Bronchoscopic Diagnosis of Peripheral Lung Lesions

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Following the finding in the National Lung Screening Trial in the USA and the Dutch-Belgian NELSON trial in Europe that lung cancer screening with low-dose computed tomography can reduce lung cancer by 20–24% in high-risk smokers, lung cancer screening has been implemented around the world [1, 2]. Sixty to eighty percent of the lung cancers found on the baseline screening low-dose computed tomography are ≤ 2 cm [3–5]. In repeat screening, 76–87% of the lung cancers are ≤ 2 cm [4, 6, 7]. With an average diagnostic yield of 34%, conventional flexible bronchoscopy techniques have a limited role in the evaluation of peripheral pulmonary nodules ≤ 2 cm [8]. To improve the accuracy of bronchoscopic diagnosis, virtual bronchoscopy with or without electromagnetic navigation (EMN) to guide insertion of the bronchoscope toward the target lesion, thin or ultrathin bronchoscopes to visualize the lesion or get as closed to the lesion as possible, and confirmation of arrival at the target before tissue sampling using radial endoscopic ultrasound (R-EBUS), fluoroscopy, CT, cone beam CT or a combination of R-EBUS, and radiology imaging are used. A recent meta-analysis of

R-EBUS-guided bronchoscopy showed a pooled sensitivity of 0.72 (95% CI 0.70–0.75) [9]. There was no association between sensitivity and the use of virtual bronchoscopy or fluoroscopy. Another meta-analysis comparing the performance of R-EBUS and EMN showed a similar diagnostic accuracy for malignant nodules between the 2 techniques; 72.4% (95% CI 68.7–76.1 for R-EBUS) and 76.4% (95% CI 70.8–82.0 for EMN) [10]. The role of virtual bronchoscopy, R-EBUS, fluoroscopy-guided bronchoscopy using a 3.0-mm ultrathin bronchoscope without a guide sheath (GS) versus a 4.0-mm thin bronchoscope with a GS was compared in a randomized trial. The diagnostic yield was significantly higher in the ultrathin bronchoscope group than that in the thin bronchoscope group (70.1 vs. 58.7%, respectively; $p = 0.027$) [11]. More recently, robotic-assisted bronchoscopy techniques have been associated with improved reach of target lesions. Successful localization with R-EBUS was 96%. However, the diagnostic yield for concentric lesion was 80.6%; for eccentric lesion, it was 70% [12]. The discrepancy between the successful target localization rate of over 90%

and a diagnostic yield of 70–80% in the R-EBUS and robotic bronchoscopy studies have not been adequately explained.

The bronchoscopy-pathology correlation study by Fukada and colleagues [13] reported in this issue provides an explanation as to why tissue sampling after arrival at the target lesion with confirmation by R-EBUS may not yield a diagnosis. The investigators used a physiological saline injection technique to dilate the small peripheral airways, leading the tumor to allow clearer observation of the endo-luminal features and then classified them into a stenotic or nonstenotic type and to determine if the tumor was exposed on the surface or submucosal with an intact ciliated epithelium as reflected by a light blue line using narrow band imaging. The latter cannot be done using a 3-mm ultrathin bronchoscope, but an intact epithelium can be recognized on white light examination. As can be expected, the diagnostic yield of bronchial brush and bronchial wash cytology was much lower with the nonexposed tumor types, most of them being adenocarcinomas. The ability to visualize the tumor using an ultrathin bronchoscope to take a biopsy using forceps or TBNA explains the better diagnostic yield than a “blind” biopsy using a GS after removal of the R-EBUS probe [11]. The R-EBUS image can appear to be concentric or eccentric, but the biopsy can be nondiagnostic when the tumor is of the nonexposed type, especially if the airway is nonstenotic. In a robotic bronchoscopy study where a flexible 19- to 23-G needles was used for transbronchial needle aspiration along with conventional biopsy tools

where the needle can sample submucosal or peribronchial lesions, the difference between reaching the target lesions and a positive diagnosis of malignancy was smaller – 97 and 88%, respectively [14]. The alternative is to access the nodule by penetrating through the bronchus at an appropriate location and traversing the lung parenchyma to sample the nodule [15, 16]. This technique may offer a simpler direct route to the nodule but has the potential greater risk of bleeding.

The findings of the study by Fukada and colleagues [13] have practical implications. The use of ultrathin bronchoscopes and injection of physiological saline to dilate the small peripheral airways leading the tumor to allow clearer observation of the endo-luminal features to position forceps or TBNA needles for tissue sampling should lead to a higher diagnostic yield of small peripheral tumors [17].

Conflict of Interest Statement

The authors have no conflict of interest to declare.

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Author Contributions

Dr. Lam and Dr. Shah contribute equally to the paper.

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