Case Report

Flex-rigid pleuroscopic biopsy with the SB knife Jr is a novel technique for diagnosis of malignant or benign fibrothorax

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Abstract: Diagnosing pleural effusion is challenging, especially in patients with malignant or benign fibrothorax, which is difficult to sample using standard flexible forceps (SFF) via flex-rigid pleuroscopy. An adequate sample is crucial for the differential diagnosis of malignant fibrothorax (malignant pleural mesothelioma, metastatic lung carcinoma, etc.) from benign fibrothorax (benign asbestos pleural disease, tuberculous pleuritis, etc.). Novel biopsy techniques are required in flex-rigid pleuroscopy to improve the sample size and quality. The SB knife Jr, which is a scissor forceps that uses a mono-pole high frequency, was developed to allow convenient and accurate resection of larger lesions during endoscopic dissection (ESD). Herein, we report two patients with fibrothorax who underwent a pleural biopsy using an SB knife Jr to investigate the potential use of this tool in flex-rigid pleuroscopy when pleural lesions are difficult to biopsy via SFF. The biopsies were successful, with sufficient size and quality for definitive diagnosis. We also successfully performed adhesiolysis with the SB knife Jr in one case, and adequate biopsies were conducted. No complications were observed. Electrosurgical biopsy with the SB knife Jr during flex-rigid pleuroscopy allowed us to obtain adequate samples for the diagnosis of malignant versus benign fibrothorax, which is usually not possible with SFF. The SB knife Jr also demonstrated a potential use for pleuropulmonary adhesions.

Keywords: Flex-rigid pleuroscopy; SB knife Jr; pleural effusion; fibrothorax; scissor forceps; medical thoracoscopy

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Introduction

Pleural effusion is a common respiratory disease with a challenging diagnosis. Flex-rigid pleuroscopy is an important technique that is successfully used for diagnosing pleural diseases, and its diagnostic yield is similar to that of rigid pleuroscopy (1,2). However, the samples obtained by flex-rigid thoracoscopy are smaller due to the limitations of standard flexible forceps (SFF) (1,2), and the diagnostic yield of the intent-to-treat (ITT) population of flex-rigid thoracoscopy is also lower than that of rigid thoracoscopy (1). An adequate sample is crucial for the differential diagnosis of malignant pleural mesothelioma, which usually presents as fibrothorax originating from benign fibrothorax, such as benign asbestos pleural disease and tuberculous pleuritis (3). Finding an efficient and safe biopsy technique to obtain a larger sample of pleura is a key topic in flex-rigid pleuroscopy. The SB knife Jr, which is a scissor forceps that uses a mono-pole high frequency, was developed to allow convenient and accurate resections of larger lesions during endoscopic dissection (ESD) (4,5). Therefore, we sought to apply the SB knife Jr to pleural biopsies to obtain adequate samples during flex-rigid pleuroscopy. Herein, we report two patients presenting with fibrothorax who underwent

Table 1 Summary of analysis of pleural effusion and tumour markers

Items	Case 1	Case 2
Pleural effusion		
White blood cells (×10^9/L)	950	1,027
Mononuclear cells (%)	85	99
Polymorphonuclear cells (%)	15	1
Red blood cells (×10^{12}/L)	0.04	0.013
Total protein (g/L)	40.0	42.5
LDH (U/mL)	319	317
CEA (ng/mL)	821.32	67.51
NSE (ng/mL)	7.54	8.72
CA19-9 (IU/mL)	6.59	4.61
CA125 (IU/mL)	191.30	648.20
Serum		
Total protein (g/L)	54.5	58.5
LDH (U/mL)	148	169
CEA (ng/mL)	42.21	79.90
NSE (ng/mL)	18.52	17.53
CA19-9 (U/mL)	5.89	6.60
CA125 (U/mL)	13.62	87.64

LDH, lactate dehydrogenase; CEA, carcino-embryonic antigen; NSE, neuron-specific enolase; CA19-9, carbohydrate atigen 19-9; CA125, carbohydrate atigen 125.

a pleural biopsy using the SB knife Jr. To the best of our knowledge, this is the first case report to investigate the potential use of the SB knife Jr as a novel device for pleural biopsy in pleural diseases, which are difficult to biopsy via SFF. Written informed consent was obtained from the patients for publication of this manuscript and any accompanying images.

Case presentation

Case 1

A 46-year-old Chinese man, admitted to our hospital in March 2016, presented with progressive dyspnoea and right chest pain of 2 months duration. Chest computed tomography (CT) showed a solitary nodule located in the right lower lobe, a right pleural effusion and an enlarged mediastinal lymph node. Pleural fluid analysis revealed an exudate; cultures for bacteria, fungi and mycobacteria were negative. Tumour markers and pleural effusion analysis are shown in *Table 1*. The cytopathology of the pleural fluid and the endobronchial ultrasound-guided transbronchial needle aspiration of mediastinal lymph nodes revealed no evidence of malignancy. We performed flex-rigid pleuroscopy (LTF260, Olympus, Tokyo, Japan) under local anaesthesia. Sampling with SFF (FB-55CR-1, Olympus, Tokyo, Japan) failed due to the consistency and smooth surface of the thickened pleura. Therefore, we performed a pleural biopsy using the SB knife Jr (Model: MD-47703W, Sumitomo Bakelite co., Ltd., Tokyo, Japan) (*Figure 1A*). We injected a solution of 2% lidocaine and sodium hyaluronate into the thickened parietal pleura using a sub-mucosal needle to raise the pleura for electrosurgical pleural biopsy (*Figure 1B,C*). We used the SB knife Jr to cut (*Figure 1D*) and dissect the target pleura with an electrosurgical output of 30W in the ENDO CUT mode using a VIO200E (ERBE, Tubingen, Germany); the SB knife Jr can freely rotate 360 degrees, which makes the procedure convenient (*Figure 1E*). Finally, a portion of pleura was incised (*Figure 1F*) and collected using a cryoprobe (*Figure 1G*) with a size of 8 mm × 10 mm (*Figure 1H,I*). The total operation time was approximately 10 min without bleeding or chest pain. The duration of chest tube drainage was 4 days. The pleural biopsy revealed metastatic lung adenocarcinoma, and immunochemical staining showed that the sample was positive for CK, CK7, and TTF-1 and negative for Vimentin, P63, CK5/6, CR, and WT1.

Case 2

A 51-year-old Chinese man, admitted to our hospital in April 2016, presented with cough, haemoptysis, and dyspnoea on exertion of 2 months duration. Chest CT showed a moderate pleural effusion in the left chest cavity and a thickened right pleura. The pleural fluid was bloody; cultures for bacteria, fungi and mycobacteria were negative. The tumour markers are shown in *Table 1*. The C-reactive protein (CRP) level was 45.0 mg/L, and the erythrocyte sedimentation rate (ESR) was 21 cmH_2O. A purified protein derivative (PPD) test and a T-SPOT test were negative. The cytological pathology of the pleural fluid revealed no evidence of malignancy. Flex-rigid pleuroscopy was performed under local anaesthesia. Scattered, whitish, thickened, parietal pleural lesions were observed. Fibrous pleuritis was present within the chest cavity that presented

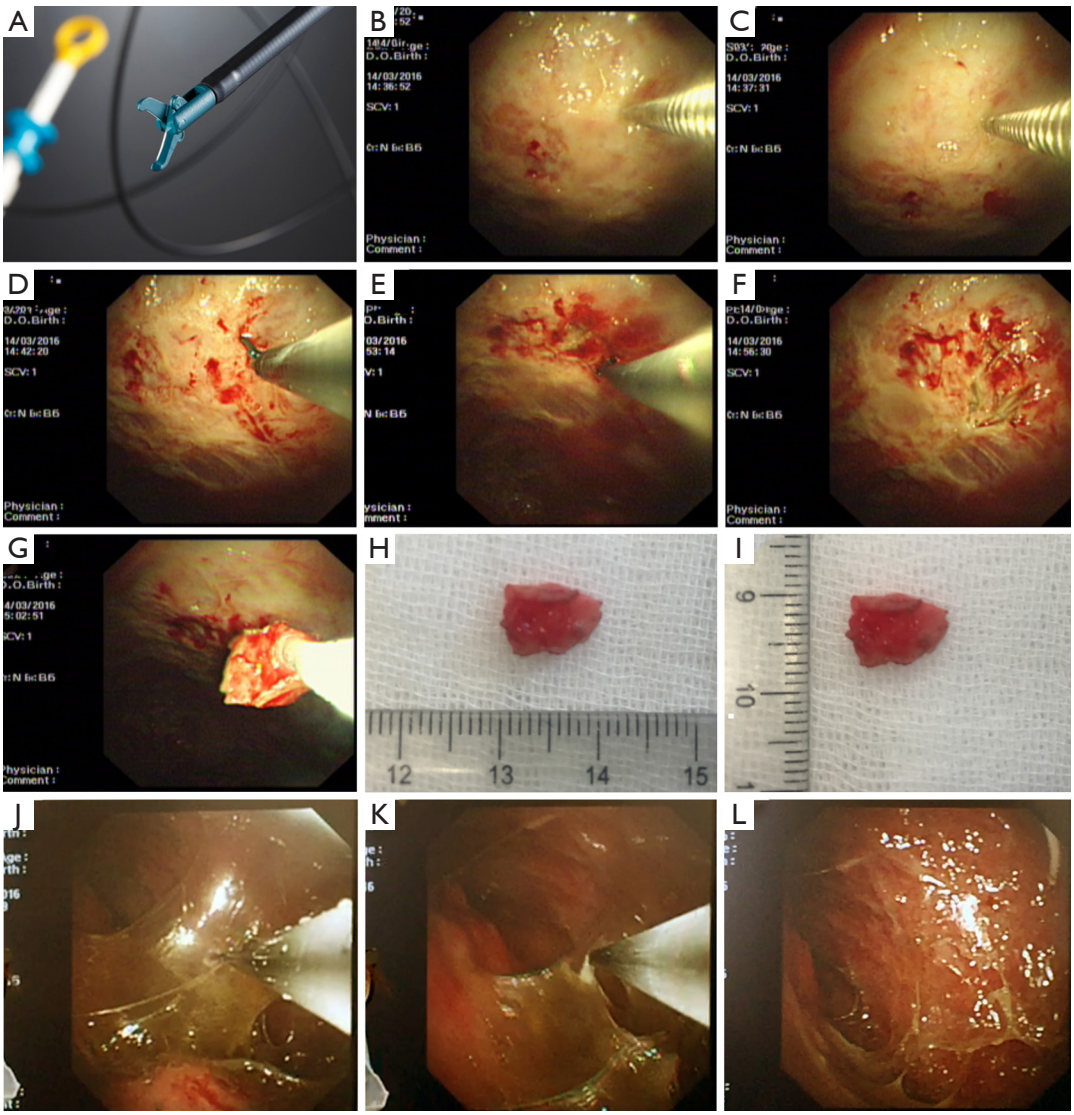

Figure 1 The SB knife Jr and Procedure of pleural biopsy with SB knife Jr. (A) The SB knife Jr is a scissors-type mono-polar electrosurgical knife; (B) a sub-mucosal injection needle was used to access the whitish pleura with fibrin; (C) a sub-mucosal injection with a solution of 2% lidocaine and sodium hyaluronate was used to raise the target pleura; (D) the SB knife Jr was used to incise the target pleura; (E) the SB knife Jr was rotated smoothly by the operator without the rotation of the flex-rigid pleuroscope; (F) the target pleura were incised in 14 min; (G) the pleura were collected by cryoprobe; (H) the long axis of the pleura sample was 10 mm; (I) the short axis of the pleura sample was 8 mm; (J) an obvious pleural adhesion in case 2; (K) incision of a pleural adhesion with the SB knife Jr; (L) the adhesiolysis was completed with the SB knife Jr.

as adhesions between the parietal pleura and visceral pleura (*Figure 1J*). We used the SB knife Jr to perform adhesiolysis (*Figure 1K,L*) and to expose the parietal pleura. Because the pleura was difficult to biopsy with SFF due to their consistency, we used the SB knife Jr to perform electrosurgical cutting and dissection of the pleura. The settings of the instruments were the same as those used in case 1. The incised portion of pleura (13 mm × 9 mm) was collected using a cryoprobe without pleural bleeding or chest pain. The procedure time was approximately 20 min. The duration of chest tube drainage was 6 days. The pathological diagnosis was chronic granuloma with

infiltration of lymphocytes, which suggested a diagnosis of tubercular pleurisy.

Discussion

Flex-rigid pleuroscopy is important in the diagnosis of pleural effusions and is recommended by BTS guidelines for investigation of unilateral pleural effusions in adults (3). However, biopsies with SFF are limited by the size of forceps, which might lack the mechanical strength to obtain pleural specimens of sufficient depth if fibrotic pleura is encountered (6). New techniques have been introduced into medical thoracoscopy to improve the quality and size of samples, such as cryobiopsy (7) and electrocautery (8,9). Sasada et al. introduced the insulation-tipped (IT) knife, which was used in ESD for pleural biopsy and showed a better diagnostic yield than that of SFF. Finding novel techniques to improve the quality and size of biopsies from flex-rigid pleuroscopy remains a key topic for the future. The SB knife Jr is a novel electrosurgical device once used for ESD; this device could realize convenient and accurate resections of larger lesions during ESD. We have introduced this device for pleura biopsies and revealed that it is also effective, safe, and convenient. The SB knife Jr is different from the IT knife, which requires that the user carefully manipulate the rotation of the pleuroscopy. The tip of the SB knife Jr can be smoothly rotated via a torque wire inside the sheath through a full 360 degrees as needed by the operator. Therefore, when performing an incision with the SB knife Jr, the pleuroscopy does not need to be rotated. Less skill is required when using this knife than when using the IT knife.

According to previous studies of the IT knife, the potential complications of the SB knife Jr include chest pain and bleeding. For safety purposes, we carefully performed electrosurgical incisions in raised pleural areas. We did not experience pleural bleeding with our new technique, perhaps because the sub-mucosa was sealed with two blades before being cut. The use of the scissor-type forceps makes it possible to perform haemostasis and dissection procedures at the same time.

Pleuropulmonary adhesions are common in fibrous pleuritis and might cause failure of flex-rigid pleuroscopy (1). Rigid pleuroscopy is the preferred procedure to treat these adhesions. However, flex-rigid pleuroscopy with electrocautery accessories is an alternative. Our experience in case 2 shows that the SB knife Jr has a potential use for adhesiolysis, which enables the biopsy of fibrous pleuritis and also benefits the re-expansion of collapsed lungs, although this indication requires further evaluation.

Our study has limitations. First, our report includes only two cases and only demonstrates the feasibility of the SB knife Jr in pleural biopsy via a flex-rigid pleuroscopy. Second, we did not treat all the pleural adhesions of case 2 and follow up the effect of treatment. It only showed a possibility of using SB knife Jr in pleural adhesiolysis. We hope that a random control study will be performed to explore the efficacy, safety, and best indications of this novel technique.

In conclusion, electrocautery biopsy with the SB knife Jr via flex-rigid pleuroscopy allowed us to obtain adequate samples of malignant or benign fibrothoraxes, which was not possible with SFF. The SB knife Jr also showed potential use for pleuropulmonary adhesions.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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