Case report

The Early Detection of Lung Cancer During Follow-Up of Patients Undergoing Endobronchial One-Way Valve Treatment for Emphysema

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A B S T R A C T

We describe the early detection of lung cancer during the follow-up of two emphysematous patients undergoing endobronchial treatment with one-way valves for severe dyspnea. In both cases, the lung function improvement achieved after the valves placement allowed their surgical treatment. In additional to standard follow-up for evaluating the progression of emphysema, such patients should be enrolled in a screening program. It may allow the early detection of lung cancer with the possibility for surgery in accordance with respiratory function of patient.

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Introduction

We describe the early detection of lung cancer during the follow-up of two emphysematous patients undergoing endobronchial treatment with one-way valves (Zephyr TM; Pulmonx Inc., Redwood, CA, USA) for severe dyspnea. The functional improvement obtained after EBV (endobronchial valve) procedure meant that patients could undergo surgery.

Case 1

A 71-year-old male smoker was admitted for giant emphysematous bulla (GEB) that occupied the entire upper left lobe (Fig. 1A). He had had a previous right upper lobectomy for tuberculosis 25 years ago. The patient’s respiratory condition was so poor that bullectomy was contraindicated (Table 1). Under moderate sedation, 3 valves were sequentially placed to occlude the left upper lobe communicating with the bulla. One-way flutter EBVs enabled bulla deflation with re-expansion of adjacent

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Compressed lung (Fig. 1B). At 6 months of follow-up, high resolution computed tomography (HRCT) scan revealed a single nodule in the lower right lobe not previously seen (Fig. 1C). This was confirmed as cancer by CT-guided needle biopsy (clinical stage: T1N0M0). Functional improvement obtained after EBV treatment allowed the performance of a wedge resection via muscle-sparing thoracotomy. Thoracoscopy was avoided due to possible post-operative adhesions stemming from the patient’s previous lobectomy. After resection, respiratory function was similar to post-EBV values. No other treatments were given. After 10 months of follow-up, the patient was alive without recurrence.

Case 2

A 69-year-old male smoker was admitted for severe dyspnea (Table 1) due to emphysema mostly affecting the upper left lobe (Fig. 1D). Two EBVs were sequentially placed in the superior and inferior trunk of the affected lobe. Complete atelectasis of the upper left lobe was achieved with improvement of respiratory function (Fig. 1E). After 12 months of follow-up, an HRCT scan detected a solitary nodular lesion in the upper right lobe (Fig. 1F). Wedge resection was performed via thoracoscopy. Pathological findings revealed a squamous cell carcinoma (pathological stage T1N0M0). No other treatments were given. After 15 months of follow-up, the patient was alive without recurrence.

**Discussion**

Considering the growing number of emphysematous patients treated with EBVs, physicians: (i) emphysematous patients who are candidates for EBV treatment should be included in lung cancer screening programs; and (ii) lung function improvement achieved by EBV placement allows some of them to undergo limited surgical resections (open vs thoracoscopic).

The potential development of lung cancer in emphysematous patients treated with EBV is under-evaluated. In the literature, we found only 1 case where a patient developed cancer in the emphysematous lobe treated with valve placement. The diagnosis was obtained with transbronchial biopsy after valve removal, and oncological treatment was limited to chemotherapy alone due to the patient’s altered lung function. In our cases, however, detection of cancer was easier because it developed in the opposite lung. Moreover, surgery was possible due to improved respiratory function achieved after EBV treatment and maintained at the time of the cancer diagnosis. After surgery, in Case 1, respiratory function was similar to post-EBV values, probably due to the effect of lung volume reduction, as part of the surrounding hyper-expanded non-functional lung was removed with the tumor. In Case 2, the slight decline of respiratory function may be attributable to the wedge resection alone.

Obviously, valve placement does not foster the development of cancer associated with the underlying disease. Several mechanisms have been suggested to explain the strong association between emphysema and lung cancer. Smoking is the main risk factor for both lung cancer and emphysema, and induces a chronic inflammatory state in the lung through generation of reactive oxidant species that lead to emphysema and lung cancer. Moreover, emphysema and air-flow obstruction are risk factors for lung cancer independently of smoking, as shown by a study from the Mayo Clinic and 2 lung cancer screening programs. In emphysema, mucociliary...
clearance is impaired, allowing carcinogens to pool in the airway and leading to the development of lung cancer.\textsuperscript{5} Thus, the potentially prolonged survival obtained with EBV treatment may allow a patient to live long enough to develop a malignancy.

Finally, lung cancer screening programs may improve early detection of cancer in emphysematous patients undergoing EBV procedure, and cancer therapies, including surgery or non-operative therapy (stereotactic body radiotherapy or chemotherapy) may be offered in accordance with patient’s clinical status.

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\textbf{Conflict of Interest}

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\textbf{References}