



# Salvage Glue Embolization of Iatrogenic Alveolar-Pleural Fistula Following Lung Ablation

Yan-Lin Li<sup>1</sup> Emma Preston<sup>1</sup> Paul C. Lyon<sup>1</sup> Ewan M. Anderson<sup>1</sup>

<sup>1</sup>Department of Interventional Radiology, Oxford University Hospitals NHS foundation Trust, Oxford, United Kingdom

J Clin Interv Radiol ISVIR 2024;8:181–183.

Address for correspondence Yan-Lin Li, MBBS, MSc, EBIR, FRCR, FHKCR, FHKAM, Department of Interventional Radiology, Oxford University Hospitals NHS foundation Trust, Oxford, United Kingdom (e-mail: yan-lin.li@ouh.nhs.uk).

## Abstract

### Keywords

- interventional oncology
- lung ablation
- alveolar-pleural fistula

A 76-year-old smoker was referred to the interventional radiology team for thermal ablation of a solitary colorectal pulmonary metastasis. He underwent percutaneous microwave ablation that was complicated with extensive surgical emphysema due to an alveolar-pleural fistula. Percutaneous computed tomography (CT) guided glue embolization was performed resulting in fistula occlusion and resolution of surgical emphysema.

## Case Report

A 76-year-old gentleman had a 3-year history of stage 3 colorectal cancer, having undergone an emergency Hartmann resection followed by four cycles of adjuvant chemotherapy. He developed liver metastases that were treated with thermal ablation, 2 years after primary resection.

He was re-referred for ablation of an enlarging 25-mm left upper lobe subpleural nodule as a solitary residual metastatic focus. He had extensive background centrilobular emphysema. There was a large subpleural bleb adjacent to the tumor (► **Fig. 1**). After a multidisciplinary discussion, the patient agreed to ablation as treatment. The procedure was performed in a lateral decubitus position under general anesthesia maintained on high-frequency jet ventilation. A 17-gauge microwave applicator (Solero, Angiodynamics, Latham, NY) was inserted under computed tomography (CT) guidance via a direct lateral approach, followed by a 4-minute ablation at 140 W. No needle tract coagulation or plugging was performed. Immediate postprocedural CT was unremarkable with the needle tract demonstrated within the contracted, ablated tumor without pneumothorax or surgical emphysema.

While recovering, he developed increasing left chest wall swelling and crepitus around 2 hours postablation. Chest radiograph and then repeat same-day thorax CT showed

new left surgical emphysema and pneumomediastinum. There was no convincing direct connection between the bronchioles and the pleural and extrapleural spaces. A radiological diagnosis of an alveolar-pleural fistula (APF) decompressing through the ablation needle tract into the chest wall was made (► **Fig. 1**).

A decision was made to attempt embolization of the fistula tract percutaneously using surgical glue. Under local anesthesia and in the right lateral decubitus position, an 18-gauge needle was advanced to the pleural space overlying the APF under CT fluoroscopic guidance. After 5% dextrose flush, 0.87 mL of glue was injected starting at the pleural surface and ending at the deep fascial space under gradual needle withdrawal. The solution consisted of a 1:3 mixture of n-butyl-2-cyanoacrylate (NBCA; Histoacryl, B Braun, Germany) and Lipiodol for visualization (Guerbet, Aulnay-sous-Bois, France; ► **Fig. 2**).

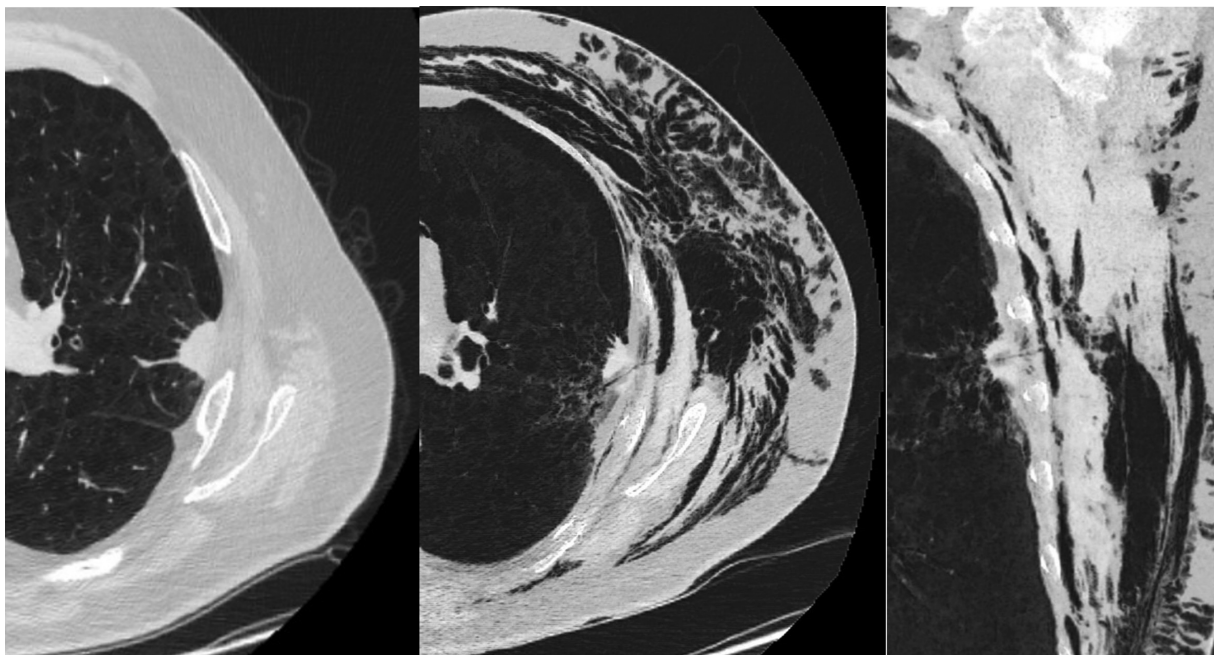
The patient improved significantly following the procedure with resolving pneumomediastinum clinically and on chest radiograph performed at 12 hours (► **Fig. 3**). He was observed on a specialist respiratory ward and discharged on day 4 postablation. Follow-up CT at 1 month postoperation showed complete resolution of the surgical emphysema and pneumomediastinum with maintained local disease control.

article published online  
June 27, 2024

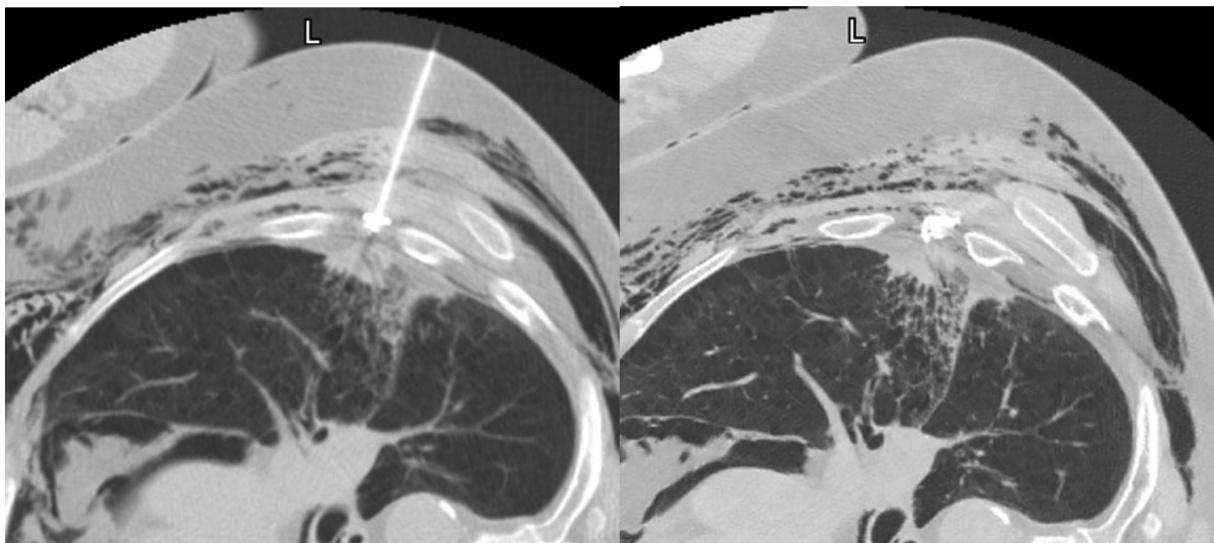
DOI <https://doi.org/10.1055/s-0044-1787079>.  
ISSN 2457-0214.

© 2024. The Author(s).

This is an open access article published by Thieme under the terms of the Creative Commons Attribution License, permitting unrestricted use, distribution, and reproduction so long as the original work is properly cited. (<https://creativecommons.org/licenses/by/4.0/>)  
Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India



**Fig. 1** Index lesion at the left upper lobe subpleural aspect before (left) and 2 hours postablation in axial (middle) and coronal (left) projection.



**Fig. 2** Intraoperative axial computed tomography (CT) image demonstrating the needle position at injection (left) and glue cast (right).

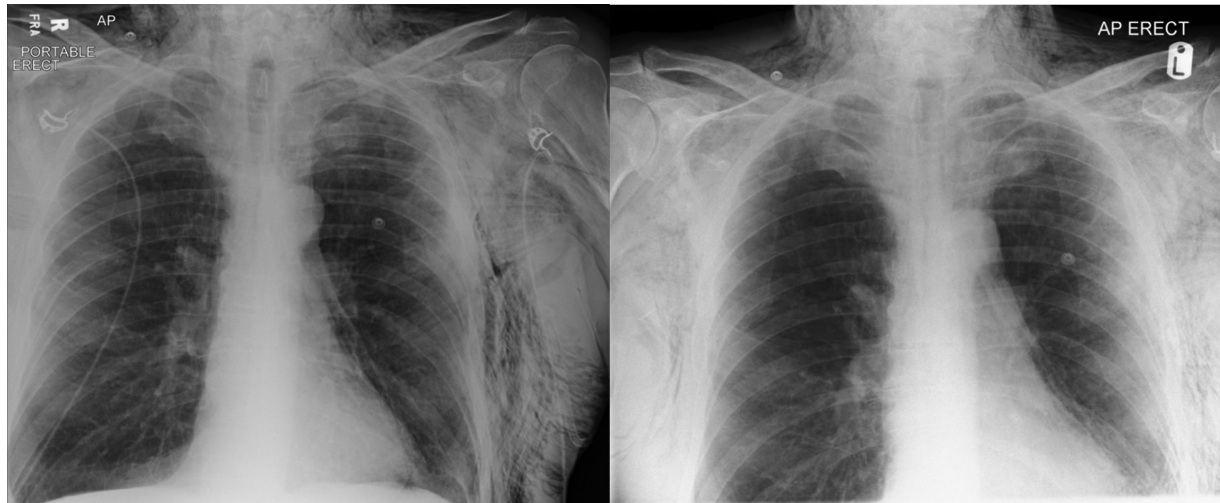
## Discussion

Percutaneous thermal ablation is an effective therapy for pulmonary metastases, achieving local tumor control in more than 80% of patients at 4 years.<sup>1</sup> It is generally a safe procedure with relatively low rate of complications.<sup>2</sup>

Bronchopulmonary fistula (BPF) and alveolar-pulmonary fistula (APF) are rare complications occurring in less than 1% of cases.<sup>3</sup> In BPF, there is a visible communication between a bronchiole and the pleura, while this is not visible in APF. Traditionally, BPFs are tackled by surgery or bronchoscopic

valve placement. Nontargeted chemical pleurodesis or fibrin spray can be performed for APFs. More recently, targeted percutaneous tract embolization has also been described.<sup>4</sup>

The typical presentation of BPF/APF is persistent pneumothorax despite adequate chest drainage. As pneumothorax following lung ablation is common, a fistula may be revealed in some days following the procedure. Our case is unusual for its early onset and rapidly progressive clinical course the same day, which we attribute to the subpleural location of the tumor and potential adhesions between the



**Fig. 3** Chest X-ray before (left) and 12 hours after (right) glue embolization showing resolving surgical emphysema.

tumor and the parietal pleura. This appears to have led to early decompression into the subcutaneous tissues and prompted early imaging leading to discovery of the APF.

Because of its rarity, there is a lack of high-level evidence on the aetiopathogenesis of BPF/APF. Pneumothorax, prior radiotherapy, primary lung neoplasm, chronic obstructive pulmonary disease (COPD), tract coagulation, and bronchiole puncture have been proposed as risk factors.<sup>5</sup> In addition to the above, we believe that subpleural location and larger ablation zones are additional risk factors.

While targeted fistula embolization is technically difficult, it may be more effective than nontargeted pleurodesis. Unless it can be performed under the same anesthesia as the thermal ablation, it requires reasonable patient cooperation including breath-holding to minimize respiratory movements for precise location and may not be suitable for critically ill patients.

Once the fistula is located on CT imaging, injection should be performed promptly to prevent blockage of the needle. Imprecisely placed glue may be ineffective and contribute to unnecessary pleural adhesions leading to further morbidity. We suggest, as demonstrated in this case, that sealing the pleural surface alone is sufficient to close the air leak and should be adopted as the first-line technique. Puncturing the lung for attempted tract infiltration may be associated with generation with further fistulas and may be attempted as a subsequent, second-line technique in some cases. Further evidence-based research would be of value to define the optimal treatment strategy of this rare condition as in some cases such fistulas will seal spontaneously.

## Conclusion

We have demonstrated that postablation APF can be safely treated with percutaneous glue embolization. Early intervention may lead to reduced morbidity and better outcome. Interventional radiologists should be aware of the technique and its limitations to better handle complications arising from percutaneous pulmonary procedures.

### Funding

None.

### Conflict of Interest

None declared.

## References

- 1 Palussière J, Catena V, Buy X. Percutaneous thermal ablation of lung tumors - Radiofrequency, microwave and cryotherapy: where are we going? *Diagn Interv Imaging* 2017;98(09):619–625
- 2 de Baere T, Tselikas L, Woodrum D, et al. Evaluating cryoablation of metastatic lung tumors in patients: safety and efficacy—the ECLIPSE trial: interim analysis at 1 year. *J Thorac Oncol* 2015;10(10):1468–1474
- 3 Kashima M, Yamakado K, Takaki H, et al. Complications after 1000 lung radiofrequency ablation sessions in 420 patients: a single center's experiences. *AJR Am J Roentgenol* 2011;197(04):W576–80
- 4 Lim DY, Wang M, Chokkappan K, et al. Percutaneous treatments for persistent bronchopleural and alveolar-pleural fistulae. *J Vasc Interv Radiol* 2022;33(04):410–415.e1
- 5 Alberti N, Buy X, Frulio N, et al. Rare complications after lung percutaneous radiofrequency ablation: incidence, risk factors, prevention and management. *Eur J Radiol* 2016;85(06):1181–1191