

[CASE REPORT]

The Transbronchial Drainage of a Lung Abscess Using Endobronchial Ultrasonography with a Modified Guide Sheath

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Abstract:

Lung abscess is usually treated with long-term antibiotic therapy. Due to the lack of a safe and easy drainage technique, drainage is only applied in refractory cases. We herein describe three cases in which drainage was successfully performed by endobronchial ultrasonography using a modified guide sheath. This procedure may have advantages in the detection of causative pathogens and early infection source control, and may therefore lead to the appropriate selection of antibiotics and reduce the duration of antibiotic therapy.

Key words: EBUS-GS, bronchoscopy

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Introduction

Lung abscess is a severe type of pneumonia, which is characterized by the destruction of the lung parenchyma, cavity formation, and the collection of pus or necrotic debris. In the antibiotic era, surgery is rarely needed; however long-term antibiotic therapy is required. The etiological pathogens of lung abscess are difficult to specify, as the lesion is compartmentalized, and the pattern is occasionally poly-microbial (1, 2).

The essential treatment of abscess is drainage. However, lung abscess is usually treated conservatively because the drainage of a lung abscess is problematic. Drainage is only considered for cases of refractory lung abscess; in such cases, percutaneous lung drainage is usually applied (3). Even when drainage is successful, percutaneous drainage is associated with the risk of complications such as pneumothorax and bacterial seeding of the pleural space; such complications occur in 16.1% of patients (3). There are sporadic reports of the application of transbronchial drainage (i.e., en-

doscopic drainage with a guide wire) and laser or argon plasma coagulation in order to avoid such complications; however, these methods require a great deal of experience (4-6). Recently, endobronchial ultrasonography with a guide sheath (EBUS-GS) has become available (7). This system has significantly improved procedures by placing the biopsy forceps within the target nodular region. We have experienced four cases of lung abscess, which were successfully drained using EBUS-GS with a modified guide sheath (EBUS-mGS); three of these cases are described in the present case series. We consider this procedure to be advantageous as it achieves early source control and allows for the early detection of causative pathogens; thus, theoretically, it can lead to the appropriate selection of antibiotics and reduce the duration of antibiotic therapy.

The procedure of transbronchial drainage by EBUS-mGS

Under sedation with midazolam and/or pethidine hydrochloride, we orally inserted a flexible bronchoscope (BF-1T 260; Olympus, Tokyo, Japan). We performed EBUS-GS

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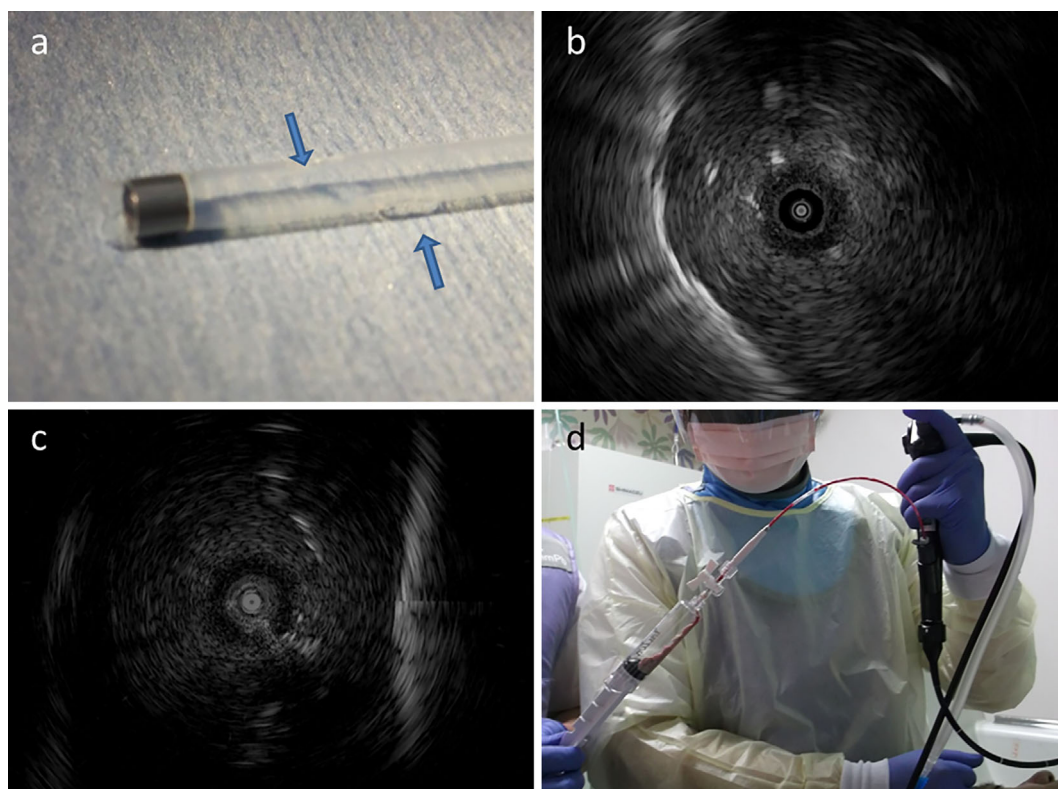


Figure 1. A representative case of endoscopic abscess drainage (case 1). a) We created two small side holes (arrows) diagonally, approximately 1 cm apart, on the tip of the guide sheath. b,c) We confirmed that the tip of the guide sheath was in the abscess by ultrasonography. d) Pus was drained through the guide sheath.

(GuideSheathKit, K-203; Olympus) under fluoroscopic guidance. Before the procedure, we punched two small holes on the tip of the guide sheath. These were approximately 1.5×2 mm in size and were placed diagonally, approximately 1 cm apart, in order to avoid breaking the sheath (Fig. 1a). After confirming that the tip of the guide sheath was located within the abscess by ultrasonography (Fig. 1b and c), we manually aspirated the pus through the guide sheath (Fig. 1d); the pus was subjected to a microbiological examination. The cavity was then lavaged with 10-20 mL of normal saline per load (total volume: 50-100 mL). The bronchoscope was removed without leaving an indwelling catheter.

Case Reports

Case 1

A 67-year-old man developed fever, after undergoing total laryngectomy and permanent tracheotomy for oropharynx cancer. Despite taking levofloxacin for 5 days, his low-grade fever persisted and a chest X-ray and computed tomography (CT) showed a 56×33×33-mm cavity lesion with fluid collection in the right middle lobe (Fig. 2a). He was diagnosed with lung abscess. Levofloxacin was empirically changed to sulbactam/ampicillin (SBT/ABPC). On day 6 after the diagnosis, we performed transbronchial drainage by EBUS-mGS,

as described above. A guide sheath was inserted into the right B⁵b and 10 mL of high-viscosity pus was drained. The cavity was lavaged with 50 mL of normal saline. *Streptococcus constellatus* was isolated from the pus. The antibiotics were changed to ampicillin for 21 days, followed by amoxicillin for 70 days. The patient recovered without any complications (Fig. 2b).

Case 2

A 61-year-old woman developed fever without any respiratory symptoms. She had dementia, hemiparesis, and type 1 diabetes mellitus. She was diagnosed with aspiration pneumonia affecting the left lower lobe and a lung abscess was detected on the right middle lobe by chest CT (Fig. 2c). Only normal oral flora grew in a sputum culture and she was initially, she was empirically treated with SBT/ABPC. On day 3, we performed transbronchial drainage by EBUS-mGS. A guide sheath was inserted into the right B⁵a and 16.5 mL of high-viscosity pus was drained. The cavity was lavaged with 55 mL of normal saline and 45 mL of turbid fluid was drained. Microscopy revealed predominantly gram-positive cocci with a few gram-negative bacilli. Thus, we changed SBT/ABPC to tazobactam/piperacillin (TAZ/PIPC). Later, *Klebsiella oxytoca* producing extended-spectrum β -lactamase was cultured. Meropenem was initiated on day 7 and continued for 49 days; no fluid was left in the cavity upon CT-imaging on the 27th day after drainage (Fig. 2d).

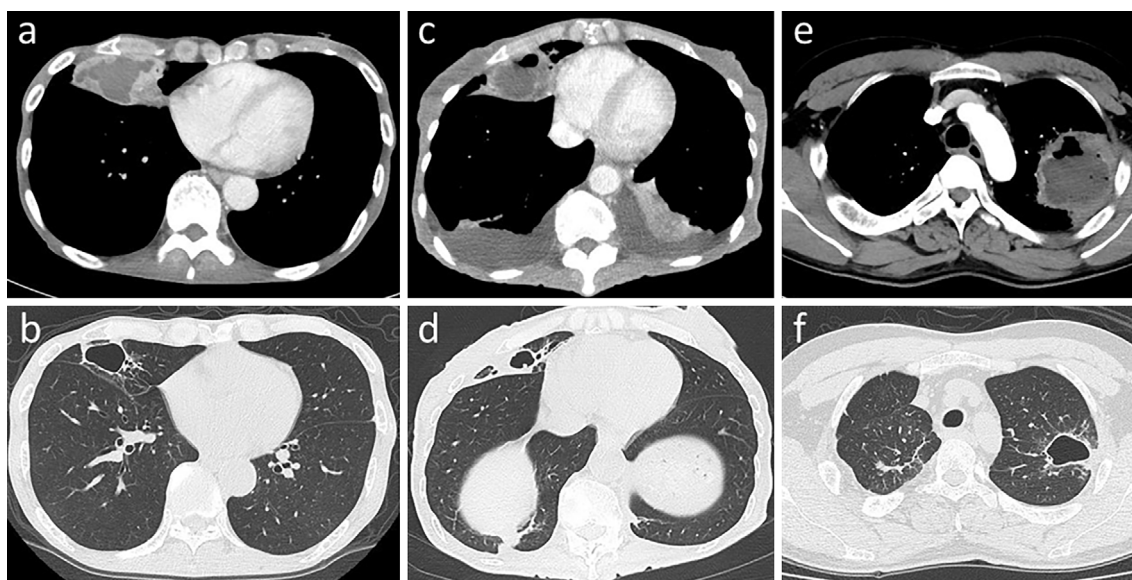


Figure 2. The radiological findings of each case. a) Six days before and b) 86 days after drainage by bronchoscopy (case 1). c) One day before and d) 27 days after drainage by bronchoscopy (case 2). e) One day before and f) 22 days after drainage by bronchoscopy (case 3).

Case 3

A 37-year-old man developed fever 5 days prior to admission and garenoxacin was prescribed by his local doctor. However, his condition deteriorated and a chest X-ray showed a 35-mm cavity lesion on the left upper region. He was diagnosed with lung abscess. He had a retained esophagotracheal fistula complicated by esophageal atresia, which had been surgically treated at birth. Despite the administration of TAZ/PIPC, which was started on the day of admission, the cavity lesion with fluid collection grew to 50 mm (Fig. 2e) and his fever persisted. We therefore performed transbronchial drainage by EBUS-mGS on day 7. A guide sheath was inserted into the left B¹⁺²c. A total of 10 mL of high-viscosity pus was aspirated, the cavity was lavaged with 90 mL of normal saline, and 104 mL of turbid fluid was drained. A large number of gram-positive cocci were observed by microscopy; no bacteria were cultured. Based on this finding we suspected that oral bacteria might be the causative pathogen. His fever persisted after drainage, leading to the suspicion of drug fever due to the administration of TAZ/PIPC. Consequently, we changed TAZ/PIPC to clindamycin, which was continued for 23 days. All of the symptoms subsided; however, a remnant thin wall cavity remained (Fig. 2f).

Discussion

This case series showed that trans-bronchial drainage by EBUS-mGS is an effective option for treating lung abscess. No significant complications have occurred in our facility, in which the EBUS-GS system has already been introduced. The four cases that we experienced in our facility are summarized in Table. Although case 3 had mild hypoxemia at

the end of lavage, the patient promptly recovered after the procedure. Lung abscess has been treated with conservative antibiotic therapy, mainly due to the lack of safe and easy drainage techniques. Our drainage method was a modification of the established EBUS-GS method. Direct visualization under an echoic monitor enabled the operator to confirm that the drainage catheter had been placed inside the abscess. Recently, two case reports, including our own, have described the usefulness of EBUS-GS in performing drainage (8, 9). Abu-Awwad et al. reported that they used EBUS-GS with DNase to drain abscess fluid in a single procedure (8). We did not use DNase. Instead, we drained the necrotic debris in a single procedure by making two side holes on the tip of the guide sheath and performing lavage with normal saline. Completing drainage with a single suction procedure was difficult because of the high viscosity of the pus. Repeated flushing and suction with a sufficient volume of normal saline were required for effective drainage.

Tip breakage due to the modification of the guide sheath was a major concern. In order to ensure the durability of the guide sheath, the side holes (of which there were only two) were made carefully and were smaller in size than the internal diameter of the guide sheath; these holes were placed diagonally approximately 1 cm apart. We must be careful that this modification does not increase the risk of sheath breakage. Hemoptysis and the spreading of infection into the intact lobe via lavage are other potential adverse events. None of these adverse events occurred in the present study; however, the number of cases was limited and the accumulation of more clinical experience and the development of a specially-designed guide sheath (for drainage) is warranted.

This case series also showed that our technique had an advantage in the detection of causative pathogens. EBUS-mGS provided an *in situ* sample that was crucial for the mi-

Table. Clinical Characteristics of Lung Abscess Cases Treated by EBUS-mGS.

	Case1	Case2	Case3	Case4 (9)
Age	67	61	37	86
Sex	Male	Female	Male	Female
Comorbidity	Post-operative oropharynx cancer Metastatic lung cancer Hypothyroidism	Type 1 diabetes mellitus Malnutrition Dementia	Post-operative esophageal atresia Tracheoesophageal fistula	Polymyalgia rheumatica Lumbar compression fracture Deep venous thrombosis Malnutrition
Location	Right B ⁵ b	Right B ⁵ a	Left B ¹⁺² c	Right B ³
Size (mm)	56×33×33	42×34×45	50×50×48	95×64×82
Treatment time (min)	85	90	60	70
Drained pus (mL)	10	16.5	10	5
Infusion fluid (mL)	50	55	90	80
Waste fluid (mL)	NA	45	104	95
Gram staining of pus	GPC	GNR, GPC	GPC	GNR, GPC
Culture from lung abscess	<i>Streptococcus constellatus</i>	<i>Klebsiella pneumoniae</i> (ESBL)	Negative	<i>Burkholderia cenocepacia</i> , <i>Klebsiella pneumoniae</i> , MSSA
Sputum culture	MRSA	MSSA	Normal oral flora	<i>Burkholderia cenocepacia</i>
Antibiotics	ABPC→AMPC	MEPM	CLDM	MEPM, TPM-SMX
Duration of intravenous antibiotics (days)	21	49	23	48
Duration of total antibiotics (days)	91	49	23	48
Adverse event	None	None	Transient hypoxemia	None

One case was previously reported (9). NA: not available, GPC: gram-positive coccus, GNR: gram-negative rod, ESBL: extended-spectrum β -lactamase, MRSA: methicillin-resistant *Staphylococcus aureus*, MSSA, methicillin-sensitive *Staphylococcus aureus*, ABPC: ampicillin, AMPC: amoxicillin, MEPM: meropenem, CLDM: clindamycin, TPM-SMX: Trimethoprim-sulfamethoxazole

crobiological diagnosis. Consequently, we were able to promptly change antibiotics according to the results of a local samples obtained from the abscess, which showed differences to the sputum cultures (Table). Recently, the emergence of antibiotic-resistant bacteria has become a serious problem worldwide and antimicrobial stewardship is warranted (10). The standardized administration of long-term broad-spectrum antibiotic therapy in the treatment of lung abscess might increase the risk of the emergence of resistant bacteria. Early intervention with less invasive EBUS-mGS drainage and the detection of pathogens could allow for the appropriate selection of antibiotics and could potentially reduce the duration of therapy.

The authors state that they have no Conflict of Interest (COI).

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