Case Report

Endobronchial Ultrasound Radial Probe Guided Cryo-biopsy: New Technique for Diagnosis

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Abstract

Fibreoptic bronchoscopic biopsy specimens traditionally suffer the disadvantage of recovering small biopsy specimens. The determination of histopathological cell type and stage of primary lung carcinoma is of paramount importance, especially if these are diagnosed at stage I and II, so that these can be surgically removed and the patient be cured. Now-a-days, the use of endobronchial ultrasound (EBUS)-guided biopsy is getting well established. The radial probe EBUS allows for evaluation of central airways, accurate definition of airway invasion, and facilitates the diagnosis of peripheral lung lesions. It has been observed that the tissue samples collected with the cryo-probes are of high quality and are larger than conventional biopsy samples. We have combined these three procedures (EBUS bronchoscopy, use of radial probe for localisation and cryo-probe for biopsy specimen) successfully and achieved a confirmed diagnosis of non-small cell lung cancer by removing a very large tissue specimen without any complications. **[Indian J Chest Dis Allied Sci 2016;58:269-272]**

Key words: Bronchoscopy, Lung cancer, Radial probe EBUS, Cryo-biopsy probe.

Introduction

As it is known that most of the cases with non-small cell lung cancer (NSCLC) without any metastasis can be cured by surgical modalities, the determination of histopathological cell type and stage of primary lung carcinoma is of paramount importance.[1,2] Bronchial washings, brushings and bronchoscopic biopsy are widely used in the diagnosis of lung cancers. The diagnostic yield with standard biopsy forceps taken during flexible bronchoscopy ranges from 72% to 82%.[3]

Successful removal of endobronchial tumour from the central airways by using flexible cryo-probes has been previously demonstrated.[4,5] It was observed that the tissue samples collected during the cryo-recanalisation procedure were of high quality and much larger than conventional biopsy samples.[5] Henceforth, cryo-biopsy specimens are being increasingly used for the central[6] and peripheral pulmonary pathologies.[7]

The efficacy and safety of endobronchial ultrasound (EBUS)-guided biopsy is well established.[8,9] Two types of EBUS exist: radial probe EBUS (RP-EBUS) and convex probe EBUS. The RP-EBUS allows for evaluation of central airways, accurate definition of airway invasion, and facilitates the diagnosis of peripheral lung lesions. Using RP-EBUS, the vast majority of peripheral pulmonary nodules can be identified. Radial probe ultrasound provides a 360 degree image of the airways and the surrounding structures. This technique provides real-time, ultrasound-based confirmation of target lesion localisation prior to biopsy.

We report a case where a diagnosis of NSCLC was confirmed from a large tissue piece removed by a cryo-probe biopsy obtained with the help of RP-EBUS, without any complications.

Case Report

A 50-year-old male presented with complaints of dry cough for the last two months and two episodes of haemoptysis. He was a tobacco smoker (smoking index = 14 pack years). There was no history of dyspnoea, fever or chest pain. Physical examination was unremarkable. Chest radiograph revealed a well-defined right parahilar homogeneous mass (Figure 1). Contrast-enhanced computed tomography (CECT) of the thorax showed a mass measuring 4.3cm x 3.6cm at the level of tracheal bifurcation which was inseparable from the right hilar lymph nodes (Figure 2). Computed tomography (coronal section) showed large mass encasing the right upper lobe bronchus (Figure 3). Right lung also showed multiple sub-centimetre patchy nodular infiltrates, emphysematous changes in both the upper lobes. A hypermetabolic lymph node was seen in the right upper para-tracheal region. Few

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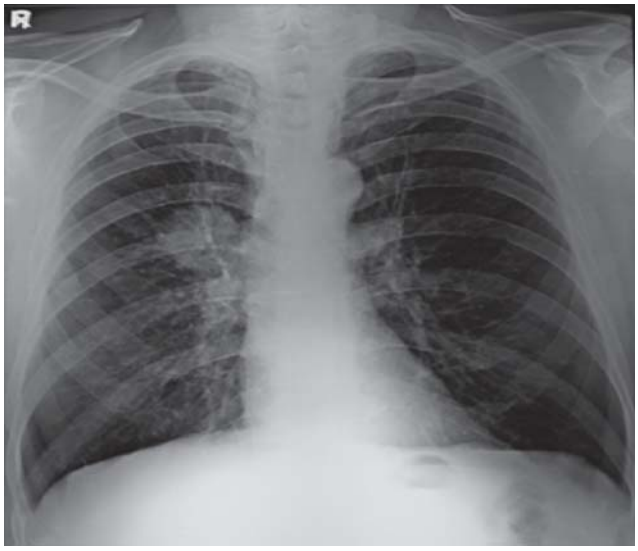

Figure 1. Chest radiograph (posterior-anterior view) showing right para-hilar mass.

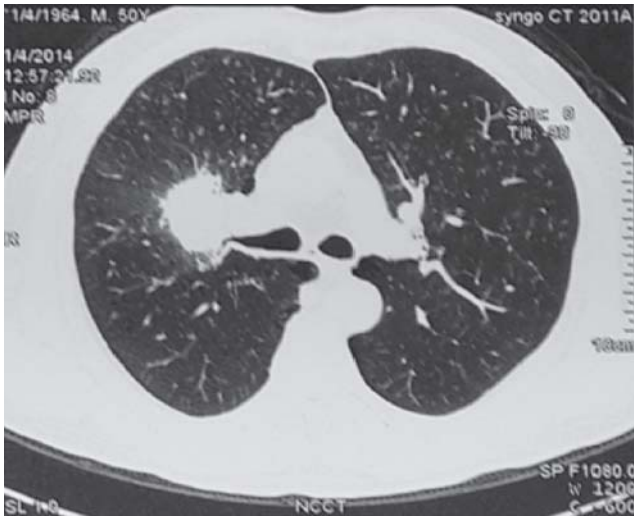

Figure 2. Computed tomography of chest showing mass at the level of tracheal bifurcation.

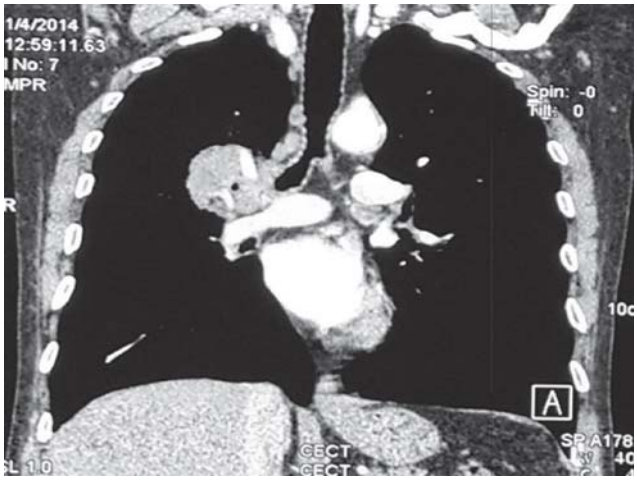

Figure 3. Computed tomography (coronal section) showing large mass encasing the bronchus.

lymph nodes were also seen in the left para-aortic region without tracer uptake, which appeared to be unrelated to the primary disease process. No other metabolically active disease was seen elsewhere in the body.

Fibreoptic bronchoscopy (FOB) revealed narrowing of the anterior segment of the right upper lobe bronchus. Bronchial biopsy showed few crushed atypical cells with pleomorphic hyper-chromatic nuclei giving rise to suspicion of a malignancy. Patient underwent EBUS-guided biopsy via radial probe which was inconclusive. Subsequently, the patient was planned for RP-EBUS-guided cryo-biopsy.

A fiberoptic therapeutic bronchoscope (Olympus, Japan) with a working channel of 2.8 mm, a 360° ultrasound radial probe -UM-2R 2.4mm with a probe driving unit (MAJ-1720) (Olympus, Japan) was used for the visualisation of the extra-bronchial tumour. Also a flexible cryo-probe (90cm in length, 2.4mm in diameter, ERBE, Medizintechnik GmbH, Tübingen, Germany) was used for procuring biopsies.

Radial EBUS probe was inserted through the suction channel of the scope keeping the probe within the sheath, which was introduced upto the anterior segment of the right upper lobe bronchus. The EBUS probe was advanced from the outer sheath and activated, continuously assessing the airway; the lesion was located by its ultrasonic characteristics (Figure 4). After localising the tumour area, EBUS probe was withdrawn, while the bronchoscope was kept in the same position. The length of the radial probe needed to reach the lesion was measured. Then, cryo-probe was inserted through the channel upto the tumour area, the tip of probe was embedded into the lesion and the freezing cycle was initiated causing the tissue to attach to the probe tip. Cryo-probe was perfused with nitrous oxide (N_2O) in a closed probe circuit. Probe tip was cooled up to a temperature of –89.5 °C which was achieved by rapid gas expansion when injected from a highly pressurised capillary channel into a cavum inside the probe tip. The tissue was frozen for four seconds. Cryo-technique uses very low temperatures induced by rapid expansion of gas released at high flow (Joule-Thompson effect) and leads to adhesion of the specimen to the probe. Whilst still frozen, the cryo-probe was removed along with the bronchoscope. The large frozen biopsy specimen (Figure 5) was then released from the probe by thawing in a water-bath and placed in formalin. Histopathological examination of the specimen revealed small cell lung cancer (SCLC). Argon plasma coagulator (APC) was kept as a standby option for possible bleeding complications.

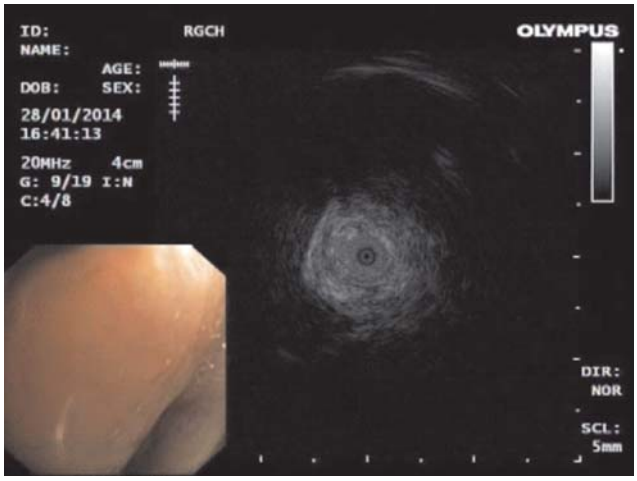

Figure 4. Radial probe view showing the dense mass.

Figure 5. Large biopsy piece taken by the radial cryo-probe.

Discussion

Bronchoscopy is a very safe and effective diagnostic tool. Complications are rare, including post-bronchoscopic pharyngitis, fever, bronchospasm, pneumonia, pneumothorax, vasovagal reactions, cardiac arrhythmias, haemorrhage and death. However, deaths during bronchoscopy are rare. Credle *et al*[10] reported only three deaths (0.01%) out of 24521 bronchoscopies. Haemorrhage after bronchoscopy is a relatively common occurrence and has been reported between 1% to 26%.[6,11] Bleeding requiring local or additional systemic treatment is seen in 1.3% patients only.[6] Our patient did not experience any haemorrhage after the biopsy procedure. It has been reported that occurrence of haemorrhage using forceps biopsies and cryo-probe biopsies has been observed to be similar.[12]

The diagnostic yield with standard biopsy forceps use with FOB ranges from 72% to 82%.[3] One of the drawbacks of forceps biopsy is the small amount of tissue collected, which is determined by the size of the forceps.[5] The standard biopsy forceps tends to alter the alveolar anatomy. On the other hand, the size of the cryo-biopsy specimens as compared to standard forceps biopsy specimens has been reported to range from two[13] to four times.[12] Further, cryo-biopsy specimens are of a higher quality[13] and alveolar anatomy is well preserved in the cryo-specimens as compared to standard biopsies.[14] One histological characteristic of SCLC is the presence of large amount of necrotic tissue. As the size of the cryo-biopsy specimen is larger, the diagnostic yield is better than with forceps biopsy[6] and no significant difference has been observed in the incidence of post-procedure bleeding. It has also been observed that the yield of cryo-biopsy (95%) was better than the traditional forceps biopsy (85.1%) in patients with a suspicion of malignancy.[6]

As there is concentric expansion of the freezing area starting from the tip of the cryo-probe and expanding into the periphery, a larger surface area, and thereby, larger biopsies can be generated with the cryo-probe. A significant advantage of the cryo-probe is that the biopsy can be extracted even when the cryo-probe is positioned parallel to the lesion whereas the standard biopsy forceps has to be placed almost perpendicularly to get a good specimen. This is an important advantage especially in the setting of distal locations and narrower lumens. So, endobronchial cryo-biopsy appears to be a safe technique with superior diagnostic yield in comparison with conventional forceps biopsy.

The endobronchial application of ultrasound was first described in 1990,[15] whereas cryo-surgical techniques are being used for the endobronchial lesions from almost five decades.[16,17] The major advantage of the RP-EBUS is the capability to visualise the layers of the airway wall in detail. The RP-EBUS which uses a flexible catheter and contains a rotating ultrasound transducer which produces a 360° ("radial") ultrasound image was first used to guide transbronchial lung biopsy by Herth *et al*.[18] By this probe, the sensitivity for the detection of cancer ranges from 49%[9] to 88%.[19] Complications during RP-EBUS are minimal and include minor self-limiting bleeding[20] or rarely, a pneumothorax in 1% of patients.[21] No deaths have been reported till date. We utilised this probe as it allows for evaluation of central airways, accurate definition of airway invasion, facilitates the diagnosis of peripheral lung lesions. Better positioning of RP-EBUS probe significantly affects the diagnostic yield.

We propose that combining RP-EBUS with cryo-biopsy is more successful than plain forceps biopsy in the diagnosis of lung cancers. Endobronchial cryo-biopsy appears to be a safe technique, provides a larger specimen, associated with a similar risk of bleeding and offers the advantage of obtaining a biopsy even when tissue is placed at an awkward angle.

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