



# Catheter-Directed Glue Embolization for the Treatment of Bronchopleural Fistula with Associated Retained Microwave Ablation Needle Tip

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## Abstract

### Keywords

- bronchial fistula
- embolization
- pleural disease
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- bronchopleural fistula
- case report

Bronchopleural fistula (BPF) is a rare but severe complication of lung tumor ablation. The mainstay treatment of BPF is surgical or bronchoscopic intervention; however, there are no current guidelines on the best practice for the management of BPF. In this case presentation, a 72-year-old woman developed a persistent and refractory BPF post-thermal microwave ablation of a lung tumor, complicated by detachment of the ceramic ablation needle tip, which resulted in recurrent tension pneumothoraces. The BPF was successfully treated with cone beam computed tomography (CBCT) and fluoroscopy-guided catheter-directed glue embolization, which offers a novel potential treatment option for persistent, refractory BPF.

## Introduction

There is a paucity of data and lack of consensus on how best to manage bronchopleural fistula (BPF).<sup>1</sup> Treatment options include surgical repair, pleurodesis, and endobronchial management.<sup>1,2</sup> Prior case reports and case series have described needle-directed percutaneous glue embolization under computed tomography (CT) guidance as an alternative treatment option.<sup>3–6</sup> We present a case of recurrent BPF treated with catheter-directed percutaneous glue embolization using cone beam CT (CBCT) and fluoroscopic guidance. An angled catheter approach was selected as it was felt that a closer apposition of the catheter to the fistula could be achieved as opposed to a needle approach. Ethics review board approval and patient consent were obtained.

## Case Report

A 72-year-old woman undergoing surveillance 2 years after left lower lobectomy for a non-small-cell lung cancer was

found to have a progressing right upper lobe lung nodule with low-grade metabolic activity on positron emission tomography (PET; standardized uptake value [SUV] of 2.3), suspicious for an adenocarcinoma spectrum lesion. A multidisciplinary case conference review deemed the patient to be a poor surgical candidate and radiation therapy was felt to be contraindicated given a background pulmonary fibrosis. As such, she underwent thermal lung ablation by interventional radiology.

Thermal ablation was performed with a Solero (AngioDynamics, Latham, New York, United States) 15-gauge 14-cm microwave ablation needle positioned in the right upper lobe lung nodule using CBCT guidance (Philips Imaging, Amsterdam, the Netherlands) at an intensity of 140 W for 4 minutes. Postablation CBCT demonstrated detachment of the distal 15-mm ceramic tip of the ablation needle, remaining positioned centrally within the ablation zone. Postablation, the patient experienced recurrent right-sided pneumothoraxes refractory to treatment with thoracostomy tube placement. Chest CT demonstrated a BPF at the ablation site, adjacent to the retained ablation needle tip (–Fig. 1). The BPF persisted

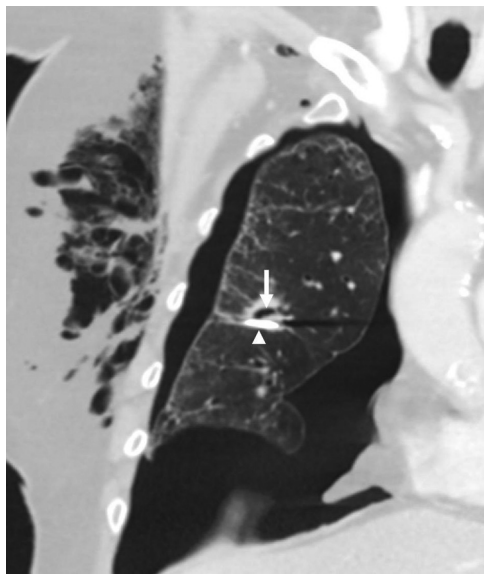
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**Fig. 1** Preprocedural coronal computed tomography (CT) thorax showing a pneumothorax, the bronchopleural fistula (arrow), and the retained needle ablation tip adjacent to the fistula (arrowhead).

for 16 days with ongoing air leak and incomplete lung expansion precluding pleurodesis.

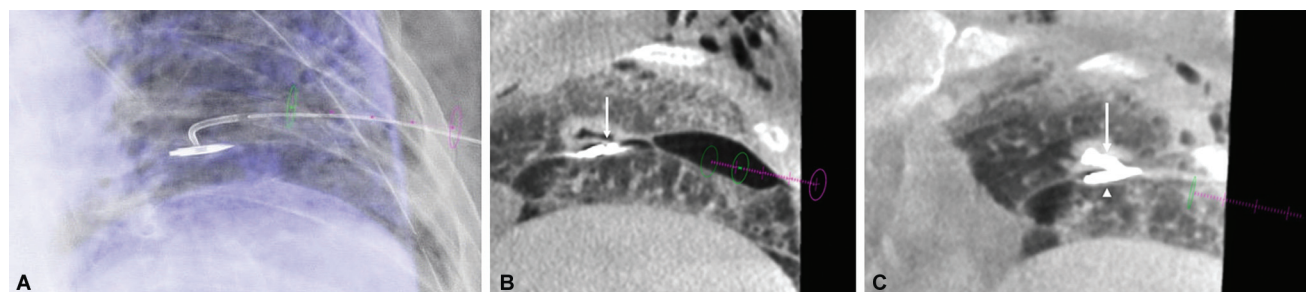
A decision was made to attempt sealing the fistula percutaneously. Given the anterior position of the fistula, prone positioning was utilized to direct the glue to the site of the fistula gravitationally. This was felt to be the lowest risk option for this patient. The main risks of this approach were felt to be failure of sealing of the BPF and trapping of a catheter fragment within the glue. Using CBCT and XPerGuide (Philips Healthcare, Best, the Netherlands) needle guidance, the minor fissure pneumothorax was punctured with a 16-gauge angiocatheter. A 0.035-inch J-wire was advanced under fluoroscopic guidance toward the retained needle tip. A 5-Fr KMP catheter (Cook Medical, Bloomington, Indiana, United States) was then positioned immediately adjacent to the fistula, using the retained needle as a fiducial marker (►Fig. 2A). Under fluoroscopic guidance, 0.6 mL of 1:1 n-butyl-2-cyanoacrylate (GluBran: GEM, Viareggio, Italy) to ethiodized oil (Lipiodol; Guerbet, Aulnay-sous-Bois, France) mixture was injected, filling the cavity adjacent to the fistula. Proper filling was confirmed

with CBCT (►Fig. 2C). There was immediate resolution of the BPF and pneumothorax.

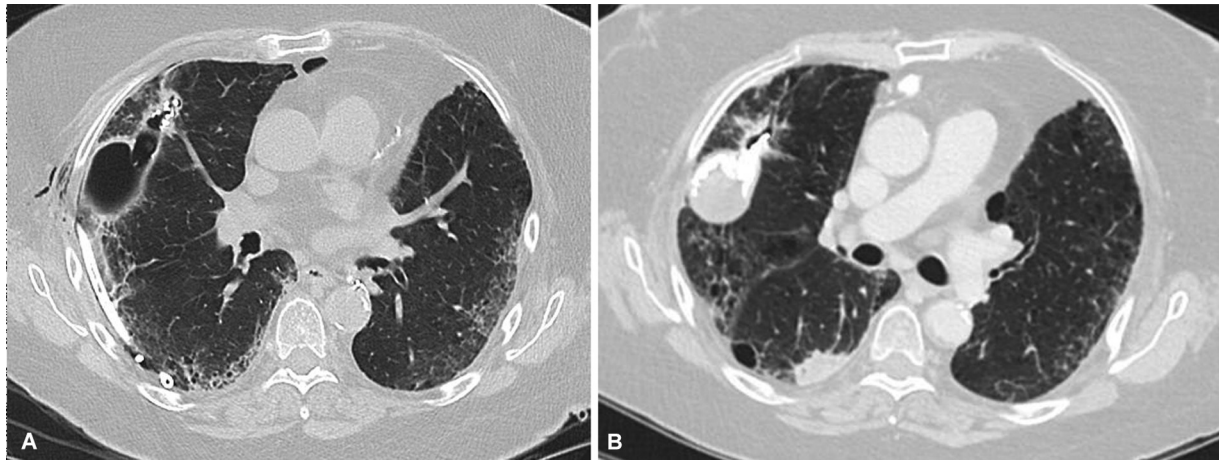
The patient re-presented 9 weeks postembolization with a recurrent right-sided pneumothorax. Lack of immediate collapse of the pneumothorax within the minor fissure adjacent to the BPF and a small volume of glue were hypothesized as potential causes of recurrence. Repeat glue embolization was performed using the same procedural steps as described earlier. A total of 1.4 mL of glue was utilized. Post-glue embolization CBCT demonstrated that the minor fissure collapsed around the glue, which extended into the BPF with no residual pneumothorax. Compared with the first procedure, broader collapse of the air space within the minor fissure and a larger volume of glue at the fistula site were identified on the CBCT. Repeat X-rays confirmed re-expansion of the lung at 48 hours postprocedure, at which point talc pleurodesis was performed via thoracostomy tube. Repeat chest CT at 2 weeks, 1 month, and 13 months postprocedure demonstrated ongoing lung expansion with the adjacent cavity filling with fluid (►Fig. 3).

## Discussion

For the treatment of BPF, previous reports describe direct injection of glue into a fistula by positioning a needle under CT guidance.<sup>3-6</sup> This case presents the use of CBCT and fluoroscopy catheter-directed glue embolization for the treatment of BPF. The benefits to the technique described are the ability to use fluoroscopy following CBCT, which facilitates the use of guidewires and catheters, allowing for easier selection of small fistulas compared with direct needle access. Additionally, fluoroscopy allows direct visualization of the glue during the embolization, providing better control. Finally, using dependent positioning of the patient can facilitate glue embolization. In this case, repeat treatment was required to achieve long-term success. In the largest case series, repeat embolization was required in four of seven treatments.<sup>3</sup> In this case series, all seven patients eventually reached technical success, with a follow-up duration of 2 to 47 months. This case report adds to the limited published information on the use of glue in BPF treatment and demonstrates the feasibility of the use of



**Fig. 2** (A) Overlay XperGuide fluoroscopy demonstrates the KMP catheter advanced over the planned trajectory with the tip positioned adjacent to the retained ablation needle tip and the bronchopleural fistula. (B) Coronal cone beam computed tomography (CBCT) image acquired in prone positioning shows the bronchopleural fistula (arrow), the retained ablation needle tip, and the planned puncture trajectory through a partly loculated pneumothorax in the minor fissure. (C) Postembolization CBCT image shows filling of the bronchopleural fistula with the glue/lipiodol mixture and collapse of pneumothorax.



**Fig. 3** Computed tomography (CT) chest axial images (A) prior to repeat glue embolization (B) 13 months postprocedure showing the cavity adjacent to glue embolization filling with fluid over time and stable in appearance.

catheters instead of needles and CBCT/fluoroscopy instead of conventional CT.

A limitation to this case report is that the extent to which the retained ceramic needle tip may have contributed to recurrent pneumothorax or influenced the BPF treatment course is unknown. There are no previous reports of a retained ceramic needle tip with associated BPF; however, the mainstay of treatment for foreign bodies is surgical removal. Given our patient's previous lobectomy and tenuous clinical status, surgical intervention for resection of the retained ceramic needle and/or BPF repair were not options. Alternative treatments such as transbronchial embolization or other endoscopic therapies were not available at our center. It is acknowledged that pleurodesis performed after the second embolization may have contributed to prolonged treatment success; however, it would not have been possible without re-expansion of the lung, which was facilitated by embolization.

## Conclusion

In the presented case of recurrent BPF, with retained ablation needle tip, CBCT and fluoroscopy catheter-directed glue embolization provided a successful treatment. This technique could be considered in patients who are not suitable for surgical or bronchoscopic interventions or in the cases where these interventions are not available.

### Ethical Approval

Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (HSREB) approval was received for this case report (file number: 6038579). All the procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

### Informed Consent

Informed consent was obtained from all individual participants included in the study.

### Funding

None.

### Conflict of Interest

A.M. receives a speaker honorarium from Inari Medical and Philips Imaging and has received payment for expert testimony from the College of Physicians and Surgeons of Ontario. G.D. has received the Lung Cancer Innovation Grant from MaRS/Merk & Co Inc and the Global Quality Improvement Grant from Pfizer Inc. She is the Canadian Thoracic Society Choosing Wisely Working Group Chair and has received presentation honorarium from Merck & Co Inc and from AstraZeneca. The authors declare that they have no conflict of interest not listed above.

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