Complications of Valve Lung Volume Reduction in a Case of Previous Pleurodesis

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Lung volume reduction with valves is increasingly used to treat selected patients with severe emphysema. The indications for this procedure have been previously described; however, its contraindications have not yet been conclusively established. This case highlights the potentially severe complications of endobronchial one-way valve placement in the setting of a previous pleurodesis.

We present the case of a 64-year-old patient suffering from stage IV chronic obstructive pulmonary disease (forced expiratory volume in the first second of expiration = 20% predicted, diffusing capacity of lung for carbon monoxide = 20% predicted) associated with major hyperinflation (residual volume = 244% predicted). The patient had extensive bilateral emphysema (Figs 1A, 1B), non-hypercapnic respiratory failure and suffered from severe dyspnea. Five years ago, 2 episodes of spontaneous left-sided pneumothorax motivated a left lower lobe bullectomy and a pleural abrasion pleurodesis performed by thoracoscopy.

The patient was considered a poor candidate for lung transplantation because of associated cardiovascular comorbidities. Severe dyspnea and functional limitation motivated an evaluation for a lung volume reduction procedure. Lung volume reduction surgery, endobronchial thermal vapor, and polymeric reduction techniques were considered high-risk procedures because of the severely reduced lung function [1, 2]. Concerning endobronchial valves, previous thoracotomy has been an exclusion criterion in 1 relevant study [3], but it was not considered an absolute contraindication. Endobronchial coils, although an alternative, were not available at this time in our center. Thus, in this context, lung volume reduction by valve was regarded as the optimal procedure.

Collateral ventilation [4], the major limiting factor of valve efficacy, was assessed prior to valve placement with the Chartist system (Pulmonx Inc, Redwood City, CA) [5]. The latter uses a balloon catheter that is inserted by the bronchoscope into the target bronchus and provides a direct evaluation of the interlobar airflow by measuring flow and pressure. This system, used in the first part of the intervention, detected significant collateral ventilation in the right upper and lower lobes, making them unsuitable for valve placement. Measurements in the left upper lobe (LUL) showed no collateral ventilation, designating it a target territory. Five valves were placed (lobar occlusion) in the 5 segmental bronchi without immediate complications. Within 24 hours, a left-sided tension pneumothorax developed and the clinical evaluation revealed an abnormal pendulum-like movement of the thorax during spontaneous respiration. Immediate drainage with a large-bore chest tube was performed and it was followed by the placement of a second chest tube, due to a massive air leak. Despite these measures the patient deteriorated and was intubated.

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The computed tomographic scan revealed a valve-induced left upper lobe atelectasis and a left lower lobe failing to fill the left thoracic cavity. As a result an important residual space was present within the left thoracic cavity (Fig 2A). The removal of 2 valves resulted in the reexpansion of the left upper lobe and the immediate cessation of the leak (Fig 2B). The last 3 valves were also removed due to absence of radiologic lung volume reduction. A slow, favorable clinical course allowed the extubation of the patient and his transfer to a rehabilitation hospital 2 months after the initial intervention.

Comment

Endobronchial placement of unidirectional valves is being increasingly implemented for the treatment of heterogeneous emphysema [6]. The indications for this procedure have been previously described [3, 7]; however, its contraindications have not yet been conclusively established.

The complications developed in this case were attributed to a previous pleurodesis. The parenchymal-pleural fistula and the pneumothorax have most probably resulted from pleural tears of the left lower lobe associated with previous pleural adherences. The localization of the air leak to the left lower lobe is supported by the fact that the left upper lobe was totally occluded by the valves when pneumothorax developed. Furthermore, the adherences rendered reexpansion of the left lower lobe impossible and resulted in the persistent residual space. The latter induced the instability of the thoracic cavity and the mediastinum, which was visualized as an abnormal pendiculum-like thoracic movement. The abovementioned events led to the respiratory deterioration necessitating intubation. These complications were treated by valve removal, which resulted to the reexpansion of the left upper lobe, the cessation of the leak, and permitted the gradual clinical improvement of the patient.

As emphasized by this case, endobronchial valve placement may be associated with major complications in patients who had a previous pleurodesis. Physicians should be aware of these potential pitfalls of endobronchial one-way valve placement in the context of a previous pleurodesis. Concentrating experience of specialist centers, which implement a high volume of endoscopic volume reduction procedures, should help in the better description of this intervention’s contraindications.

References