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Do respiratory comorbidities limit the diagnostic usefulness of ultrasound-guided needle aspiration for subpleural lesions?

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ABSTRACT

Background: The usefulness of ultrasound-guided needle aspiration for subpleural lesions has been reported. However, no reports have evaluated its usefulness and safety in patients with respiratory comorbidities such as chronic obstructive pulmonary disease (COPD) and interstitial pneumonia (IP), which can increase the risk of iatrogenic pneumothorax. In this study, we evaluated the influence of chronic respiratory diseases (CRDs) on the usefulness and safety of ultrasound-guided needle aspiration for subpleural lesions.

Methods: Between January 2000 and September 2011, we examined 144 patients with intrapulmonary subpleural lesions. We retrospectively reviewed clinical data, including lesion size on thoracic computed tomography (CT), ultrasound findings, pathological findings obtained by ultrasound-guided needle aspiration, final diagnosis, and complications.

Results: A positive definitive diagnosis was obtained in 74.3% of all 144 patients; 84.7% patients with malignant diseases, including lung cancer; and 26.9% patients with benign diseases. Of the 144 patients, 64 belonged to the CRD group and 80 to the non-CRD group. The former included 31 patients with COPD, six with emphysematous changes on thoracic CT, 17 with IP, and 10 with other diseases. The positive rate of diagnosis for malignant diseases was 84.7% in the CRD group, which was the same as that in the non-CRD group. With regard to complications related to ultrasound-guided aspiration, there were only two cases of pneumothorax in the CRD group and one in the non-CRD group.

Conclusion: Ultrasound-guided aspiration is safe and useful for subpleural lesions, particularly malignant lesions, even in patients with respiratory comorbidities such as COPD and IP.

Abbreviations: US, ultrasonography; COPD, chronic obstructive pulmonary disease; IP, interstitial pneumonia; CPFE, combined pulmonary fibrosis and emphysema

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1. Introduction

With the advent of improved diagnostic imaging modalities such as high-resolution computed tomography (HRCT), the number of patients who undergo surgical resection for undiagnosed intrapulmonary lesions is increasing. However, the surgical risk for elderly patients and patients with comorbidities is high; therefore, these patients should be diagnosed using minimally invasive and safe methods.

When diagnosis cannot be determined using bronchoscopy for intrapulmonary lesions, computed tomography (CT)-guided needle biopsy is commonly performed. However, during needle biopsy for intrapulmonary lesions under respiratory movement, the needle reaches the target lesion through the adjacent normal lung, which increases the risk of pneumothorax and intrapulmonary hemorrhage [1–6]. Therefore, it is sometimes difficult to perform CT-guided biopsy in patients with emphysematous or fibrotic changes in the lung around the target lesion.

The usefulness and safety of ultrasound-guided needle aspiration for subpleural lesions, defined as lesions contacting the visceral pleura, have been reported [7–9]. We generally perform needle aspiration under ultrasound guidance even in patients with respiratory comorbidities such as chronic obstructive pulmonary disease (COPD) or interstitial pneumonia (IP), in whom the risk of pneumothorax associated with percutaneous puncture is considered to be high. However, there are no reports describing the usefulness and safety of ultrasound-guided needle aspiration for such cases. In the present study, we evaluated the influence of respiratory comorbidities, i.e., chronic respiratory diseases (CRDs), on the usefulness and safety of ultrasound-guided needle aspiration for the diagnosis of subpleural lesions.

2. Materials and method

2.1. Patients

We perform ultrasound-guided needle aspiration for patients with subpleural lesions abutting the visceral pleura with an accessible “ultrasound window”, patients who cooperate during the examination, and patients who can hold their breath for 10–15 s. Between January 2000 and September 2011, we investigated 144 patients who underwent ultrasound-guided needle aspiration for intrapulmonary subpleural lesions. All 144 patients met the following inclusion criteria: evaluable thoracic CT findings; detailed pathological findings; and available medical records of the clinical course during the follow-up period. We defined the CRD group as patients with emphysematous, cystic, or interstitial changes around the intrapulmonary lesion on thoracic CT.

We evaluated the patients' characteristics, radiological findings on both thoracic CT and ultrasonography (US), other diagnostic findings obtained before ultrasound-guided aspiration, diagnostic accuracy, final diagnosis, and complications. The final diagnoses in patients without surgical indications were made on the basis of pathological findings using biopsy samples. On the other hand, in patients who underwent surgical resection, the final diagnoses were established using surgical specimens. When the abnormal shadow spontaneously disappeared after needle aspiration in undiagnosed patients, we classified these lesions into benign disease with inflammatory changes.

Using these data, we retrospectively reviewed the medical records of all 144 patients and compared the usefulness and safety of ultrasound-guided aspiration between the CRD and non-CRD group.

Patient data were used after obtaining comprehensive consent from the patients and approval of the local ethics committee of our institution (Approval date: March 22, 2013; Approved #: 24-619).

2.2. US examination

Thoracic US was performed using a commercially available ultrasound unit (SSA-550A, Toshiba, Tokyo, Japan). We used an 8-MHz convex type probe (PLM-805AT; Toshiba, Tokyo, Japan) for the observation of lesions and 3.75-MHz linear type probe (PLF-308P; Toshiba, Tokyo, Japan) for ultrasound-guided aspiration. The method of ultrasound-guided aspiration used was as follows. After the induction of subcutaneous local anesthesia using lidocaine hydrochloride, a metallic needle (0.8-mm inner diameter, 1-mm outer diameter, and 150-mm length; Takei Medical & Optical; Tokyo, Japan) was introduced and advanced under ultrasound guidance. After anesthetizing the region above the parietal pleura, the injector syringe was removed and a 20-mL syringe was fixed to the one-handed grip aspirator. The patient was instructed to stop breathing to allow the needle to be positioned just above the lesion. The needle was then advanced into the lesion. With negative pressure generated by the aspirator, the needle was moved up and down in the lesion during aspiration. Adequate puncture of the lesions was confirmed by the appearance of a high echoic spot within the lesion on monitor imaging. The aspirate was smeared and fixed with ethanol for cytology. Then, the residue of aspirate in the needle was washed with saline and submitted for cytology, laboratory culture, and testing for fungal antigens such as Cryptococcus. When the tissue specimen obtained from the lesion was small, ultrasound-guided biopsy using a biopsy needle (normally 19G) was performed for lesions >10 mm in size. These tissue specimens were fixed by formalin and submitted for pathology. Chest radiography was subsequently performed to evaluate the occurrence of iatrogenic pneumothorax or intrapulmonary hemorrhage.

2.3. Statistics

Statistical analysis was conducted using SSPP (IBM, USA, New York) version 19. For the comparison of patients'

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