

[CASE REPORT]

Empyema with Multiple Bronchopleural Fistulae Improved by Bronchial Occlusion Using an Endobronchial Watanabe Spigot with the Push and Slide Method

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Abstract:

The push and slide method is a method of endoscopic bronchial occlusion using an endobronchial Watanabe spigot that facilitates occlusion of the target bronchus rapidly and accurately using a guidewire. We herein report the case of a man who was diagnosed with empyema forming bronchopulmonary fistulae that was successfully treated by endoscopic bronchial occlusion. Because of the multiple fistulae, balloon occlusion was not a favorable therapeutic approach. Instead, the push and slide method was used in order to detect the fistulae. Endoscopic occlusion, particularly that using the push and slide method, may be a valid treatment option for empyema with multiple bronchopulmonary fistulae.

Key words: endobronchial Watanabe spigot (EWS), push and slide method, bronchopleural fistula (BPF), empyema

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Introduction

Endoscopic bronchial occlusion using the endobronchial Watanabe spigot (EWS; Novatech, La Ciotat, France) is a highly effective, minimally invasive procedure for the management of intractable pneumothorax and empyema with persistent bronchopleural fistula (BPF) (1). The push and slide method of EWS placement allows the occlusion of the target bronchus quickly and accurately (2).

We herein report the control of empyema forming multiple BPFs using bronchial occlusion via the push and slide method.

Case Report

A 60-year-old man visited our department with a chief complaint of a fever and productive, worsening cough for the past 2 months. His body temperature was 37.4°C, but his other vital signs were within normal limits. He had a half-a-pack per day smoking habit and no remarkable medical his-

tory except for some dental caries. He was hospitalized.

The patient's white blood cell count was 17,100/ μ L, with 80.4% neutrophils and 10.6% lymphocytes. Serum biochemistry results revealed hypoalbuminemia (1.8 g/dL) and an elevated C-reactive protein level (19.6 mg/dL). His serum fungal antigen test was negative. A chest radiograph demonstrated massive pleural effusion with meniscus sign in the left thoracic cavity and mediastinal shift to the right (Fig. 1a). Computed tomography (CT) of the chest revealed left lung consolidation and hydropneumothorax. Leakage of the pleural fluid into the extrapleural tissues was also noted (Fig. 1b). Thoracentesis was performed, and the thoracentesis fluid was light green, purulent, and malodorous. The fluid grew *Actinomyces* spp. and *Fusobacterium* spp. The fungal and mycobacterial cultures were negative. Based on these results, we made a final diagnosis of anaerobic empyema caused by *Actinomyces* spp. and *Fusobacterium* spp.

Antibiotic therapy was initiated, and odontectomy and tube thoracostomy were performed. Despite these measures, the left lung remained hypoinflated on repeat chest radiograph, and the air leak persisted (Fig. 2a). A second chest

CT scan showed obvious BPFs in several sub-segmental bronchi (B3b, B4b, and B8a; Fig. 3). Due to this finding, we decided to perform endoscopic bronchial occlusion.

Under fluoroscopic guidance, we gently inserted a guidewire (VisiGlide; OLYMPUS, Tokyo, Japan) into the channel of a bronchoscope and confirmed that the tip of the guidewire passed through a fistula and into the chest cavity

(Fig. 4a). The bronchoscope was then withdrawn, leaving the guidewire in place. An EWS (small size) was pierced with an 18-gauge needle and penetrated by the toe of the guidewire. The bronchoscope was reinserted, and the EWS was pushed and slid by the bronchoscope. Spigots were wedged into B3b and B4b using the method described above (Fig. 4b-e) and into B8a by a simple method using a curette. After the procedure, the air leak markedly decreased, and the left lung expanded (Fig. 2b).

Subsequently, pleurodesis with an autologous blood patch was performed on four occasions by day 49 after EWS embolization, and the air leakage completely ceased. The chest tube was removed on day 49, and the patient was discharged from our hospital on day 55 after EWS embolization. At his follow-up two months later, there was no recurrence, and his condition was good (Fig. 2c).

Discussion

Endoscopic bronchial occlusion using an EWS is a highly effective procedure for managing intractable pneumothorax and empyema with persistent BPF (1) and is far less invasive than surgical treatment. The push and slide method, first described by Miyazawa et al., allows for the quick and accurate filling of the target bronchus (2). Although there are reports of three patients being successfully treated by this method (2-4), we were unable to locate any published case reports of empyema with BPF treated with EWS inserted via the push and slide method.

The great advantage of EWS embolization is its low invasiveness, but one disadvantage is the risk of potential complications, such as infection and EWS migration. In general, endoscopic bronchial occlusion is a good treatment option in patients that may be poor surgical candidates. Surgery was considered in our patient because his general health condition was good. Ultimately, however, EWS embolization was chosen because chest CT showed clear BPFs, and the clinical disease progression was chronic. Lois et al. reported that the successful management of BPF with bronchoscopic tech-

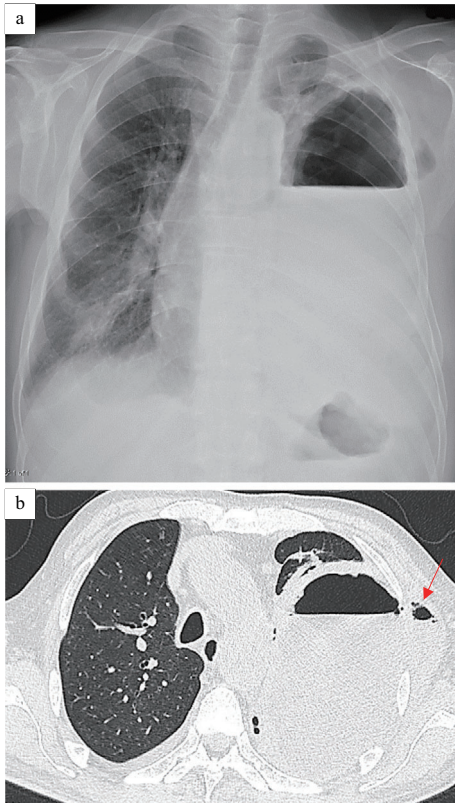


Figure 1. Imaging findings at the time of admission. a) Chest radiograph showing massive pleural effusion with niveau in left thoracic cavity and mediastinal shift to the right. b) Computed tomography images showing left hydropneumothorax and leakage of pleural fluid into the extrapleural tissues (arrow).

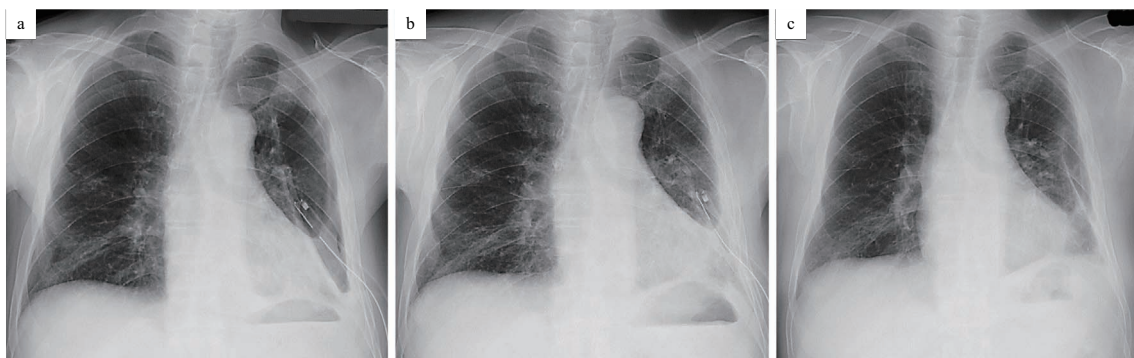


Figure 2. The chronological change in the chest radiographs. a) After introduction of a chest tube, left-sided pneumothorax remained. b) After EWS embolization, the left lung expansion improved. c) One month after removing the chest tube, expansion of the left lung was good. EWS: endobronchial Watanabe spigot

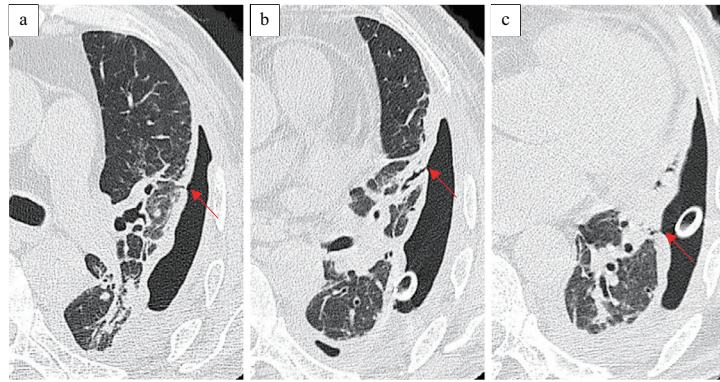


Figure 3. Computed tomography performed after chest drainage revealed multiple BPFs in the a) B3b, b) B4b, and c) B8a bronchi. BPF: bronchopleural fistula

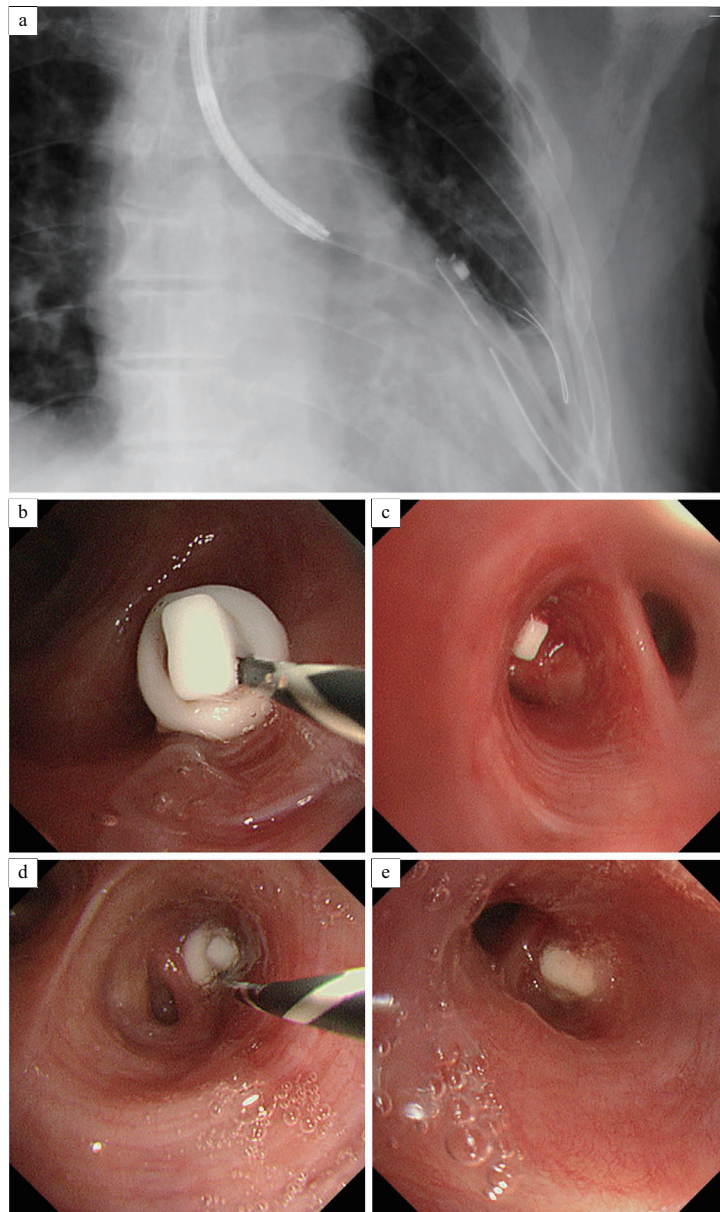


Figure 4. Radioscopic and endoscopic images at the EWS embolization procedure. a) The tip of the guidewire reached the chest cavity via the B4b peripheral fistula and replicated at parietal pleural wall under radioscopic guidance. b, c) The EWS penetrated by the guidewire was pushed and slid using the apex of the endoscope to the target bronchus and wedged into B4b and d, e) B3b. EWS: endobronchial Watanabe spigot

niques requires the demonstration of a fistula on imaging studies or a significant decrease or stop of air leakage on post-occlusion imaging (5). Although our patient was a surgical candidate, EWS embolization is appropriate for the first-line treatment of patients who are poor surgical candidates or who desire less-invasive therapies.

The push and slide method of EWS placement offers several advantages over other treatment alternatives. The primary advantage of this method is the ease of placement into the upper lobe bronchi, which can be difficult to approach with ordinary the grasping method (2, 6). An additional advantage that this case highlighted was the effective location of the perforated bronchus. In our case, we visualized the guidewire as it passed through a BPF, which allowed for faster localization and occlusion of the target bronchus. Although the balloon occlusion test is often useful for identifying the source of an air leak in cases of simple BPF, air leakage continues when only one bronchus is occluded in cases of multiple BPFs, making it difficult to locate the perforated bronchi. Confirming leakage by bronchography and thoracoscope has also been reported (7, 8), but unfortunately, bronchography is time-consuming, and its efficacy depends on the diameter of the BPF. Placing the EWS by the push and slide method allows for a more accurate placement and can be completed quickly. Confirming air leakage by thoracoscopy is a highly accurate option, but this procedure is not the first-line therapy, likely because it is time-consuming and invasive.

Of note, EWS placement by the push and slide method carries a risk of complications. Advancing the guidewire requires vigilance to avoid perforating the peripheral lung tissue during this part of the procedure. A soft-tipped guidewire is recommended to ensure patient safety. It is imperative that the guidewire be gently advanced, and forcibly proceeding should be avoided if friction is sensed. This procedure should also be done under radiographic guidance, as the peripheral lung tissue may be particularly fragile in patients with empyema due to chronic plural inflammation.

The appropriate EWS wedging method should be selected on a case-by-case basis by a trained clinician. In this case, the push and slide method was selected for occlusion of B3 b and B4b because their locations were difficult to approach by the grasping method (1), but a simple method using a curette was chosen for occlusion of B8a because this approach had a shorter procedure time than the grasping method (9). The occlusion method is often chosen based on whether the target bronchus is easy to approach or not. Appropriate procedural planning can improve patient comfort and shorten the duration of the procedure.

It is important to select not only the appropriate wedging method but also the appropriate size of the EWS. Although Watanabe et al. reported that a medium-size EWS was preferred in cases of embolization to the segmental bronchus considering the risk of EWS migration (1), in the present case, a small EWS was selected because chest CT demonstrated obvious BPFs and target bronchi before procedure.

Particularly in cases in which the push and slide method is used, close attention must be practiced when selecting the EWS size, as it can take several attempts to change the size once the spigot has been penetrated by a guidewire during the procedure. It is thus important to measure the diameter of the target bronchial lumen before the procedure, and a medium-size EWS with a low migration risk should be used in the absence of visible BPFs.

Although there is no consensus regarding the safest duration of EWS placement, some reports have shown the long-term safety of indwelling EWS (10, 11). Infection control at the target bronchus is important for EWS with a prolonged duration of indwelling. All EWSs in the present case were placed after achieving infection control by antibiotic therapy. We did not remove the EWS at the two-month follow-up visit because of the risk of recurrence of empyema in this patient. It is important to monitor the chest X-ray and CT findings closely in patients with BPFs.

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

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