Treatment of persistent air leakage with endobronchial one-way valves

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Persistent air leaks are among the most frequent complications after invasive diagnostic procedures and lung surgery.1 Treatment and outcome depend on the cause of the air leak, the quality of the lung, and the clinical status of the patient. The “wait and see” policy can be proposed in a relevant number of cases; if it fails, placement of a Heimlich valve, use of a blood patch,2 and surgical repair are effective options.

We report the case histories of 3 patients with persistent air leak after thoracentesis, video-assisted thoracic surgical treatment of spontaneous pneumothorax, and wedge resection for tuberculosis who were successfully treated with placement of a unidirectional endobronchial valve (EBV). We employed the type of valve used for bronchoscopic lung volume reduction in patients with emphysema.3

Clinical Summaries

**Patient 1.** An 82-year-old woman with pleural effusion positive for metastatic breast cancer had a pneumothorax after thoracentesis. A chest tube was placed, but the air leakage persisted. After a week, blood patch pleurodesis was attempted with no success. A unidirectional Zephyr EBV (Emphasys Medical, Inc, Redwood City, Calif) (Figure 1) was placed in the bronchus related to the parenchymal lesion to stop the air leak. The procedure was performed with a flexible bronchoscope under intravenous sedation with ventilation through a laryngeal mask. The source of the air leak was localized in the posterior segment of the right upper lobe by inserting a Fogarty catheter through the operative channel of the bronchoscope. The delivery catheter containing the valve was advanced through the operative channel of the bronchoscope to the target bronchus, and the valve was delivered. The air leak immediately stopped after valve placement with complete lung expansion. Talc slurry was performed to promote pleurodesis, and the chest tube was removed after a week. The patient died 1 year later of disseminated disease. The valve was still in place and no infectious complications or granulations were observed at follow-up.

**Patient 2.** A 29-year-old man with leukemia receiving chemotherapy had a right pneumothorax. Inasmuch as the air leakage persisted after a week, thoracoscopy involving a wedge resection of the apex with endoscopic GIA staplers (Auto Suture Company, Division of United States Surgical Corporation, Norwalk, Conn) was performed. The postoperative course was complicated by incomplete lung expansion, persistent air leakage, and subcutaneous emphysema (Figure 2, A). After 10 days, EBVs were placed in the apical and posterior segments of the right upper lobe. The air leak completely stopped within 24 hours, allowing lung expansion (Figure 2, B) and chest tube removal. The patient has still the valve in place after 6 months.

**Patient 3.** A 57-year-old patient came to our attention with a 5-cm lung lesion and bullous emphysema; the preoperative diagnosis was epidermoid carcinoma. At thoracotomy, a wedge resection of the lesion (posterior segment of the left upper lobe) was performed including the bulla, and the specimen was sent for frozen section examination to establish the diagnosis. The intraoperative diagnosis was “tuberculosis” and the procedure was interrupted without performance of a lobectomy. The postoperative course was complicated by persistent air leakage, notwithstanding two attempts to stop it with an autologous blood patch. After 3 weeks an EBV was placed; the air leak immediately stopped, the chest tube was removed 2 days later, and the patient was discharged.

Discussion

Persistent air leaks are more frequent after surgery, but diagnostic procedures such as thoracentesis or computed tomography–guided needle biopsy also may cause them. The impact on prognosis is certainly underestimated, especially in patients with cancer; in this group they may delay the administration of chemo-radiotherapy, favoring the onset of infection. Air leaks may also occur in 20% of patients undergoing lung resections4 and have been defined as a
complication that prolongs hospitalization for more than 5 to 7 days. Management requires prolonged drainage and additional maneuvers (alternation of water seal and suction, Heimlich valve, blood patch). Surgical repair is rarely required.

Bronchoscopic lung volume reduction with an EBV has been demonstrated to be safe and has been proposed for patients with emphysema with encouraging medium-term results. The EBV works like a Heimlich valve, allowing air outflow and mucus clearance, but preventing air inflow. Valve placement is easy and can be performed with a fiberoptic bronchoscope.

Because this valve avoids the entrance of air, it has also been placed with success in patients with persistent air leak. Our report confirms the potential of this device. EBV placement allows the physician to solve a problem that may keep patients in the hospital for a long time. No major complications have been described. The valve can be removed after a few months, when the tear on the lung surface is sealed and no recurrence can be reasonably expected.

Endoscopic placement of an EBV is a valid option to help resolve difficult situations, reducing the length of hospitalization and costs. Patients with oncologic problems may receive the appropriate treatment earlier.

References