The Successful Removal of a Broken Needle as an Unusual Complication of Endobronchial Ultrasound-guided Transbronchial Needle Aspiration (EBUS-TBNA): A Case Report and Literature Review

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Abstract: Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is recommended for the diagnosis of mediastinal lymph nodes by the American College of Chest Physicians guidelines; however, the guidelines state that this procedure should only be performed by a trained bronchoscopist. Complications related to needle malfunction during the EBUS-TBNA procedure have recently been reported. We herein describe a rare case involving the successful management of a needle breakage that occurred as an unusual complication of EBUS-TBNA. An 81-year-old male patient with a medical history of myocardial infarction was introduced to our institution to undergo an evaluation for mediastinal and right hilar lymphadenopathy on chest computed tomography (CT). We performed EBUS-TBNA in a 14×10 mm subcarinal lymph node station using a 22 G aspiration needle (NA-201SX-4022, Vizishot®, Olympus, Japan) for diagnosing and staging of the patient’s lung cancer. After the second aspiration, we noticed that the needle tip was broken and that it was stuck in the right main bronchus. We immediately removed the broken needle tip from the right main bronchus by flexible bronchoscopy using an ID 8.5 mm tracheal tube without cuff inflation. The length of the needle tip was 13 mm and it was considerably bent. The EBUS scope did not suffer any apparent damage. The patient did not have any other procedure-related complications. Needle breakage during EBUS-TBNA is rare; however, inhaling or swallowing of a broken needle tip has the potential to cause serious complications. Bronchoscopists should therefore be aware of the possibility of needle breakage, which is an important complication during EBUS-TBNA.

Keywords: endobronchial ultrasonography, transbronchial needle aspiration, needle breakage, lung cancer.

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Introduction

Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is recommended for the diagnosis of mediastinal lymph node lesions by the American College of Chest Physicians (ACCP) guidelines [1] because it is a safer and less invasive method of evaluating mediastinal lymph nodes than mediastinoscopy. Mediastinitis, mediastinal abscess, empyema, and lung abscess have been reported as major complications of EBUS-TBNA in recent years [2, 3], and a few recent reports have also described...
needle malfunction as a complication during EBUS-TBNA [4, 5]; however, there have only been two reported cases of needle breakage during EBUS-TBNA [5, 6]. We herein report a successfully managed case in which needle breakage occurred as an unusual complication of EBUS-TBNA.

Case report

An 81-year-old male patient with a medical history of myocardial infarction showed mediastinal and right hilar lymphadenopathy with two pulmonary nodules in the right lower lobe on chest computed tomography (CT) (Fig. 1). Lung cancer and mediastinal lymph node metastasis were suspected, and EBUS-TBNA was performed (without intubation) in a 14×10 mm subcarinal lymph node station (station #7) for the diagnosis and staging of lung cancer using a 22 G aspiration needle (NA-201SX-4022, Vizishot®, Olympus, Japan). The procedure was performed at the university hospital of the University of Occupational and Environmental Health, Japan. The first aspiration to obtain core tissues was unsuccessful, but, as no complications occurred, we attempted the procedure again. During the second aspiration, we confirmed that the needle had penetrated the target lesion on an EBUS image (Fig. 2), but the needle did not move back and forth smoothly. We therefore removed the fiberscope, and noticed that the tip of the needle was broken and stuck in the right main bronchus (Fig. 3). We subsequently removed the broken needle tip from the right main bronchus by flexible bronchoscopy (1T260, Olympus, Japan) using alligator forceps under temporal tracheal anesthesia.

Fig. 1. Chest contrast-enhanced computed tomography (CT). A. The lung window shows two peripheral lung nodules in the right lower lobe (S’). B. The mediastinal window shows enlarged subcarinal (station #7) lymph nodes (arrow).

Fig. 2. An endobronchial ultrasound (EBUS) image of the mediastinal lymph node. The aspiration needle was stuck in the subcarinal (station #7) lymph node (arrow).

Fig. 3. The broken needle tip was left in the right main bronchus after the second aspiration (arrow).
intubation using a tracheal tube (ID 8.5 mm) without cuff inflation (Fig. 4). No extra-bleeding or any other procedure-related complications were observed. The broken needle tip was 13 mm in length and was considerably bent (Fig. 5). We did not observe any damage to the EBUS scope by the broken needle tip. X ray fluoroscopy after the successful removal of the broken tip revealed no other residual materials. In spite of this trouble, a diagnosis of adenocarcinoma was made, based on the results of cytological and pathological examinations of aspirate specimens obtained from the enlarged mediastinal lymph node. The patient was discharged on the following day without any procedure-related complications.

**Discussion**

EBUS-TBNA is considered to be a safer and less invasive procedure for evaluating mediastinal lesions than mediastinoscopy; however, this procedure can occasionally induce severe infectious complications that require surgical treatment [2, 3]. Among the more than 300 EBUS-TBNA procedures that were performed in our hospital between November 2011 and January 2016, only one patient developed a mediastinal abscess [2] as a serious complication. As previously reported, there is limited information on equipment-related malfunctions in EBUS-TBNA [4–6]. Asano et al focused on complications associated with EBUS-TBNA that were reported by the Japan Society for Respiratory Endoscopy (JSRE) and noted that the breakage of the puncture needle occurred in 15 of 7,345 (0.20%) cases in Japan [7], but the details of this complication were not described.

As shown in Fig. 3, the broken needle tip that was removed from the right main bronchus was considerably bent toward the side of the basal bronchus (Fig. 5). There are three possible reasons as to why needle breakage occurred in the present case, as follows.

First, we used the “push” method during needle aspiration. In this method, the assistant secures the bronchoscope with the patient’s mouth and gives it a little push; at the same time, the operator pushes the needle out to insert the needle into the mediastinal lymph node between the cartilaginous ring on the EBUS image [8]. It is likely that the assistant pushed the aspiration needle more strongly than was necessary at the same time as the operator was pulling the needle out. The assistant in EBUS-TBNA requires a sufficient degree of operational experience to perform the push technique safely, and the ACCP guidelines recommend that physicians should perform more than 25 procedures of EBUS-TBNA per year to maintain their capacity to perform it [9], but, unfortunately, the assistant did not have sufficient experience. With regard to other methods, Inoue et al reported that the diagnostic yield of EBUS-TBNA was improved by the “outer sheath” method [10], in which the hyperechoic line appears on the surface of the bronchial wall on the EBUS image when the outer sheath of the puncture needle is pressed against the bronchial wall. Then, by pushing and pulling the bronchoscope, the tip of the outer sheath is moved to the epithelium.
above the bronchial cartilage while detecting the best position for puncture on the EBUS images, as the operator can visualize the cartilage movement on the EBUS image. The movement of cartilage stops when the tip of the outer sheath is caught in a concavity between cartilaginous rings [10]. Although the “push” method can be more easily performed and is more widely used than the “outer sheath” method, needle breakage can occur due to an excessive load on the needle tip.

As shown in Fig. 6, we simulated the “push” method using the same bronchoscope and needle in this case. The needle tip was inserted straight, according to the normal TBNA procedure (Fig. 6A); however, the tip of the needle was bent when performing the “push” method (Fig. 6B). Thus, although the “push” method is widely used, it is thought that it may be associated with the rare breakage of the needle tip. In recent years, the selection of EBUS-TBNA sampling devices has increased. Some studies have compared aspiration needles for histological sampling during EBUS-TBNA, but no studies have revealed any associations between these devices and the incidence of complications [11, 12]. Although the 22G aspiration needle (NA-201SX-4022, Vizishot®, Olympus, Japan) used in this case was made of stainless steel, it might have been possible to avoid needle breakage if the tip of the aspiration needle had been harder and more resilient to deformation.

Second, it is possible that the durability of the needle was reduced by pulling out the stylet. We often pull the stylet back by 10–15 mm before puncture to make it easier to perform the puncture, as the length of the stylet is slightly longer than the inner blade. In this case, the length of the broken needle tip was 13 mm, which corresponded to the length of the stylet that was pulled out from the inner blade.

Third, puncturing a ‘hard’ lymph node might bend or break the tip of the aspiration needle. In the present case, however, the first puncture was successful and the needle movement was smooth. Thus, it is unlikely that the hardness of the target lymph node caused the breakage of the needle in the present case.

The aspiration needle we used in this case had a dimpled echogenic area to improve visibility on ultrasound images (Fig. 7). Özgül et al reported that the design might be damaged or become thinner during puncture [5]. The broken needle tip in our case, however, was not close to the dimpled area; therefore, the dimpled area was not related to the needle breakage. Özgül et al also reported that the broken needle tip was

Fig. 6. A simulation of the puncture in EBUS-TBNA using the same bronchoscope and needle. A. A normal aspiration model. B. A model of aspiration under tension. In B., the needle tip is slightly bent in comparison to the straight line (blue dotted line).

Fig. 7. The aspiration needle (NA-201SX-4022, Vizishot®, Olympus, Japan) has a dimpled echogenic area.
found in the transverse colon on abdominal X ray and that follow-up was required [5]. In the present case, we were able to find the broken needle tip soon after the first EBUS-TBNA procedure because it was stuck in the right main bronchus. By subsequently administering appropriate treatment, we were able to ensure that the broken needle tip was not left in the patient's body.

In conclusion, needle breakage is a rare complication during EBUS-TBNA, but this complication can be potentially severe if the broken needle tip moves into the peripheral bronchus or is swallowed. Bronchoscopists should be aware that needle breakage is an important complication during EBUS-TBNA.

**Conflicts of Interest**

The authors declare no conflicts of interest.

**References**

超音波気管支鏡ガイド下針生検での稀な合併症である破損穿刺針の除去に成功した1例：症例報告と文献的考察

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要旨：超音波気管支鏡ガイド下針生検（EBUS-TBNA）は，アメリカ胸部医学会のガイドラインにおいて，縦隔リンパ節の診断に推奨されている。しかしながら，そのガイドラインには熟練した気管支鏡医によって施行される場合でのみと記されている。近年EBUS-TBNA施行時の穿刺針の故障に関連した合併症が報告されている。我々はEBUS-TBNAの珍しい合併症である破損穿刺針の除去に成功した稀な1例を報告する。症例は心筋梗塞の既往がある81歳男性であり，胸部CTにて縦隔リンパ節，右肺門リンパ節腫大の精査を行うために当院を紹介受診された。その患者の肺腫の診断とステージングのために22ゲージの穿刺針（NA-201SX-4022, Vizishot®, Olympus, Japan）を用いて気管分岐部リンパ節に対してEBUS-TBNAを行った。2回目の穿刺の後，我々は針先が破損し，右主気管支に突き刺さっていることに気がついた。我々は，ただちに内径8.5 mmのカフなし挿管チューブ挿入下に軟性気管支鏡を用いて破損した針先を除去した。針先の長さは13 mmであり，明らかに曲がっていた。なお，EBUSスコープに損傷はなく，本症例において他に処置に関連した合併症はなかった。EBUS-TBNA施行時の穿刺針の破損は稀である。しかしながら，破損した針先を吸い込んだり，飲み込むことで重大な合併症を引き起こす可能性がある。それゆえ，気管支鏡医はEBUS-TBNAにおける重要な合併症として，穿刺針が破損する可能性を知っておかなければならない。

キーワード：超音波内視鏡，経気管針生検，穿刺針破損，肺がん。