Editorial

The many facets of diagnostic bronchoscopy for pulmonary ground glass nodules

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The recent years have witnessed a paradigm shift in the detection and management of pulmonary nodules, especially with regard to developments in imaging and biopsy modalities (1). Several investigators have demonstrated the use of three basic approaches for the diagnosis of peripheral pulmonary lesions: surgical, transbronchial, and transthoracic (2). The recent use of image guidance has particularly improved the yield of transbronchial biopsy (TBB) for pulmonary lesions, including those in the peripheral subsegments (3-5).

There has also been emerging interest in pulmonary ground glass opacities (GGOs), especially the focal type. Although majority of GGOs are benign, those that have a high probability of malignancy warrant biopsy or resection (6). Similar to solid pulmonary peripheral lesions (PPLs), GGOs can be diagnosed in varied ways. Computed tomography (CT)-guided percutaneous biopsy of such lesions had been shown to be accurate (7), but the risk for complications, such as pneumothorax, is not negligible (8). On the other hand, TBB for GGOs has been an emerging modality with good yield and safety profile (9). Several investigators have published their results on the factors that affect the yield of TBB for GGOs (10-12). Indeed, there are many aspects that could affect the accurate diagnosis of GGOs.

Aspects of biopsy

Following the decision to proceed with pathologic confirmation of a GGO, the first factor to consider is the presentation of GGO on CT scan with regard to location, size, and presence of a bronchus sign (13).

Next is planning the bronchial route to the GGO. Needless to say, one can never go wrong with mastering the basic anatomy of the bronchial tree on endoscopy and CT images. In fact, this should be a prerequisite for residents, pulmonary fellows, aspiring bronchoscopists, as well as interventional pulmonologists in practice before attempting to use navigation systems that are generated by machines, which could malfunction anytime. For machine-generated virtual bronchoscopic navigation (VBN), several systems are now available. Studies have shown the efficacy of VBN for lesions (4,14-16). Electromagnetic navigation bronchoscopy is another modality for image guidance (17,18). However, one also needs to consider the cost of these navigation systems and determine whether the added benefits outweigh the additional monetary expenses.

In the past several years, X-ray fluoroscopy had been commonly employed to determine the lung field during TBB; however, precise localization of a PPL has not always been possible leading to low diagnostic yield (1). For GGOs, the value of X-ray fluoroscopy even becomes less. We have previously reported the use of tomosynthesis instead for

GGOs (10). The value of virtual X-ray fluoroscopy and CT fluoroscopy has potential but remains to be known. The advent of EBUS has dramatically increased precise bronchoscopic confirmation of the location of a PPL before sampling (19). In particular, the radial probe EBUS is used to indicate that a lesion has been reached. For solid PPLs, Kurimoto *et al.* have described three major types of echogenicities that might differentiate between benignity and malignancy (20). For GGOs, we have observed constant R-EBUS patterns that we called blizzard and mixed blizzard signs (12). This blizzard sign seems to be the same pattern that Shinagawa et al have described in their previous reports (11).

One does not stop with precise localization of a PPL because correct sampling procedures are equally important. For non-surgical diagnosis of GGOs, especially those that are malignant, sufficient evaluation of tissue architecture had been emphasized. Although the use of large biopsy forceps seems to yield better for this purpose, size of biopsy forceps has been shown to not affect the diagnostic yield for PPLs (21). The same is true for size of the bronchoscope used. The use of GS-TBNA had been demonstrated for solid PPLs but not for GGOs alone (22). Use of ROSE, however, these studies comprised solid PPLs more than GGOs (23). Further studies that focus on GGOs in a larger number and that take into account these factors are needed. In addition, the potential of emerging techniques, such as cryobiopsy, needs to be explored (24).

Last but not least, careful and accurate pathologic examination of the collected samples should not be underestimated. Lung cancer at its beginning stages usually manifests as GGOs on CT scan; due to the fact that pathologic diagnosis of *in situ* or minimally invasive lung cancer is relatively new, histopathologic examination of small biopsy samples will need expertise and standard protocols (25).

In summary, along with the emerging interest in pulmonary focal GGOs, especially with regard to diagnosis of lung cancer in its beginning histologic stages, the procedural approaches need to constantly evolve. For bronchoscopy, specifically TBB, individualized standards on procedural technicalities are needed in order to achieve a diagnostic performance that can be reproducible worldwide. For every institution, simultaneous multidisciplinary improvement in expertise and skills—from indications for performing biopsy, procedural techniques, to pathologic evaluation—is underscored.

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Footnote

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

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