Editorial

Transthoracic lung biopsy: diagnostic accuracy and complications

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Small peripheral pulmonary lesions are increasingly being detected because of the development of radiological technologies and frequent computed tomography (CT) screening for lung cancer. Non-surgical diagnostic methods for peripheral lung nodules include transthoracic lung biopsy (TTLB) (e.g., CT-, fluoroscopy-, and ultrasound-guided lung biopsy), and transbronchial lung biopsy (e.g., bronchoscopy).

The diagnostic sensitivity of bronchoscopy is lower for small peripheral than central pulmonary lesions. Previously, fluoroscopy was the only method available to confirm that the biopsy needle had reached the target lesion during bronchoscopy. However, two-dimensional fluoroscopy does not accurately visualize the spatial relationship between the biopsy needle and the target lesion. Additionally, certain lesions (e.g., ground glass nodules and lesions obscured by mediastinal structures) are not easily visualized on fluoroscopy, making their diagnosis difficult. Radial probe endobronchial ultrasound can be used to confirm that the biopsy instrument has reached the lesion. Furthermore, navigation systems have been used to visualize the bronchial pathway to the target lesion. These two techniques have improved the diagnostic yield of bronchoscopic lung biopsy for peripheral pulmonary lesions (1).

TTLB has long been used for the diagnosis of nodular shadows in the lung periphery. It involves percutaneous puncture of the lung target lesion under CT or ultrasound guidance to collect tissue. A thin or thick needle for aspiration cytology may be used to perform fine-needle aspiration (FNA) or cutting-needle core biopsy (CNCB), respectively. The sensitivity and false positive rate of TTLB for malignancy is >90% and 1–2%, respectively (2). However, the false negative rate is high (20–30%). Therefore, although TTLB is useful for the definitive diagnosis of malignancy, it cannot exclude the diagnosis (2). The sensitivity of TTLB depends on the nodule size, imaging technique (CT or fluoroscopy), needle size (especially important for diagnosing lymphoma and benign), number of needle passes, and availability of rapid cytology (2). Similar to bronchoscopic lung biopsy, TTLB is less sensitive when the nodule size is <20 mm, with a sensitivity of 78% for nodule size <15 mm (3,4). CT- and fluoroscopy-guided TTLB has a sensitivity of 92% and 88%, respectively (2).

Complications are more common with TTLB than with bronchoscopy. And complications of TTLB with CNCB are more frequent (38.8%) than with FNA (24.0%) (5). The complications of TTLB include air embolism, post-examination pleural seeding, hemoptysis, and pneumothorax. Air embolism is an infrequent (<0.21%) but fatal complication (6,7). Risk factors for air embolism include deep needle puncture, supine position, puncture above the left atrium, and endotracheal intubation. There was no significantly increased risk of air embolism with needle passage through the lung field, although it was associated with a trend toward increased risk (8). In patients with stage I lung cancer, TTLB was associated with more than a 2-fold increased risk of postoperative pleural recurrence and, in patients younger than 55 years, with reduced time to recurrence and overall survival (9). Bleeding occurred in 4.1% and 1.7% of cases of CNCB and

FNA, respectively (5).

The most common complication of TTLB is pneumothorax. It occurs in 25.3% and 18.8% of cases of TTLB with CNCB and FNA, respectively, requiring chest drainage in 5.6% and 4.3%, respectively (5). Old age, smoking, chronic obstructive pulmonary disease, small lesion size, target lesion distant from the chest wall, need to penetrate between the lobes, and the number of punctures increase the risk of pneumothorax after TTLB (10-16). Injection of blood, collagen, fibrin glue, or saline into the puncture hole may prevents pneumothorax during TTLB. The first study of injection of blood into the puncture hole was published in 1988 and did not find any difference in the incidence of pneumothorax (17). Although it is unclear whether blood infusion prevents pneumothorax, the incidence of pneumothorax is significantly lower with infusion of collagen (8% *vs.* 28%), fibrin glue (19.2% *vs.* 40.6%), and saline (6.2–8.0% *vs.* 26.1–34.0%) (18-22).

Gadaleta *et al.* clarified that percutaneous lung biopsy using a new device MIPP-Kit PNX reduces the incidence of adverse events, such as pneumothorax, pulmonary hemorrhage, hemothorax, and chest wall hematoma, compared to conventional methods (23). The MIPP-Kit PNX is designed to inject BioGlue, an adhesive made from a mixture of bovine serum albumin and glutaraldehyde, into a lesion after a needle puncture and tissue collection with CT guidance. This specialized kit allows the two aforementioned agents to be mixed at the target site. The pleural defect may be particularly wide in cases of lesion distant from the chest wall, multiple punctures, or chronic obstructive pulmonary disease. In such cases, MIPP-kit can rapidly fill the TTLB pleural defect with BioGlue to prevent pneumothorax and hemothorax, thereby increasing the safety of TTLB and reducing the associated medical costs. A large-scale prospective study is required to confirm the benefit of this kit.

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