Value of Ultrasound in the Imaging-Guided Transthoracic Biopsy of Lung Lesions

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Transthoracic needle biopsy with fluoroscopic or computed tomographic guidance is a well-established and safe method for diagnosing malignant and benign thoracic lesions. Nonetheless, ultrasound is as effective as computed tomography for the guidance of transthoracic biopsies of peripheral pulmonary lesions and mediastinal tumors, and it offers some advantages. In this case report, we exemplify the proper use of ultrasound for the percutaneous biopsy of a lung lesion, aiming to show that it can be a safe, inexpensive, rapid, and effective alternative to CT in appropriate cases.


Imaging-guided percutaneous transthoracic biopsy is performed most frequently by a radiologist [1] and has become a widely accepted and effective minimally invasive technique for the diagnosis of a variety of intrathoracic lesions that are not readily accessible with bronchoscopy [2]. Transthoracic needle biopsy with fluoroscopic or computed tomographic (CT) guidance is a well-established and safe method for diagnosing malignant and benign thoracic lesions. Ultrasound (US) is as effective as CT for the guidance of transthoracic biopsies of peripheral pulmonary lesions and mediastinal tumors, and it offers several advantages [3].

Real-time US imaging allows for the dynamic evaluation of vessels and localization of target lesions that move during respiration. In US-guided transthoracic biopsy, the tip of the needle can be monitored throughout the procedure, and fine adjustments can be made quickly and precisely. This ability is especially beneficial in biopsies of small thoracic lesions. Moreover, US does not expose the patient to radiation and is less expensive than CT [3]. Here, we report a case in which US was used properly for percutaneous biopsy of a lung lesion, aiming to show that it can be a safe, inexpensive, rapid, and effective alternative to CT in appropriate cases.

An 80-year-old man with a history of prostate adenocarcinoma and squamous cell carcinoma of the larynx underwent thoracic CT (GE HI SPEED, General Electric Medical Systems, Milwaukee, WI), which revealed a solid lesion (~35 mm) in the lateral basal segment of the right lower lobe of the lung with no evidence of calcification (Fig 1). Inasmuch as the lesion was peripheral and had broad pleural contact, according to CT images made before biopsy, with no air interposed between the lesion and the transducer, US (Philips Ultrasound, Bothell, WA)
was used to guide the biopsy by an oblique approach, with real-time visualization of the hypoechoic lesion (Fig 2).

The patient had no relative or absolute contraindication to percutaneous transthoracic lung biopsy, which was performed without sedation with the patient in the left lateral decubitus position and with the use of a linear transducer (frequency range, 5 to 12 MHz). Cores were obtained with a 20-gauge biopsy gun with a coaxial system (Angiotech, Vancouver, Canada). The biopsy needle was advanced through the needle guide into the lesion during suspended respiration under real-time visualization.

Thoracic CT was performed ~1 hour after biopsy. No pneumothorax or other complication was observed. The patient was released from the hospital in good condition, with stable vital signs. He was warned of delayed complications and was given instructions to return if he became symptomatic.

Histopathologic examination of the biopsy specimens revealed a poorly differentiated malignant neoplasm with a sarcomatoid pattern (Fig 3). The morphologic aspects were similar to those observed in specimens from a total laryngectomy performed 6 months previously.

Comment

Although many surgeons and radiologists who perform nonvascular transthoracic procedures favor CT, US is gaining acceptance as an effective guidance modality, even for difficult or small lesions [2]. Dodd and colleagues [4] illustrated its role as the “undiscovered jewel of interventional radiology.”

With careful review of diagnostic chest CT images, peripheral lesions can easily be found on US images and successfully subjected to biopsy, with success rates exceeding 90% and complication rates of less than 5% [2, 5]. Most small parenchymal and pleural masses are hypoechoic, and the interface between the lesion and the echogenic shadowing surrounding the aerated lung is clearly demarcated [2].

Ultrasonography offers a valuable combination of cross-sectional display of anatomy (including depiction of vascular anatomy with color Doppler and evaluation of the internal echotexture of the lesion) and real-time visualization [2]. The rates of pneumothorax and hemothypsis after the procedure are low [3]. The absence of radiation exposure, noninvasiveness, low cost, safety, and ready availability are other advantages of US [4, 6].

A lesion with at least 1 cm contact with the chest wall can be considered suitable for US-guided biopsy, regardless of its size and location. A location behind a rib is not considered to be a contraindication to US guidance. All masses and areas of opacity with aerated lung interposed between the mass and the chest wall are scheduled for CT-guided biopsy [2, 5].

With this case, we sought to exemplify the usefulness of US for transthoracic biopsy of lung nodules and masses. This modality has advantages over CT in cases of peripheral lesions in contact with the parietal pleura and allows real-time visualization, requiring less patient cooperation. The short procedure time, lower cost, and lower complication rate are among the positive aspects of US.

References

A 73-year-old man with atrial fibrillation and previous left pneumonectomy was admitted with pleural effusion. Anticoagulant therapy was discontinued because of chest tube drainage. Six days later, the patient experienced chest discomfort. Echocardiography showed a pedunculated thrombus with swaying motion in the left pulmonary artery (PA) stump. Contrast-enhanced computed tomography of the chest revealed filling defects in not only the left PA stump but also the right PA, implying contralateral pulmonary embolism. Anticoagulants were resumed, and thrombolysis was successful 3 days later.

Patients undergoing pneumonectomy in whom anticoagulant therapy is discontinued should be recognized as being at high risk for PA stump thrombosis and subsequent contralateral pulmonary embolism.

Figure 1. Transthoracic echocardiograph showing (A) a thrombus in the left pulmonary artery stump (arrow) and (B) disappearance of the thrombus 3 days after anticoagulant therapy was started.

Comment
This case provides three insights into postoperative PA stump thrombosis. First, it is unclear whether a filling history. A contralateral pulmonary embolism secondary to PA stump thrombosis is rare. However, once it occurs, the embolism to the remaining lung can be lethal. We report a case of contralateral pulmonary embolism caused by postoperative PA stump thrombosis in which anticoagulant therapy was discontinued.

A 73-year-old man with right pleural effusion and ascites was referred to our hospital. Eight years previously, he had undergone a left pneumonectomy for lung adenocarcinoma. He also had a history of inferior myocardial infarction, sick sinus syndrome, and paroxysmal atrial fibrillation, and he had been taking warfarin. Transthoracic echocardiography showed a preserved ejection fraction despite an inferior wall motion abnormality of the left ventricle, an enlarged right ventricular cavity, and severe tricuspid regurgitation. We attributed the pleural effusion and ascites to right-sided heart failure caused by severe tricuspid regurgitation and a postoperative decrease in the pulmonary vascular bed. The pleural effusion was resistant to intravenous diuretics and inotropic agents. Anticoagulant therapy for paroxysmal atrial fibrillation was discontinued, and a tube was inserted to drain the chest. Six days after warfarin was discontinued, the patient experienced chest discomfort. Transthoracic echocardiography revealed a pedunculated 17-mm-long thrombus in the left pulmonary artery (PA) stump. Notably, echocardiography showed a swaying motion of the thrombus adherent to the PA stump posterior wall (Fig 1A). Contrast-enhanced CT of the chest showed an oval filling defect in the left PA stump, suggesting thrombus formation (Fig 2A). Hypercoagulability on discontinuing warfarin and blood stasis in the PA stump likely facilitated thrombus formation. Surprisingly, a filling defect was also seen in the contralateral right PA (Fig 2B). This right pulmonary embolism was likely secondary to the left PA stump thrombosis. Given the high risk of re-embolization to the remaining lung, intravenous heparin was started and warfarin was resumed, with careful observation. Three days later, transthoracic echocardiography showed that the thrombus in the PA stump had disappeared (Fig 1B).

Thrombus formation within the pulmonary artery (PA) stump is an occasional complication after pneumonectomy, which is often discovered incidentally on contrast enhanced computed tomography (CT). PA stump thrombosis almost appears to have a benign natural history. A contralateral pulmonary embolism secondary to PA stump thrombosis is rare. However, once it occurs, the embolism to the remaining lung can be lethal. We report a case of contralateral pulmonary embolism caused by postoperative PA stump thrombosis in which anticoagulant therapy was discontinued.

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