Case Report

Use of radial probe endobronchial ultrasound for the diagnosis of peripheral pulmonary lesion: First report from India

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ABSTRACT

Radial probe endobronchial ultrasound (EBUS) helps in the evaluation and sampling of peripheral pulmonary lesions (nodules, masses, consolidation), and has been demonstrated a safer alternative to computed tomography guided procedure, especially in lesions that are away from the chest wall. Although radial probe EBUS has been available for more than two decades, there is no report from the Indian subcontinent. Herein, we describe two cases of peripheral lung lesions that were successfully sampled with the use of radial probe EBUS.

KEY WORDS: Convex probe EBUS, endobronchial ultrasound, lung cancer, radial probe EBUS, solitary pulmonary nodule

INTRODUCTION

The advent of endobronchial ultrasound (EBUS) has widened the horizons for an intervention pulmonologist. While convex or linear probe EBUS enables sampling of the mediastinal and hilar lymph nodes, the use of radial probe EBUS helps in the biopsy of peripherally located lesions. The use of radial probe EBUS to visualize and biopsy the peripheral pulmonary opacities was first described in 1992 by Hurter et al. Subsequently, the technique was systematically studied by Herth et al. and Kurimoto et al. without and with the guide sheath method, respectively to sample the peripheral pulmonary lesions (PPL). Further, various sonographic patterns were described on radial EBUS to distinguish benign from malignant diseases. Radial probe EBUS consists of an ultrasound probe transducer that has a frequency of 20-30 MHz and a scanning view of 360 degrees. The tissue penetration of the radial probe EBUS is 4-5 cm and provides good quality images. Based on internal morphology, vascular and bronchial patency, and internal echoes on EBUS images, the lesions can be divided into three types (type I, homogenous pattern; type II, hyperechoic dots and linear arcs; and type III, heterogeneous pattern).

Herein, we describe two cases that were successfully diagnosed with the use of radial probe EBUS. To the best of our knowledge this is the first report on the use of radial probe EBUS in the diagnosis of peripheral lung lesions from the Indian subcontinent.

CASE REPORTS

Case 1

A 62-year old lady presented with history of dry cough of one-month duration. There was no history of fever, chest pain, breathlessness, hemoptysis and loss of weight or appetite. Physical examination was unremarkable. On chest radiograph, a solitary pulmonary nodule (2 ×
3 cm) was detected in the right upper zone [Figure 1] that was subsequently confirmed on contrast enhanced computed tomography (CT) of the thorax [Figure 1]. Sputum smear examination for fungus and mycobacteria, and cytological examination was inconclusive. A radial probe guided biopsy was planned to evaluate the etiology of the pulmonary nodule. The procedure was performed under local anesthesia and conscious sedation using fluoroscopy in the bronchoscopy suite of the department, as previously described. A flexible bronchoscope (BF-1T20, Olympus, Japan) was introduced through the nasal route and the airway anatomy was visualized. After ruling out any endobronchial abnormality, a radial probe transducer (20 MHz, mechanical-radial type, [UM-S20-20R; Olympus, Tokyo, Japan]) with an outer diameter of 17 mm covered with the guide sheath (SG-200C [inner diameter 20 mm]; Olympus, Tokyo, Japan) was introduced through the working channel of the flexible bronchoscope. The probe was connected to an endoscopic ultrasound system (EU-M30; Olympus, Tokyo, Japan). The guide sheath has a length of 105 cm and the length of the radial probe transducer is 115 cm. The position of the radial probe was adjusted ex-vivo such that only the tip of the transducer protruded out of the guide sheath and the position was secured with a locking mechanism. The length of various instruments such as biopsy brush (BC-202D-5010; Olympus, Tokyo, Japan), and biopsy forceps (FB-233D; Olympus, Tokyo, Japan) was also secured in a similar fashion. After clearing the airways of secretions, the transducer probe was pushed forwards such that only the tip was visualized. The probe and sheath was then introduced to the selected segment until the resistance was felt and the probe could not be pushed any further. The radial probe-sheath assembly was then withdrawn slowly towards the operator until either an abnormality was identified or the probe-sheath assembly was visualized outside the chosen segment. If the lesion could not be identified in the selected segment the probe-sheath assembly was introduced into another segment. Once the lesion was identified [Figure 2], the transducer was then withdrawn and the guide sheath was left in situ. Bronchial brushing, bronchial washing and transbronchial biopsy were then performed through the guide sheath. Histological examination revealed adenocarcinoma of the lung. The patient underwent whole body positron emission tomography (PET) CT, which revealed a 2.1 × 1.6 cm soft tissue density with maximum standardized uptake value (SUV max) of 7.1 involving the right upper lobe bronchus with no evidence of secondaries. A final diagnosis of adenocarcinoma of the lung stage IB was made. She subsequently underwent right upper lobectomy with mediastinal lymph node dissection. Surgical lung biopsy specimen revealed adenocarcinoma of the lung with free resection margins; the mediastinal lymph nodes were free of tumor cells. She continues to do well on follow-up (6 months).

**Case 2**

A 29-year old gentleman presented with history of intermittent hemoptysis of one-month duration. He denied any history of fever, weight-loss or chest pain. About one-and-a-half years ago, he was diagnosed as pulmonary tuberculosis, based on the presence of fever, weight-loss, cough and positive sputum smear for AFB. He was treated with six months of anti-tuberculosis therapy and was declared cured. A chest radiograph performed during current illness revealed a solitary nodule in the left upper zone region. Contrast enhanced CT of the thorax revealed a small nodule measuring 2.0 × 1.5 cm in the lingula [Figure 3]. Sputum smear for AFB, Xpert MTB/RIF, cytology, and culture for mycobacteria and fungi were all negative. Subsequently, a radial probe EBUS was performed as described above and the lesion was sampled by bronchial washing, brush cytology and transbronchial lung biopsy. Cytology revealed granulomatous inflammation. Stain for AFB was negative. Transbronchial lung biopsy did not reveal any granuloma. Patient was managed conservatively with tranexamic acid alone for hemoptysis. On follow-up at six months, the patient continues to do well and has not had any further episode of hemoptysis.

**DISCUSSION**

The index cases highlight the diagnostic performance of radial probe EBUS in the evaluation of PPL. Until recently,
CT-guided needle aspiration or biopsy, surgical lung biopsy or video-assisted thoracoscopic surgery formed the procedure of choice in the assessment of PPL. The surgical procedures are invasive and require general anesthesia and hospitalization while the performance of CT-guided procedures is associated with high risk of pneumothorax and exposure to radiation. The risk of pneumothorax ranges from 9% to as high as 64% in CT-guided sampling of thoracic lesions. This risk is higher in the presence of chronic obstructive pulmonary disease, small lesion size, greater lesion depth, needle trajectory angle of <45 degrees, and repeated pleural punctures. In a recent comparative study between CT-guided biopsy versus radial probe guided biopsy, the radial probe EBUS-guided arm had had a similar diagnostic accuracy (93.3% vs. 87.5%) but with a significantly lower incidence of pneumothorax (27% vs. 3%).

The first series of radial probe EBUS included 50 patients with PPL who underwent transbronchial lung biopsy under both fluoroscopic guidance and radial EBUS. The diagnostic accuracy for radial EBUS was similar to fluoroscopy-guided biopsy (80% vs. 76%); however, there was a trend towards better diagnostic yield with radial EBUS in lesions measuring less than 3 cm. In a subsequent study using the guide-sheath method, the radial EBUS was diagnostic in 77% of the procedures performed. In lesions measuring ≤10 mm, radial EBUS with guide sheath method was diagnostic in 76% of the cases. Importantly, the diagnostic accuracy was not affected whether or not fluoroscopy was used. In a recent meta-analysis (16 studies), the sensitivity and specificity of radial probe EBUS for sampling the peripheral lung nodules/masses was 0.73 and 1.00, respectively in the detection of lung cancer.

In the index cases, the size of the lesions varied from 20-30 mm and were located at least 3 cm away from the chest wall. We combined bronchial washing, brush sampling and transbronchial lung biopsy in both our patients. Combining all three methods increases the diagnostic yield of radial EBUS, when compared with either of the procedure performed alone. In a study involving 196 consecutive patients who underwent radial EBUS, the diagnosis was confirmed in 55.6% of patients (109/196) from a combination of washings (63/190), brushing (74/153) and transbronchial biopsy (79/149).

Several factors affect the diagnostic yield of radial EBUS with a higher yield observed in cases with malignant etiology, distance from hilum <50 mm, size of the lesion >3 cm, end-on bronchus sign on CT, use of guide sheath method, position of the probe within the lesion, number of biopsies performed and others. In both of our cases, the lesion was visualized on EBUS, and we performed at least six biopsies in both of our patients and used the guide sheath method. The use of guide sheath method ensures reproducibility of the sampling and the target area can be sampled repeatedly as the position of the sheath is secured. This is unlike CT-guided FNAC, where the position has to be reconfirmed after each pass, and changes with the respiratory movement.

Although, studies have shown that the diagnostic yield of radial EBUS is not affected by the use of fluoroscopy, we chose to use fluoroscopy due to the initial learning curve and the time needed to acquire the skill in performing radial EBUS. It has been shown that lesions can be sampled successfully using radial EBUS, even if they are not visualized on fluoroscopy. This is further supported by a meta-analysis of sixteen studies where the use of fluoroscopy did not affect the diagnostic yield of radial EBUS. The use of radial EBUS is safe and the only complications are minor bleeding and pneumothorax. In a pooled analysis of sixteen studies, the complication rates varied from 0-7.4%. None of the studies reported significant bleeding that required any intervention. The pooled rate of pneumothorax was 1% (11 of 1,090), with the rate of intercostal tube drainage being 0.4%. No deaths were reported in the studies included in the meta-analysis. In the current report, we did not encounter any complication while performing radial probe EBUS.

CONCLUSION

In conclusion, the use of radial probe EBUS can safely and effectively allow the sampling of peripheral pulmonary lesions. The radial EBUS is an important tool in the armamentarium of the interventional pulmonologist.

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Conflicts of interest
There are no conflicts of interest.
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