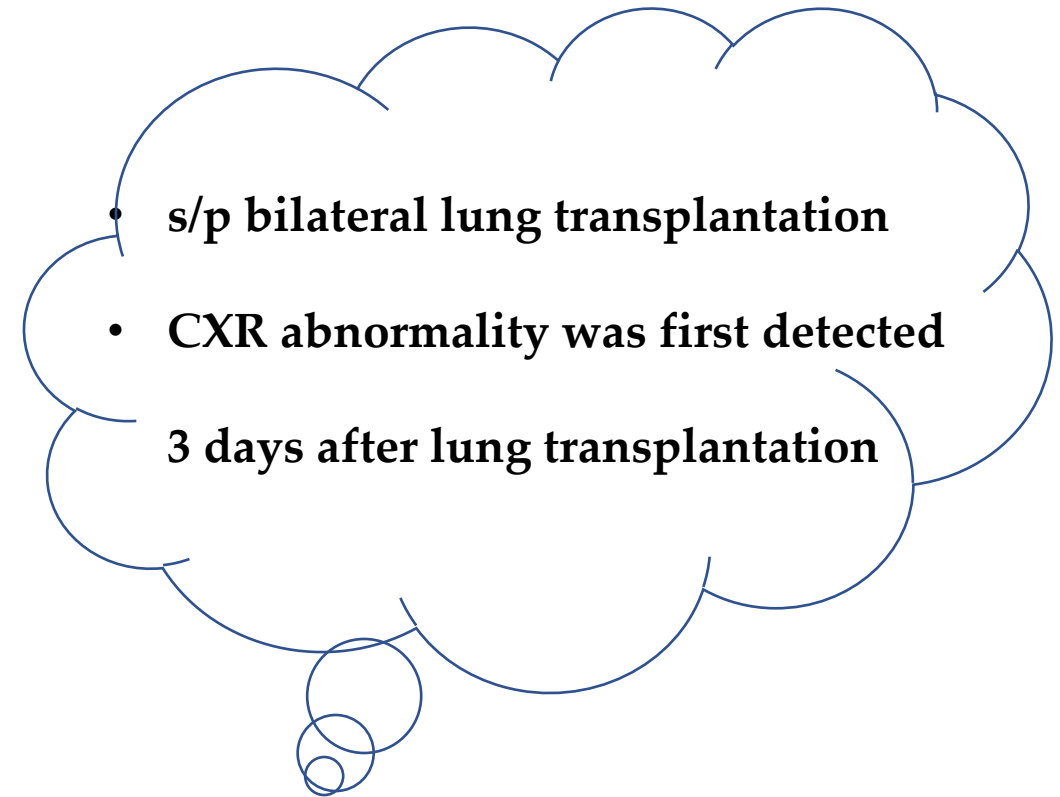
- Days to weeks
- Hemothorax (12~18%), extrathoracic hematoma, wound dehiscence (2%), wound infection, mediastinitis



POD #3D

The most likely diagnosis?

- Hemothorax
- Lobar torsion
- Bronchial dehiscence
- Pulmonary embolism
- Postoperative pneumonia



Medical Cx: PTE & DVT

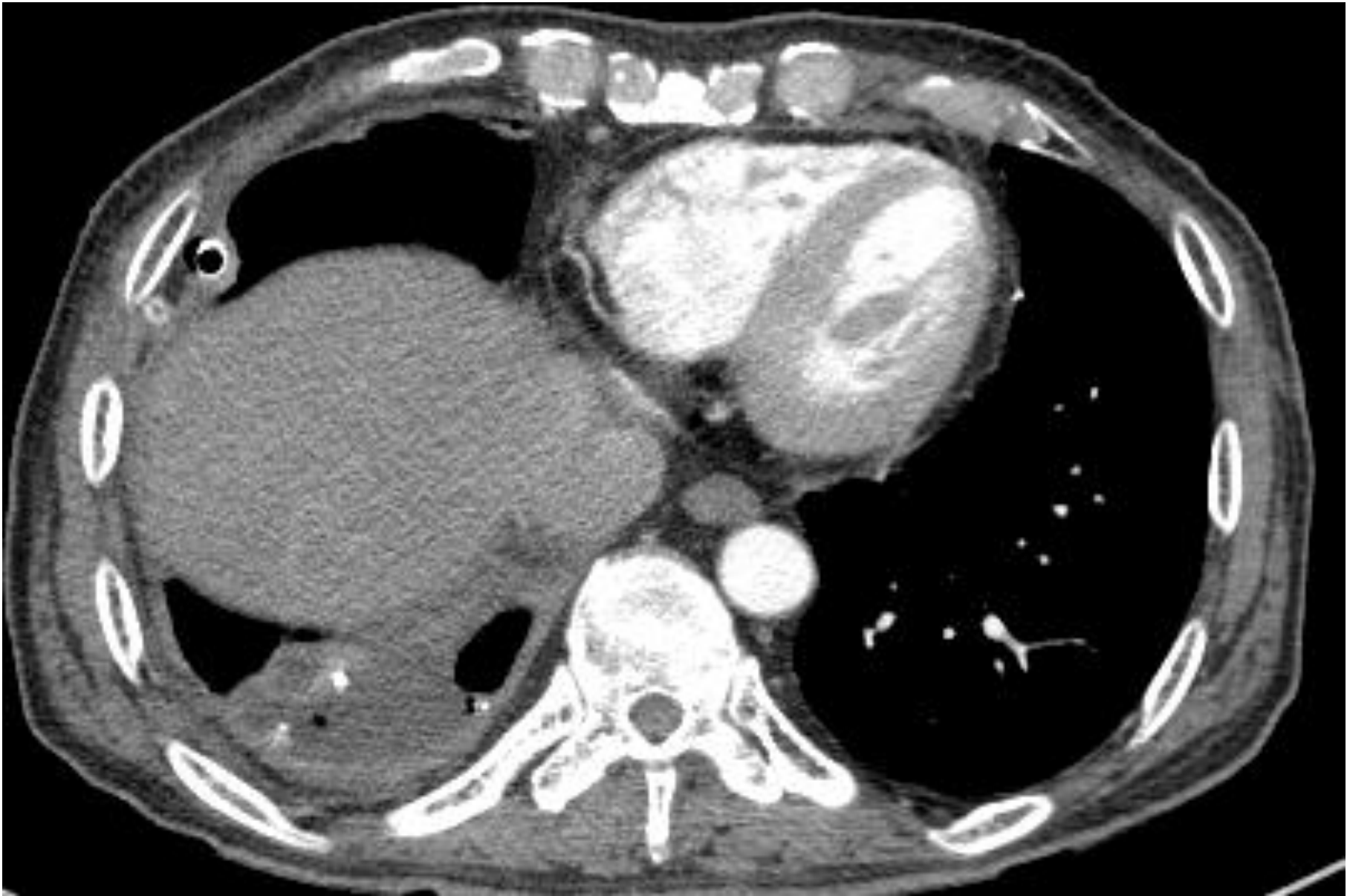
- Anytime, 8.6~26%
- Obesity, immobility, advanced age, indwelling catheter
- Increased risk of pulmonary infarction due to absent & underdeveloped collateral circulation



POD #5D, Thrombectomy & wedge resection



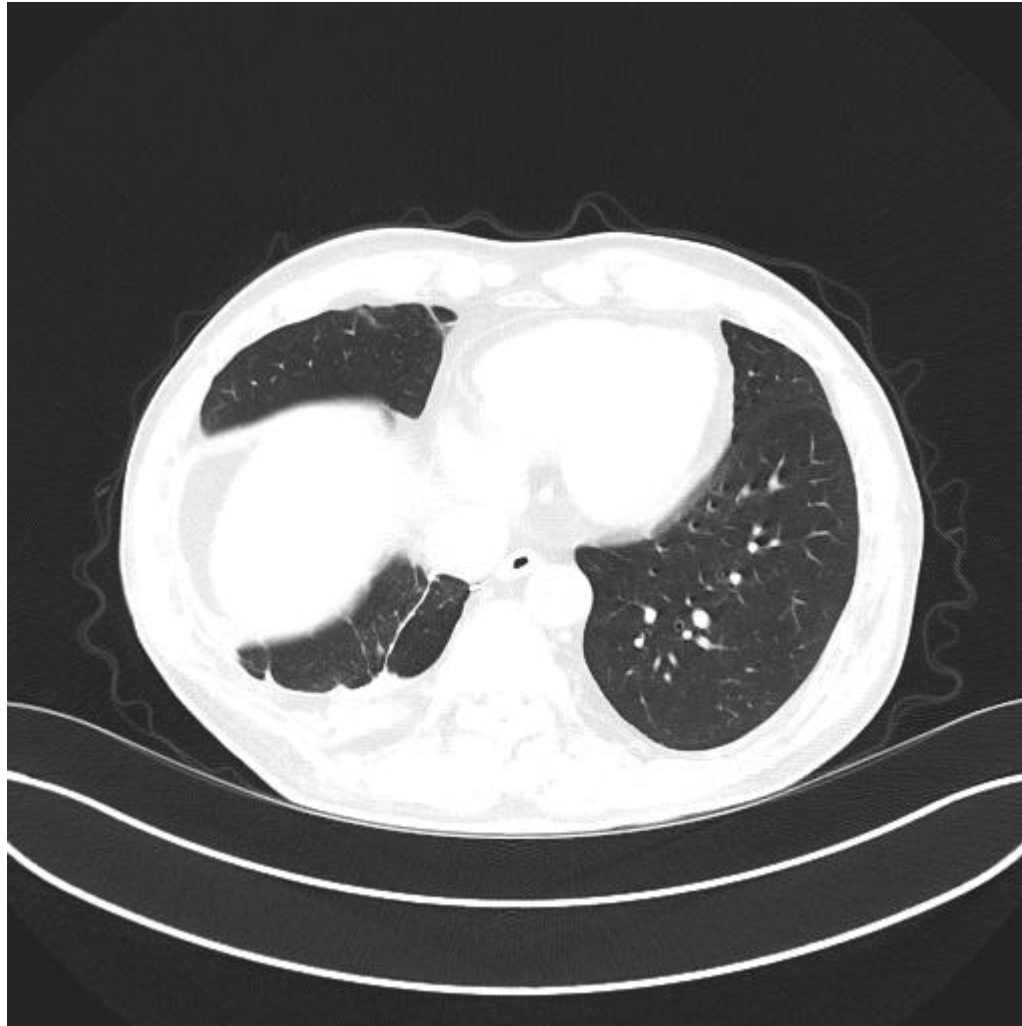
POD #30D



POD #40D



POD #90D



POD #3 years

Take-Home Messages

- Imaging should answer a clinical question, not simply describe an abnormality.
- Choose the appropriate imaging modality according to the suspected disease and clinical situation.
- Know the key imaging features that influence surgical decision-making—location, extent, invasion, resectability, and postoperative anatomy.
- Always compare with prior imaging and consider the postoperative timeline.
- Recognize critical postoperative complications early—lobar torsion, bronchial dehiscence, vascular complications, and other life-threatening conditions.
- Close communication between thoracic surgeons and radiologists improves diagnosis and patient management.