

Transbronchial Catheter Drainage via Fiberoptic Bronchoscope in Intractable Lung Abscess

Man Pyo Jeong, M.D., Woo Sung Kim, M.D., Sung Koo Han, M.D.
Young Soo Shim, M.D., Keun Youl Kim, M.D. and Yong Chol Han, M.D.

Department of Internal Medicine, College of Medicine, Seoul National University, Seoul, Korea

The use of the fiberoptic bronchoscope as a drainage procedure for lung abscess has become more and more widespread. We have recently adopted the technique of inserting a simple polyethylene catheter through the flexible fiberoptic bronchoscope into the abscess cavity of 11 patients with lung abscess. All cases had not responded to aggressive postural drainage and adequate antibiotic therapy for at least a week. The results were as follows:

- 1) Among 11 patients, the therapeutic response was dramatic in 6 patients.*
- 2) In the successful group, the abscess sizes were greater than 8cm in diameter and the air-fluid levels were higher than two-thirds of the cavity.*
- 3) Additional diagnoses, other than bacterial lung abscess, could be made in 2 cases when otherwise the diagnosis would have remained in doubt.*

The authors suggest that catheter drainage via fiberoptic bronchoscope is an effective treatment modality in the large lung abscess with a high air-fluid level which is intractable to other medical approaches, and it is also a safe procedure.

Key Words: Lung abscess, Fiberoptic bronchoscope, Transbronchial catheter drainage

INTRODUCTION

Lung abscess literally means a collection of pus within a destroyed portion of the lung. Therefore, the basic treatment of lung abscess consists of drainage and antibiotic therapy, which are the cornerstones of appropriate nonoperative management, with surgery reserved for special circumstances.

Bronchoscopy has proved a most valuable adjunct in the diagnosis and treatment of pulmonary cavitary disease. In 1936, Goldman¹⁾, and a few years later Jackson and Judd²⁾ reiterated the value of bronchoscopy in the treatment of lung abscess. They, using a rigid bronchoscope, showed that bronchoscopic measures were considered to play an indispensable role in diagnosis and to constitute an integral part of both the nonsurgical and surgical treatment of pulmonary abscess. Allen and Blackman³⁾, in a collective review of 1086 cases of

medically treated abscesses, found some 650 cases treated primarily by repeated bronchoscopic aspirations with a cure rate of 61%. Metras and Chapin⁴⁾ reported a 72.5% success rate with frequent bronchoscopic drainage and direct antibiotic instillation into the abscess cavity.

The methods of bronchoscopic drainage in lung abscess have been either simple conventional aspiration through a connecting bronchus or the recently introduced transbronchial catheter drainage via a rigid bronchoscope.^{5,6)} There have been debates⁷⁾ on the usefulness and potential hazard of performing fiberoptic bronchoscopy in lung abscess, but the application of fiberoptic bronchoscopy is widened by virtue of improved skill and instrumentation.

We have recently adopted a technique which involves the introduction of a flexible polyethylene catheter through a fiberoptic bronchoscope into the bronchus of the involved bronchial segment. The aim of this article is to review the technique, to evaluate the therapeutic efficacy in clinical practice and to determine its safety.

Address reprint requests: Yong Chol Han, M.D., Department of Internal Medicine, College of Medicine, Seoul National University, #28, Yunkun-Dong, Chongno-Ku, Seoul, 110-744, Korea

PATIENTS AND METHODS

Among 39 patients in whom fiberoptic bronchoscopy was performed from March 1986 through October 1988, with cavitary pulmonary lesions on roentgenograms and a discharge diagnosis of lung abscess at Seoul National University Hospital, 11 patients were analyzed in this article. Those abscesses occurring in potential spaces of the pleural cavity, such as blebs or bullae, and in congenitally sequestered lung were excluded. Similarly, cavitary carcinoma (lung carcinoma with central necrosis) and lung abscess occurring distal to an obstructing endobronchial tumor or foreign body were also excluded.

On admission to the hospital, all patients had chest roentgenograms (posteroanterior and lateral) and cultures of expectorated sputum for bacteria, fungi and acid-fast bacilli were performed. Efforts were made to collect these specimens prior to the initiation of antimicrobial therapy. After cultures, various antimicrobial combination therapies with penicillin, clindamycin, aminoglycoside or cephalosporin were empirically started with postural drainage and chest physiotherapy according to the location of lung abscess by chest roentgenograms. Subsequently, the selection of antibiotics was optimally changed on the basis of the identification of the offending organism and its *in vitro* antibiotic susceptibility patterns. The body temperature and other clinical manifestations were checked daily and chest roentgenograms were followed at 24 or 48 hour intervals.

Among 39 patients, we tried transbronchial catheterization in 11 patients with intractable lung abscess. Intractable lung abscess was arbitrarily defined as a cavitary lesion with poor clinical and radiological response in spite of aggressive attempts at postural drainage, chest physiotherapy and adequate antibiotic therapy for a week or more. The remaining 28 patients underwent bronchoscopy after clinical and radiological improvements for the purpose of ruling out malignancy or associated tuberculosis.

Following local anesthesia by spraying the nasal mucosa and oropharynx with 4% lidocaine, transnasal insertion of a two-channeled Olympus BF-2T10 bronchoscope was done. A flexible polyethylene catheter (Olympus PW-6P) was introduced into each subsegment of the involved segment which was determined by radiological localization before the procedure. Two patients needed biplane fluoroscopy for the confirmation of correct catheter position, but 8 did not. Then, aspiration by a 30cc syringe attached to the external opening of the catheter was done. If aspiration was inadequate, we tried the catheterization repeatedly up to three or four times with to and fro movements. Hemoptysis was absent in all patients during the procedure. The aspirated material was sent to the laboratories for cultures of bacterial and acid-fast bacilli, and for cytology.

After the bronchoscopy, chest roentgenograms were checked within 12 hours and the patients were carefully observed as to whether hemoptysis or respiratory failure occurred as a complication of the bronchoscopic procedure. The body temperature was also checked frequently. The antimicrobial

Table 1. Radiological Findings of 11 Patients

Patient No.	Sex/Age (yrs)	Location of lung abscess	Size of the cavity	Air-fluid level in the cavity
1	M/24	RLL laterobasal segment	7 × 9 cm	> 2/3
2	M/32	RLL superior segment	6 × 9 cm	> 2/3
3	M/53	RLL posterobasal segment	5 × 10 cm	> 2/3
4	M/44	LLL superior segment	11 × 15 cm	> 2/3
5	M/59	LUL lingular segment	6 × 8 cm	> 2/3
6	M/41	LLL superior segment	5 × 8 cm	> 2/3
7	M/64	LLL superior segment	5 × 6 cm	1/3 - 2/3
8	M/45	LUL anterior segment	5 × 6 cm	1/3 - 2/3
9	M/54	LLL superior segment	3 × 4 cm	1/3 - 2/3
10	F/42	RLL anterobasal segment	4 × 6 cm	1/3 - 2/3
11	M/42	RUL anterior segment	4 × 6 cm	1/3 - 2/3

RLL: right lower lobe, LLL: left lower lobe, LUL: left upper lobe, RUL: right upper lobe

therapy was continued until radiographic changes were cleared or there was only a small stable lesion.

RESULTS

The radiological findings of 11 patients are listed in Table 1. Ten patients were male and 1 was female. Patients Number 1 to 6 improved markedly after transbronchial catheter drainage. The cavity sizes

of these patients were more than 8 cm in diameter while those of the others were less than 6 cm. The air-fluid levels in the former were higher than two-thirds of the cavity. Age and the location of abscess were not related to the efficacy of this procedure.

As shown in Table 2, prolonged antibiotic therapy after the catheter drainage was necessary even in the successful group, suggesting that antibiotic therapy without drainage is ineffective in lung

Table 2. The Profiles of Antibiotic Therapy and Catheter Drainage

Patient No.	Duration of antibiotic therapy		amount of aspirate (cc)	Catheter drainage		
	before drainage (weeks)	after drainage (weeks)		defervescence within 48 hrs.	degree of change in air-fluid level	complication
1	8	2*	50	Yes	more than 1/3	No
2	5	3	>50	Yes	more than 1/3	No
3	1.5	5	50	Yes	more than 1/3	minute hemoptysis
4	3	5	110	Yes	more than 1/3	minute hemoptysis
5	1	5	20	Yes	more than 1/3	minute hemoptysis
6	2	4	30	Yes	more than 1/3	No
7	1.5	6	< 5	No	less than 1/3	minute hemoptysis
8	1	16	not	No	less than 1/3	No
9	1	6	5	No	less than 1/3	No
10	2	6	5	No	less than 1/3	No
11	2	1**	20	No	less than 1/3	minute hemoptysis

* metronidazole for amebic lung abscess

** not followed

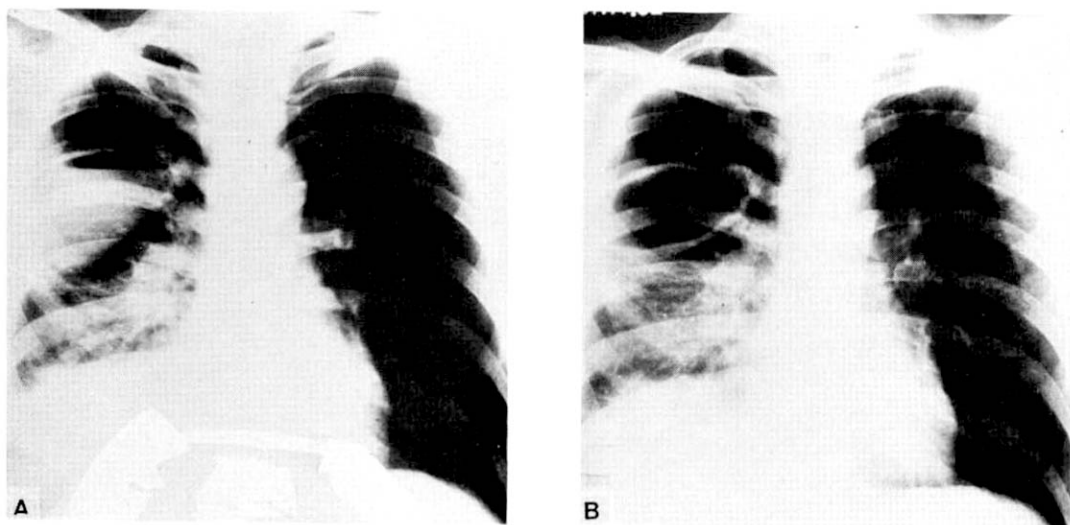


Fig. 1. (Patient No. 2): (A) Chest PA shows an abscess with a high air-fluid level; the lesion was located in the superior segment of the right lower lobe, and was intractable to postural drainage and antibiotic therapy. (B) After fiberoptic bronchoscopy and catheter drainage, a dramatic effect is noted in this film taken 4 hours later.

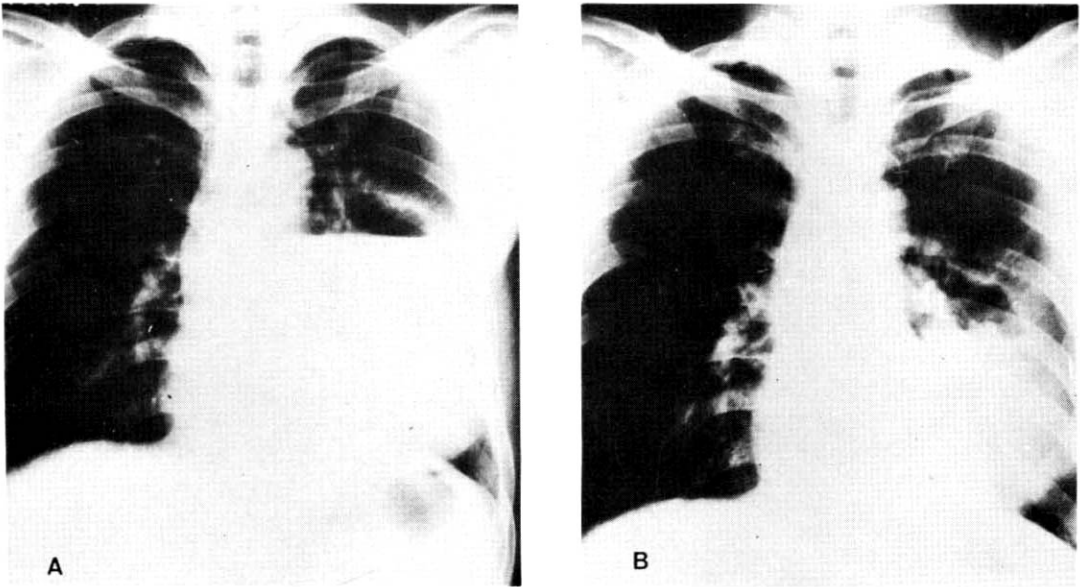


Fig. 2. (Patient No. 4): (A) A large cystic cavity is seen in the superior segment of the left lower lobe. (B) Note the remarkable radiological improvement after transbronchial catheter drainage via a fiberoptic bronchoscope in the X-ray taken 6 hours later.

abscess. In regard to complications, minute hemoptysis occurred in 5 patients and stopped spontaneously within 48 hours. Hemoptysis was not related to the amount of aspirated pus but might have been due to irritation of the abscess wall by the catheter tip.

Aside from the therapeutic results, valuable diagnostic information about the offending organisms could be obtained in some cases. The aspirate of patient No. 1 was chocolate-colored and he was diagnosed as having lung abscess secondary to the rupture of amebic liver abscess which had not been suspected. Only the culture of the aspirate from patients No. 4 revealed that tuberculosis was associated.

Fig. 1. and 2. are the X-rays of two cases which showed great success.

DISCUSSION

Although significant improvements in the curability rate have been achieved with the introduction of penicillin and other antibiotics, lung abscess still constitutes a serious illness with a significant morbidity and mortality rate, and therapeutic effects are lost unless the cavity is adequately evacuated.

The percutaneous needle drainage of lung

abscess⁸⁾ is now rarely used because it carries a risk of contaminating the pleural space, resulting in empyema. However, it is probably indicated in an elderly debilitated patient who is unresponsive to the usual medical measures and is too acutely ill to withstand any other procedure.

The role of bronchoscopy in lung abscess is well established.^{9,10,11)} This procedure provides valuable diagnostic information. Accurate localization of the involved bronchial segment can be made, thereby assuring good postural drainage. In patients with hemoptysis, bleeding sites can be identified, which is essential prior to surgical intervention. In addition, underlying obstructing lesions, such as tumors or foreign bodies, can be ruled out. The advantage afforded by precise identification of the infectious agent followed by initiation of proper systemic antibiotic therapy makes bronchoscopy a vital component of the treatment regimen. Drainage may be accomplished by simple chest physiotherapy and postural drainage in some cases. But, if drainage is not adequate with these maneuvers, the patient should be bronchoscoped.

Both the fiberoptic and rigid bronchoscope are effective in the treatment of lung abscess. However, in spite of widespread use, there has been no well described report of successful drainage through a

flexible fiberoptic bronchoscope in the patients with lung abscess. The reason may be that the bronchoscopic procedure in lung abscess has been considered to be relatively contraindicated due to the risk of endobronchial dissemination of evacuated pus or life-threatening hemoptysis.⁷⁾ Estrera et al.¹²⁾ stated that patients with a very large abscess and those with hemoptysis ideally should be bronchoscoped with the rigid instrument because this assured satisfactory evacuation of a large amount of expectorated infected material and blood. But, when compared with the flexible fiberoptic bronchoscope, the rigid bronchoscope has a number of significant disadvantages including discomfort to the patient when performed under local anesthesia, increased cost and risk when a general anesthetic is employed, limited range of vision, and unusability in patients being mechanically ventilated or when disease or trauma involves the skull, jaw or cervical spine.

Connors,⁶⁾ Groff,⁵⁾ and their associates have utilized coronary angiocatheters threaded through the rigid bronchoscope into the involved bronchial segments under topical or general anesthesia. They suggested that it was particularly useful in occasional patients with edematous and deformed bronchial orifices which are difficult, or even impossible, to enter with suction apparatus. Later, Estrera et al.²⁾ applied this technique in three cases with great success. Connors had tried this technique with the use of a fiberoptic bronchoscope in pulmonary abscess, but he said it was disappointing. Not all of our trials were successful, but without great difficulty we could introduce the instrument through a fiberoptic bronchoscope into an appropriate site within the bronchus to provide satisfactory drainage.

Except in 2 cases, we did not use fluoroscopy or portable chest roentgenograms routinely for confirmation of the correct catheter position. However, both precise localization by chest roentgenograms prior to the bronchoscopy and the return of a large

amount of purulent material on aspiration usually indicated that the catheter was correctly positioned.

Our overall results show that transbronchial catheter drainage through a fiberoptic bronchoscope in lung abscess can be applied to cases of a) persisting fever and significant toxicity without response to combined postural drainage and appropriate antibiotic therapy after at least 1 week, and b) the very large and toxic lung abscess with a high air-fluid level in the cavity.

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