AMSER Case of the Month October 2023

69-year-old female presenting for lung cancer surveillance and cough

Jihoon Lim, MS4 – University of Central Florida College of Medicine

Wayne Dell, MD – University of Virginia, Department of Radiology

Michael Sneider, MD – University of Virginia, Department of Radiology

UNIVERSITY OF CENTRAL FLORIDA
College of Medicine

AMSER

Patient Presentation

- HPI: 69 y/o female with hx of T1cN2M0 stage IIIA sarcomatoid squamous cell carcinoma of lungs (Fig 1) with positive right hilar lymph nodes presents to her oncologist for lung cancer surveillance. She reports worsening cough and dyspnea.
- PMHx: CAD s/p CABG, HTN, HLD
- Social Hx: 60+ pack-year history

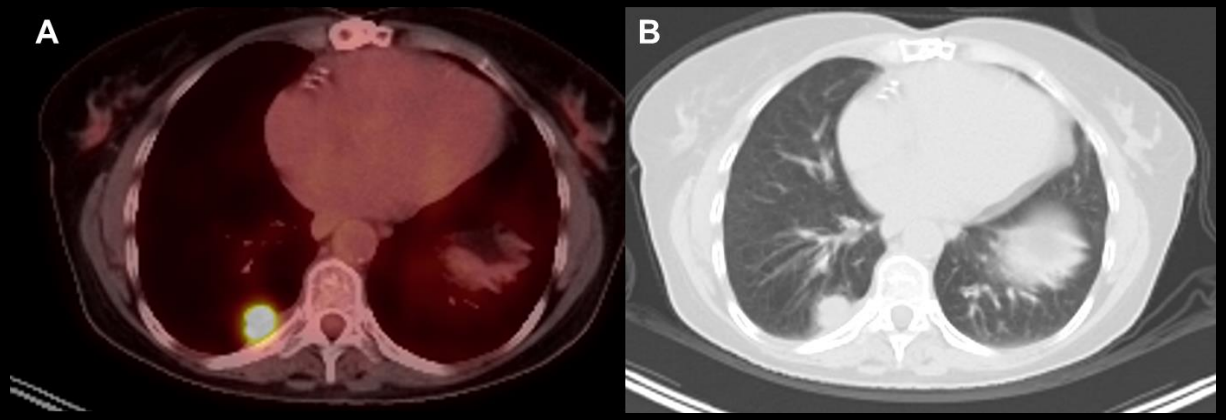


Figure 1. A) Axial FDG PET/CT fusion image at initial presentation demonstrates hypermetabolic right lower lobe nodule. B) Axial NECT lung windows demonstrate solid nodule in area of radiotracer uptake

- Treatment history: Initial treatment with concurrent chemotherapy (carboplatin/paclitaxel) and radiation therapy (66 Gy / 33 fractions) in 2019, followed by durvalumab maintenance. Recurrence in 2020 treated with gemcitabine 2020-2022. Now on surveillance without therapy.

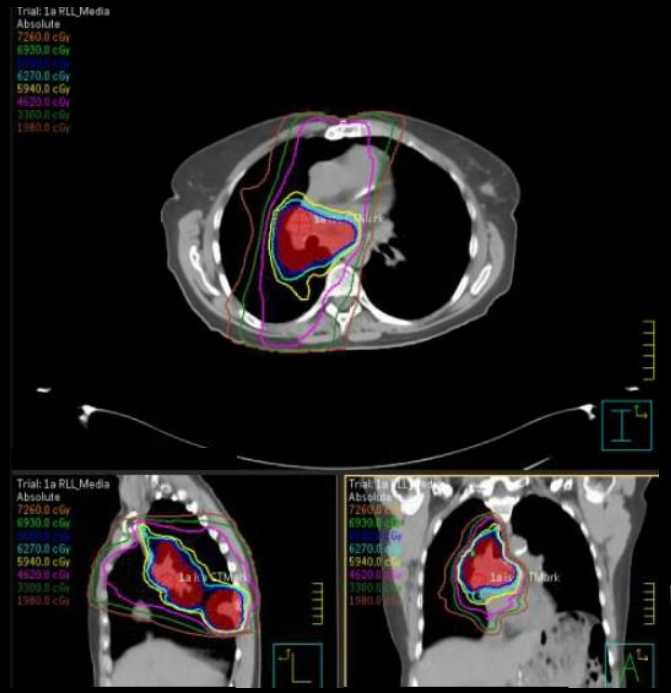


Figure 2. Intensity-modulated radiation therapy plan including right hilar lymph nodes.

ACR Appropriateness Criteria

Variant 1: **Noninvasive initial clinical staging of non–small-cell lung carcinoma.**

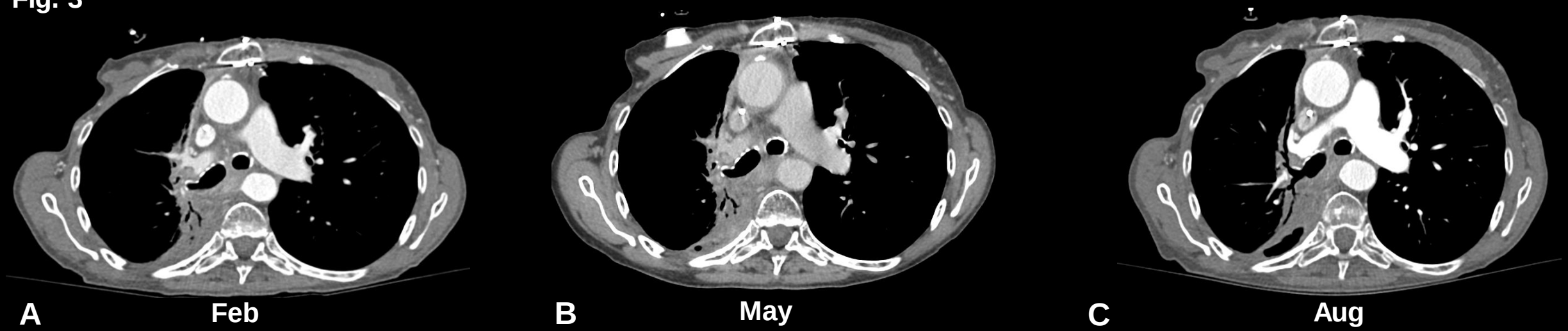
Procedure	Appropriateness Category	Relative Radiation Level
CT chest with IV contrast	Usually Appropriate	☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Appropriate	☢☢☢☢
MRI head without and with IV contrast	Usually Appropriate	O
CT chest without IV contrast	Usually Appropriate	☢☢☢
CT abdomen and pelvis with IV contrast	May Be Appropriate	☢☢☢
CT head with IV contrast	May Be Appropriate	☢☢☢
CT head without and with IV contrast	May Be Appropriate	☢☢☢
MRI abdomen without and with IV contrast	May Be Appropriate	O
MRI chest without and with IV contrast	May Be Appropriate	O
MRI head without IV contrast	May Be Appropriate	O
Bone scan whole body	May Be Appropriate	☢☢☢
CT abdomen and pelvis without and with IV contrast	May Be Appropriate	☢☢☢☢
CT abdomen and pelvis without IV contrast	May Be Appropriate	☢☢☢
MRI abdomen without IV contrast	May Be Appropriate	O
CT head without IV contrast	Usually Not Appropriate	☢☢☢
MRI chest without IV contrast	Usually Not Appropriate	O
CT chest without and with IV contrast	Usually Not Appropriate	☢☢☢
Radiography chest	Usually Not Appropriate	☢

This imaging modality was ordered by her oncologist

AMSER

Findings - Unlabeled

Fig. 3



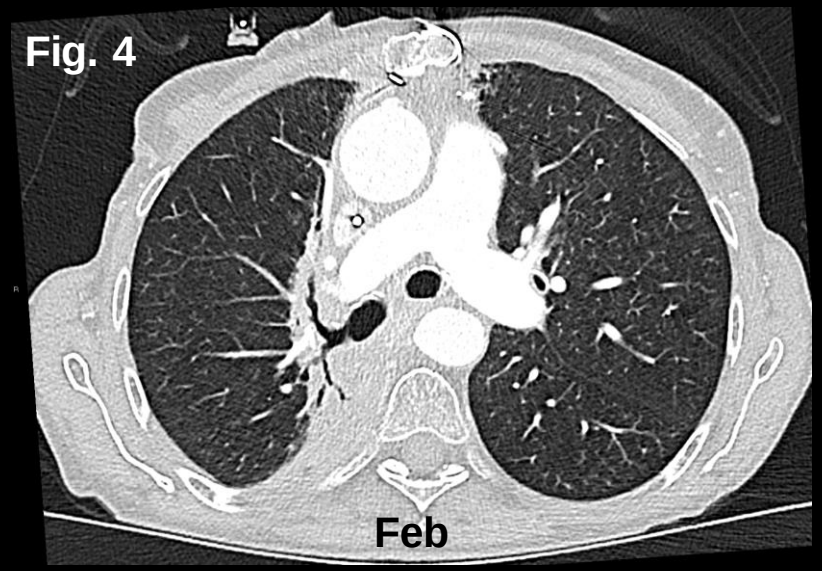


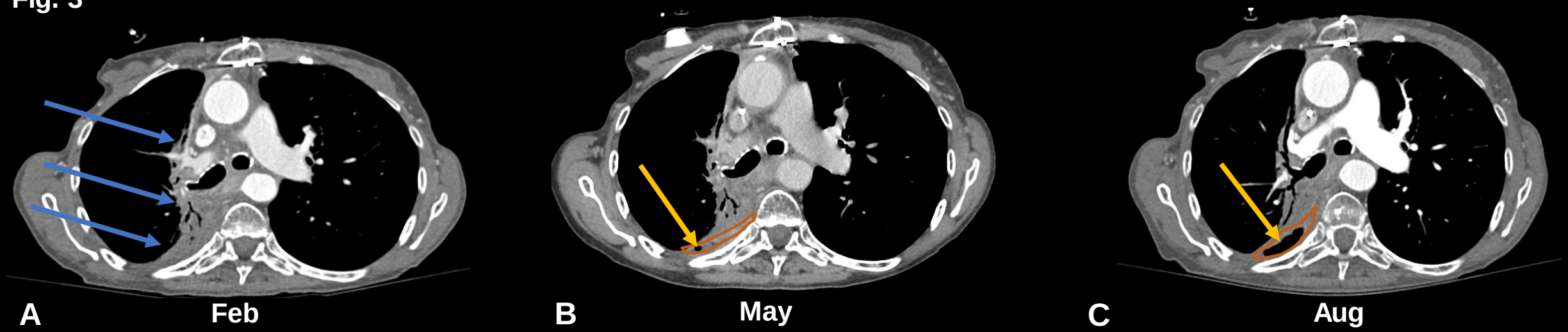
Fig. 3 – CT Chest with IV Contrast – Soft Tissue Kernel, Mediastinal Window

Fig. 4 – CT Chest with IV Contrast – Lung Kernel, Lung Window

AMSER

Findings - Labeled

Fig. 3



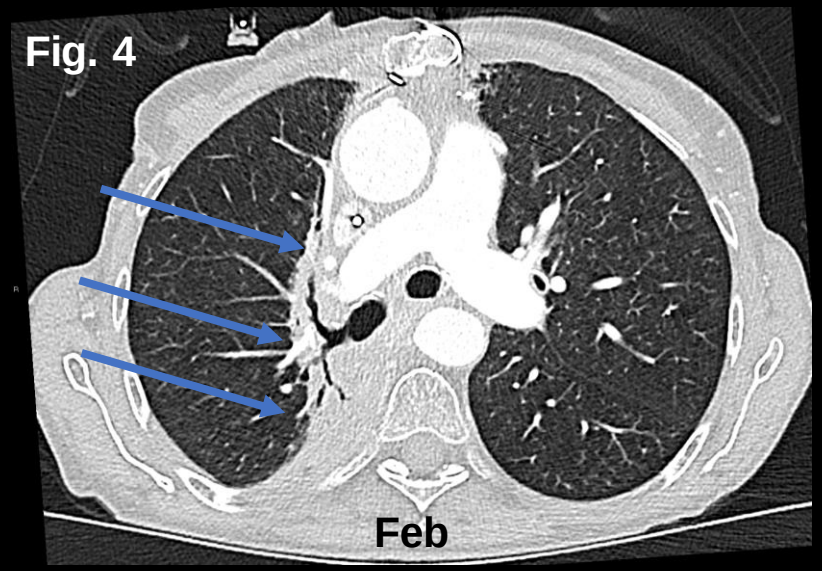


Fig. 3 – CT Chest with IV Contrast – Soft Tissue Kernel, Mediastinal Window

A) Atelectasis and pleural thickening in the prior radiation field consistent with **radiation fibrosis**.
B) Development of small **pleural effusion** with focus of **air** (hydropneumothorax)
C) Progressive increased volume of **air** in the pleural effusion

Fig. 4 – CT Chest with IV Contrast – Lung Kernel, Lung Window more clearly demonstrates the **atelectatic and fibrotic lung**

AMSER

Differential Diagnosis

- Empyema with gas-forming infection
- Pleural Fistula (most often bronchopleural)
- Iatrogenic (thoracentesis)
- Spontaneous pneumothorax (e.g. bleb rupture)

Additional Findings:

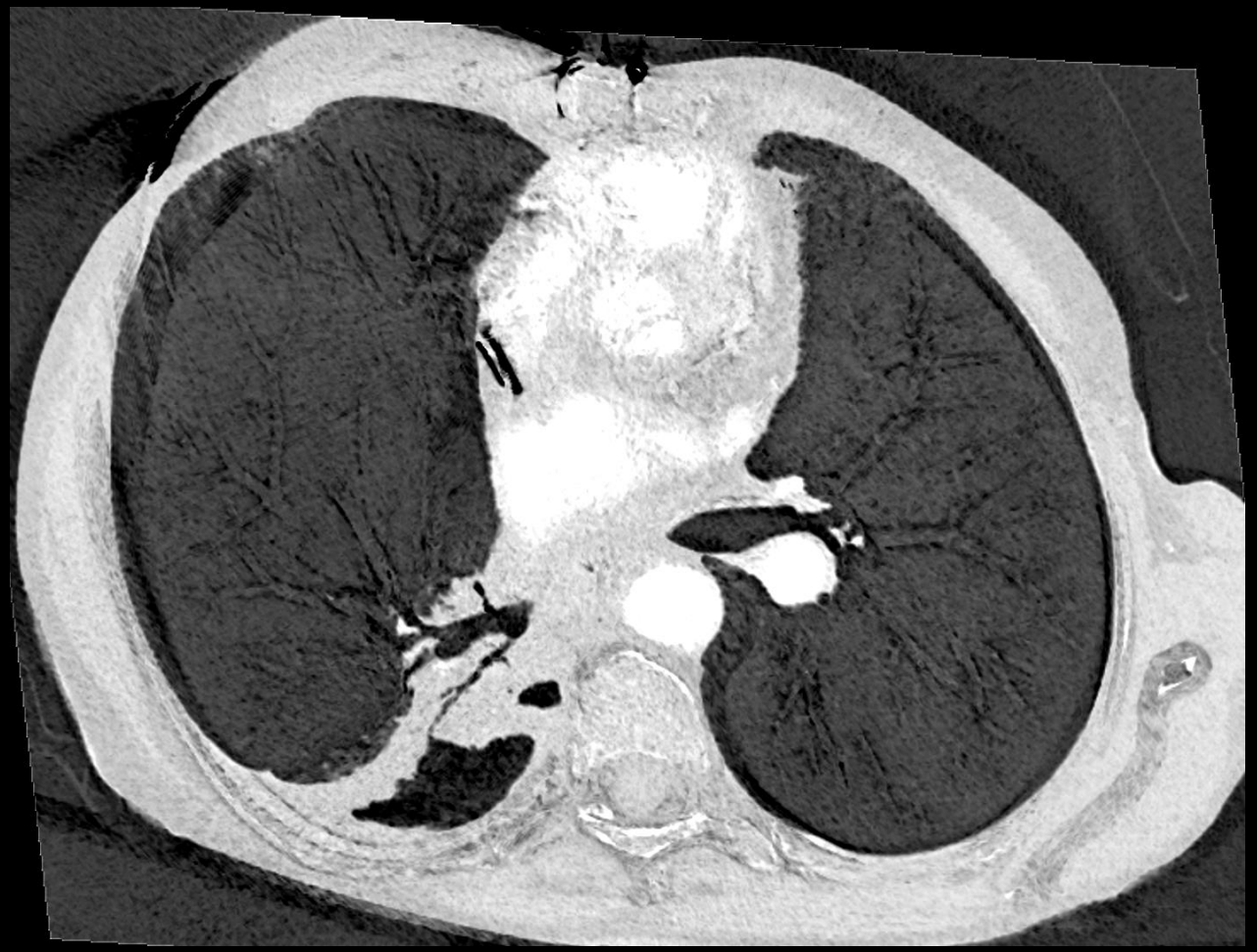


Fig. 5 - Minimal Intensity Projection (MinIP) – CT with IV Contrast Oblique Axial

Final Diagnosis: Bronchopleural Fistula

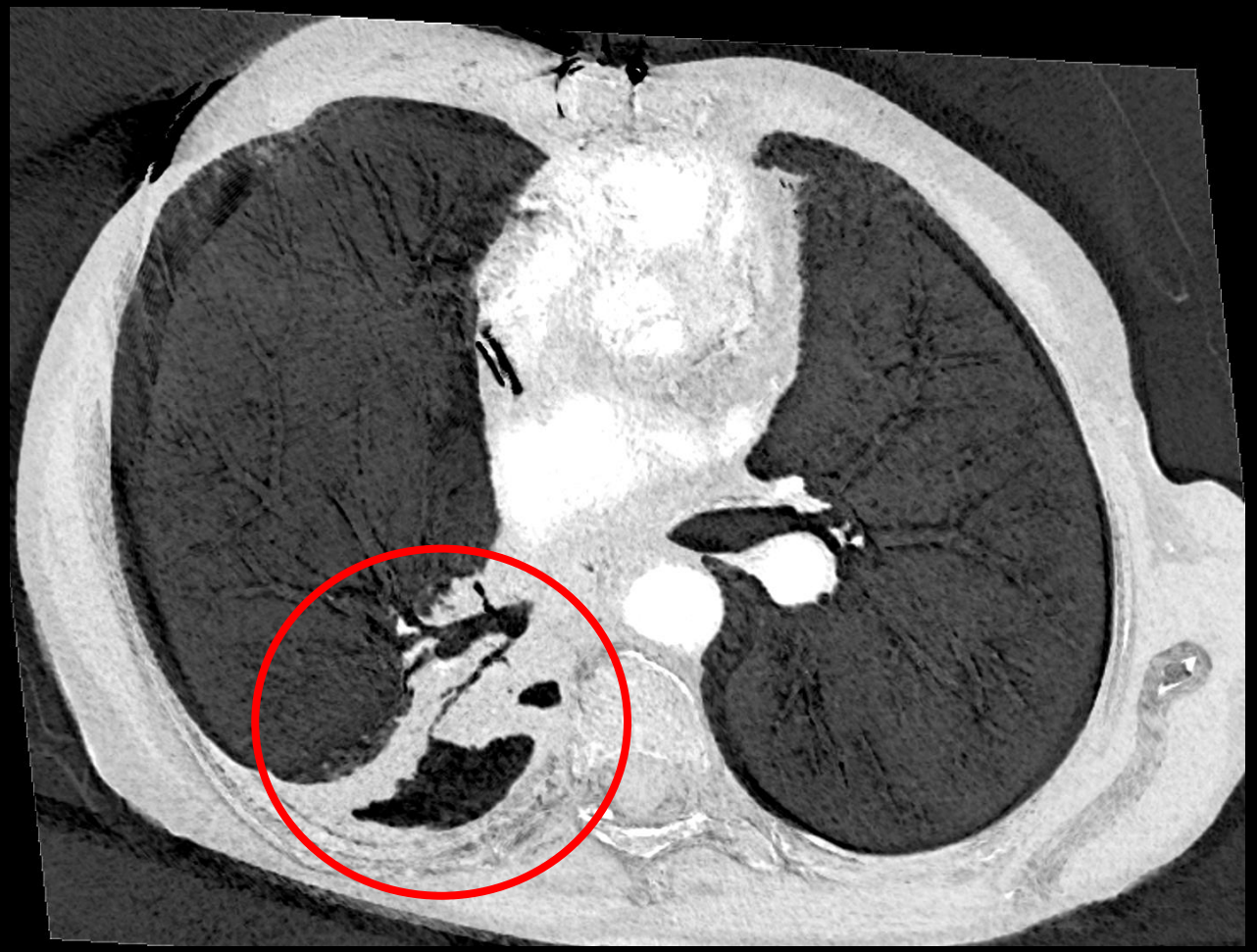


Fig. 5 – Minimal Intensity Projection (MinIP) – CT with IV Contrast Oblique Axial view demonstrates a fistulous connection between right lower lobe posterior basal segmental bronchus and the pleural gas collection.

Case Discussion

Pleural Anatomy

- Potential space containing 5-10mL of fluid between **visceral** & **parietal** pleurae[1]
- Negative pressure within the pleural space and proximity to multiple organs due to large surface area → **vulnerable to fistulas[2]**

Fistula Pathogenesis

- Damage to pleura (infection, trauma, radiation) + impaired healing → fistula formation
- Pressure difference between communicating entities → maintains fistula patency[2]

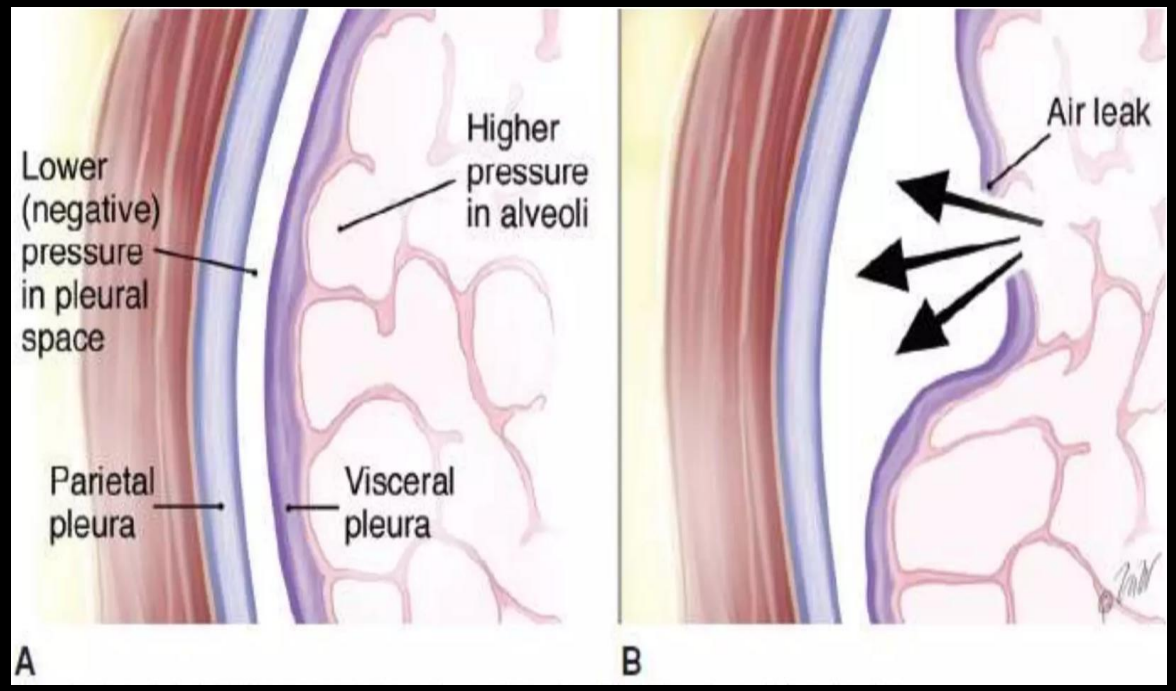


Fig. 6 – (A) Diagram of pleural space demonstrates negative pressure in pleural space making it (B) vulnerable for fistula formation.[3]

Case Discussion

Bronchopleural fistula (BPF) is a tract between the pleural space and main stem, lobar, or segmental bronchus.[2]

Etiology:

- ***Surgical resection*** (most common)
  - 4.5%-7% post-pneumonectomy, 0.5-1% post-lobectomy[5,6]
- Trauma
- Iatrogenic (e.g., ventilation, chest tube, chemotherapy, or ***radiation therapy***)
- Necrotizing infection[2]

Clinical Features

- Range from acute symptoms of tension pneumothorax to subacute complications such as empyema

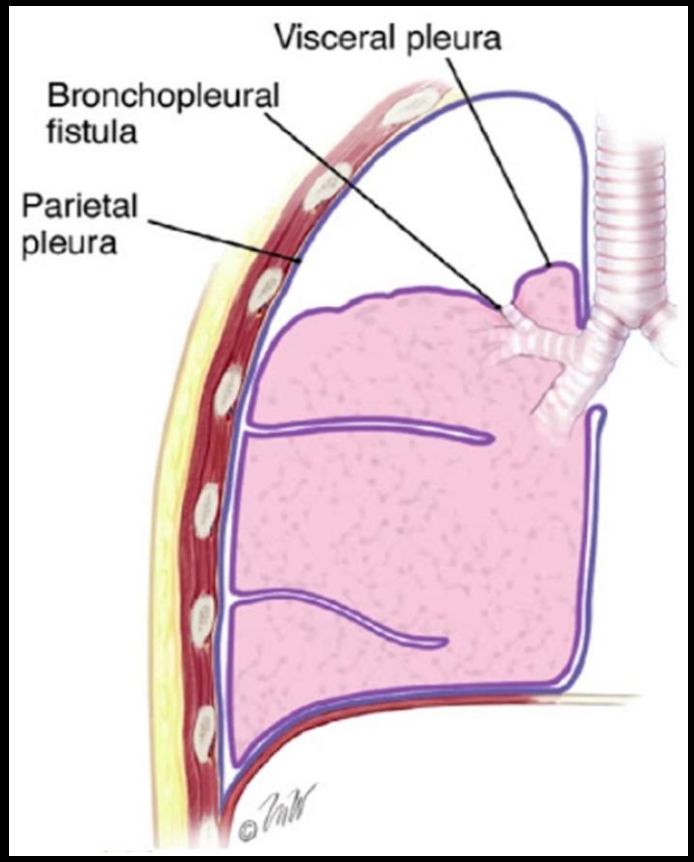


Fig. 7 – Bronchopleural fistula is a communication between the pleural space and bronchial tree. [3]

Case Discussion

Diagnosis & Imaging Features

Plain Radiograph

- Failure of post-pneumonectomy space to fill with fluid
- ≥2.0 cm drop in the air-fluid level
- Persistent or progressive ipsilateral pneumothorax

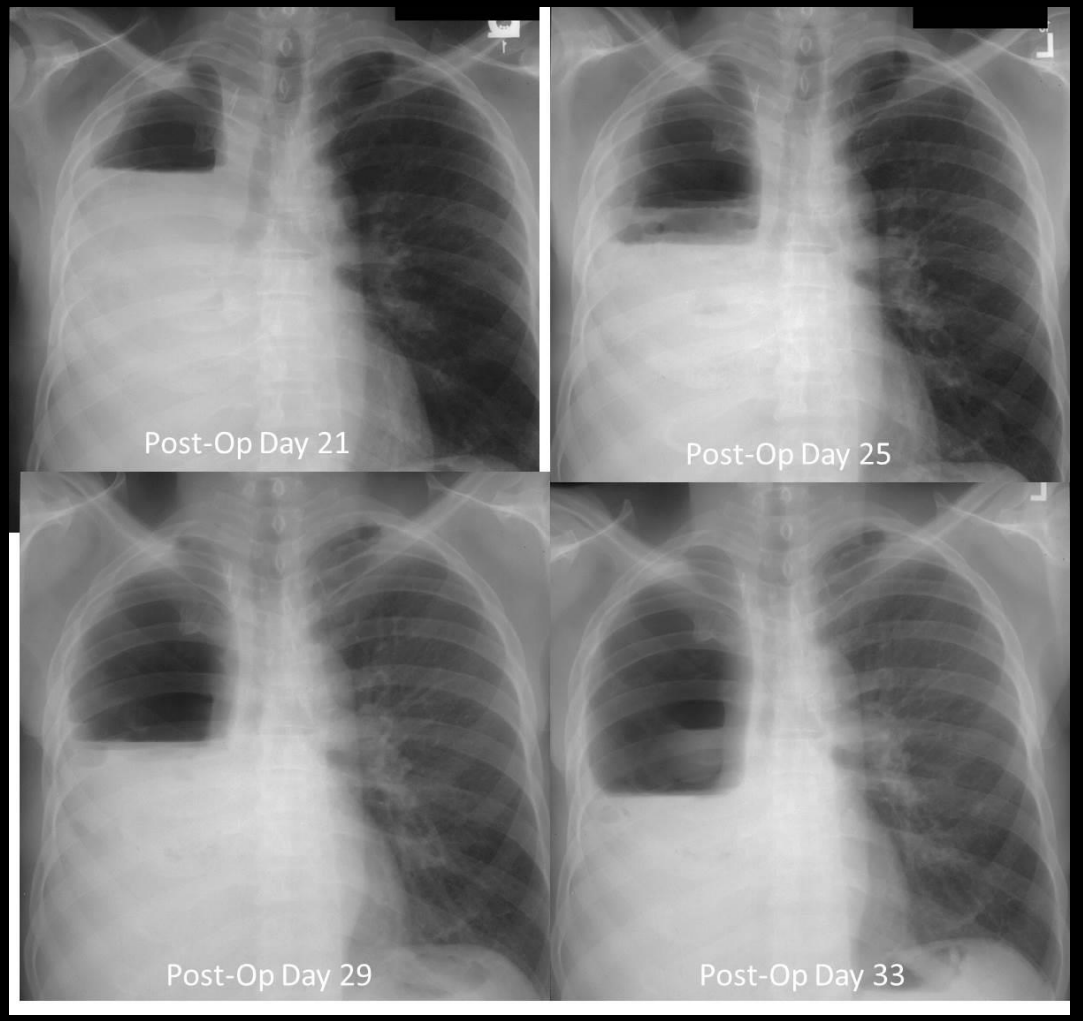


Fig. 8 – Serial post-right pneumonectomy chest radiographs show progressive drop in air-fluid level.[7]

Case Discussion

Diagnosis & Imaging Features

CT with IV Contrast – modality of choice[4]

- Pneumothorax or hydropneumothorax
- Pneumomediastinum
- Actual fistulous communication

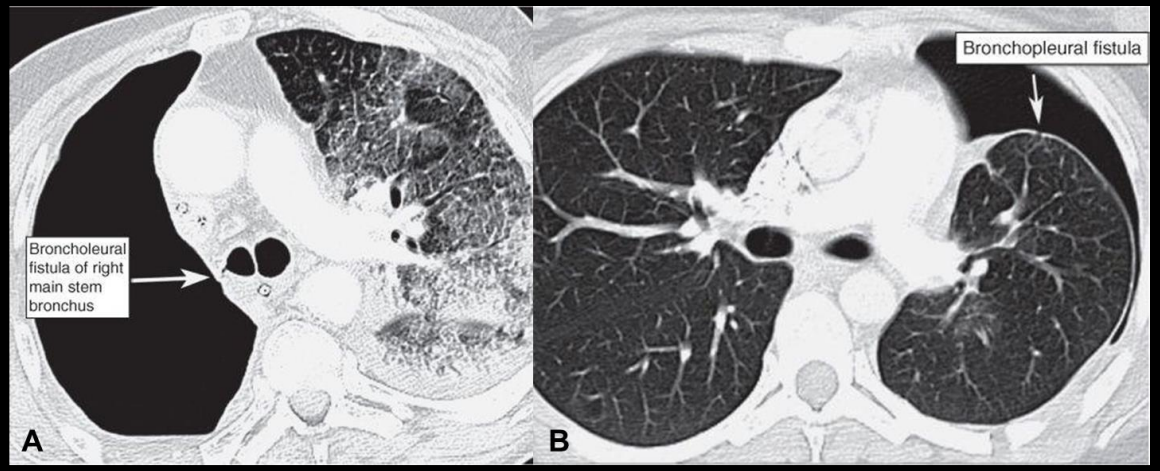


Fig. 9 – (A) Central BPF involving the right mainstem bronchus. (B) Peripheral BPF involving the distal subsegmental airway in the left lung.[8]

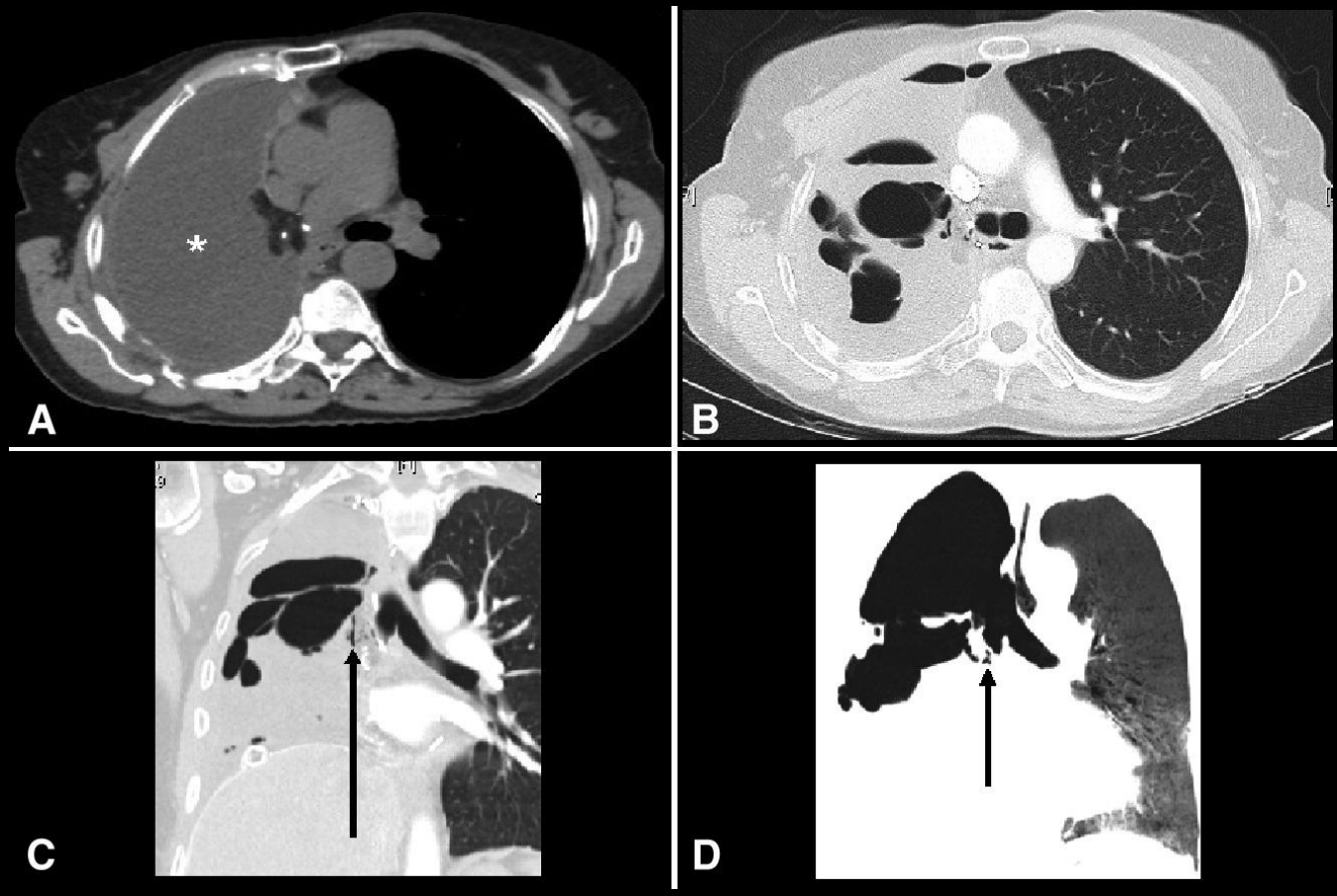


Fig. 10 – (A) Completely fluid-filled pneumonectomy space one year after pneumonectomy (asterisk). (B) New air-fluid levels in the pneumonectomy space in the same patient. (C) A coronal multiplanar reformatted image depicting the fistulous tract as suggested by air bubbles adjacent to the bronchial stump (black arrow) that was then confirmed on (D) the minimum-intensity projection (black arrow).[9]

Case Discussion

Management: Size, Impaired healing, Diversion

- Supportive care: Antibiotics, chest tube, underlying conditions
- Bronchoscopy: stent, occlusive material, Amplatzer device
- Surgical repair: membranous patch or tissue flaps[2,5]

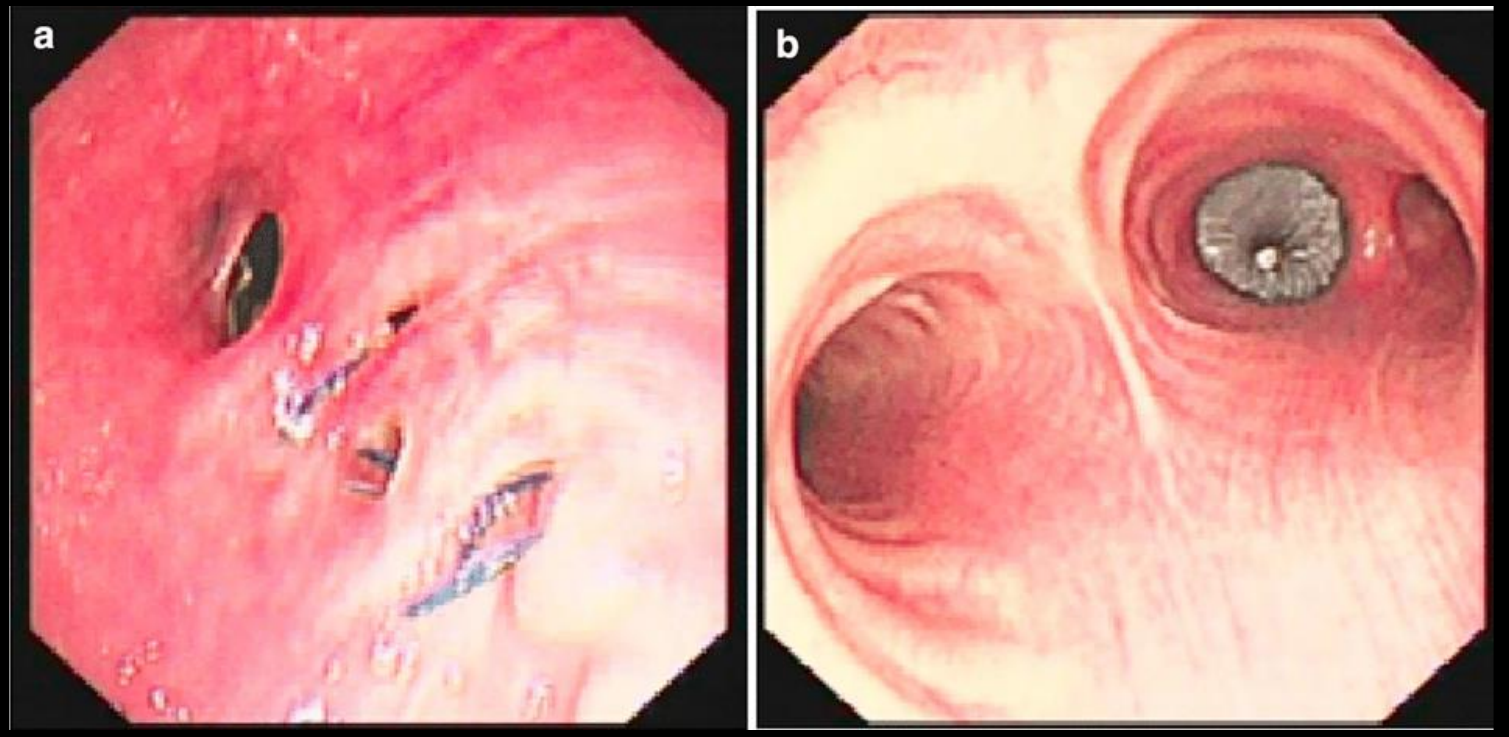


Fig. 11 – (A) Bronchopleural fistula (A) before and (B) after Amplatzer device implantation.[10]

References:

1. Yalcin NG, Choong CKC, Eizenberg N. Anatomy and pathophysiology of the pleura and pleural space. Thorac Surg Clin 2013;23(1):1–10, v.
2. Kapoor H, Gulati V, Gulati A, Donuru A, Parekh M. Comprehensive Imaging Review of Pleural Fistulas from Diagnosis to Management. Radiographics. 2022;42(7):1940-1955. doi:10.1148/rg.220083
3. Sugarbaker D, Bueno R, Colson Y, Jaklisch M, Krasna S, Mentzer S, Williams M, Adams A. *Adult Chest Surgery,* 2nd Edition: www.acccesssurgery.com
4. Stern E, Sun H, Haramati L. Peripheral Bronchopleural Fistulas: CT Imaging Features. AJR Am J Roentgenol. 1996;167(1):117-20. doi:10.2214/ajr.167.1.8659354
5. Lois M, Noppen M. Bronchopleural fistulas: an overview of the problem with special focus on endoscopic management. Chest 2005;128(6):3955–3965.
6. Asamura H, Naruke T, Tsuchiya R, Goya T, Kondo H, Suemasu K. Bronchopleural fistulas associated with lung cancer operations: univariate and multivariate analysis of risk factors, management, and outcome. J Thorac Cardiovasc Surg 1992;104(5):1456–1464.
7. VCU Department of Radiology. Bronchopleural fistula and bronchial stump dehiscence images, diagnosis, treatment options, answer review - Thoracic Imaging. (n.d.). https://www.vcuthoracicimaging.vcu.edu
8. Truong, A., Truong, D.-T., Thaker, D., Riedel, B. Bronchopleural fistula: Anesthetic Management. Anesthesia Key. 2016
9. Gaur P, Dunne R, Colson YL, Gill RR. Bronchopleural fistula and the role of contemporary imaging. J Thorac Cardiovasc Surg. 2014;148(1):341-347. doi:10.1016/j.jtcvs.2013.11.009
10. Zhang J, Hu H, Xu L, et al. Innovation method for Amplatzer device implantation in patients with bronchopleural fistulas. BMC Pulmonary Medicine. 2021;21(1).

AMSER