Introduction

Transbronchial biopsy (TBB) with the aid of radial endobronchial ultrasound (R-EBUS) had long been demonstrated to have a good diagnostic performance for peripheral pulmonary lesions (PPL) [1]. Almost 10 years ago, Kurimoto et al. introduced endobronchial ultrasound with a guide sheath (EBUS-GS) to augment diagnostic bronchoscopy for GGO lesions, especially the pure type without a solid component, is not commonly performed because most respiratory physicians recognize that GGO cannot be visualized on fluoroscopy or is undetectable by EBUS. In fact, several studies on bronchoscopic diagnosis of solid pulmonary nodules have already been published but only a few studies on GGO were reported [3].

A lung adenocarcinoma that presents as ground glass opacity (GGO) on computed tomography (CT) screening is often detected these days [4], but majority of the patients either undergo surgical resection or are observed without definitive diagnosis. However, diagnostic bronchoscopy for GGO lesions, especially the pure type without a solid component, is not commonly performed because most respiratory physicians recognize that GGO cannot be visualized on fluoroscopy or is undetectable by EBUS. In fact, several studies on bronchoscopic diagnosis of solid pulmonary nodules have already been published but only a few studies on GGO were reported [5].

Keywords:
Endobronchial ultrasound with a guide sheath
Ground glass opacity
Peripheral pulmonary lesion
Blizzard Sign

We report a case of lung adenocarcinoma presenting as pure ground glass opacity (GGO) and diagnosed by bronchoscopy with the use endobronchial ultrasound with a guide sheath (EBUS-GS). The lesion was indistinguishable by real-time fluoroscopy but simultaneous endobronchial ultrasound scanning of the involved lung segment showed a hyperechoic shadow that was subtly more intense than a typical snowstorm appearance when scanning normal alveolar tissue. Transbronchial biopsy from this area revealed adenocarcinoma with lepidic growth.

On hindsight, it was the aforementioned ultrasound pattern that helped us decide the sampling site for EBUS-GS guided TBB when fluoroscopy was equivocal. We hypothesize that this pattern is specific for GGO and we name it the Blizzard Sign.

Case presentation

The representative case is that of an 81-year old female, non-smoker, with a 35 mm pure ground glass opacity (GGO) in the right lower lobe that was incidentally seen on computed tomography (CT) scan of the chest (Fig. 1A) but was indistinct on chest radiograph (Fig. 1B). The endobronchial route was carefully planned prior to bronchoscopy using 1-mm cross-sectional CT scan images and the topographical location of the target lesion on the coronal plane was mapped out on chest tomosynthesis. The patient underwent diagnostic bronchoscopy (1T260, Olympus) using radial EBUS (UM-S20-20R, Olympus) with large type GS (K-203, Olympus). Fluoroscopy was used concomitantly with endobronchial ultrasound scanning to find the target. During the initial attempt, it was difficult to distinguish the mass on fluoroscopy (Fig. 2A) and ultrasound signals only generated a snowstorm appearance that was ascribed as normal lung tissue (Fig. 2B). But we were certain that we were in the intended lung segment so the ultrasound probe was inserted more distally. At this point, a subtle but noticeable enhancement and increase in
area of the snowstorm appearance was seen (Fig. 2C). After marking this location of the GS on fluoroscopy, seven TBB samples were obtained using a dedicated biopsy forceps with guide sheath kit (Fig. 2D). Histopathologic examination of the 3rd to the 7th consecutive biopsy specimens revealed adenocarcinoma with lepidic growth (Fig. 3). The patient was staged as T2aN0M0 but refused further treatment.

Discussion

In this case report, the EBUS image of the pure GGO lesion was an ill-defined signal that was more intense than the snowstorm appearance of normal lung tissue. Using this as a confirmation of the desired GS location, we were able to successfully diagnose the tumor by TBB. When lesions in the lung adenocarcinoma spectrum have a ground glass component, majority of the lesions are pathologically classified as either one of the following: adenocarcinoma in situ (AIS), minimally invasive carcinoma (MIA), and lepidic predominant adenocarcinoma [6]. Based on our preliminary, unpublished data, 80% (12 out 15) of patients with GGO, who were diagnosed by EBUS-GS and surgically confirmed as AIS, MIA, or lepidic predominant adenocarcinoma, had EBUS findings that were similar to this report. The average number of specimens that we obtained in this series and what we also recommend is at least five.

We observed that this EBUS pattern for GGO has several characteristics. First, the change in the ultrasound signal from normal lung tissue to the ground glass area is similar to a whiteout, albeit subtle. Second, this signal traverses an area that is greater than that of normal alveolar tissue. Based on our experience, the radius from
the probe to the periphery of the acoustic shadow is usually more than 1 cm while that of the surrounding normal lung parenchyma is less than 1 cm. Third, the character of the signals are generally more coarse compared to the typical snowstorm appearance. We designated the name Blizzard Sign for this combination of characteristics as a specific EBUS finding for GGO.

GGO patterns on CT scan are divided into pure, heterogeneous, or mixed type. In mixed type GGO, the solid component is generally detected on EBUS scanning as a well-defined signal with hyper-echoic dots. The ground glass attenuation usually surrounds the periphery of the lesion and demonstrates the Blizzard Sign just described.

In this case, definitive diagnosis was successfully obtained from seven TBB specimens by using the usual 1.8 mm biopsy forceps included in the K-203 Guide Sheath Kit (Olympus). We underscore the importance of using this biopsy forceps, particularly for pure GGO, to preserve the structural integrity of the tissues. We suppose that doing so would facilitate a more comprehensive histopathologic examination of the ground glass tissue sample, especially for identifying AIS or MIA, which often exhibit weak cellular atypia. Most physicians commonly use small guide sheath kit (K-201) when approaching peripheral lesions but from our experience it often fails to provide adequate amount of tissues. A usual 1.8 mm biopsy forceps with large guide sheath (K-203) is favored in obtaining the desired quality of specimens compared to the small one.

In conclusion, Blizzard Sign on EBUS was found to be useful for detecting GGO, especially the pure type, during bronchoscopy even if the lesion was not visualized by fluoroscopy.

Ethical issues

This study was approved by the hospital’s Institutional Review Board and Ethics Committee; informed consent was sought from the patients.

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