Video-assisted thoracoscopic management for emphysema associated with contralateral destroyed lung

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ABSTRACT

Background: Surgery can be quite challenging in condition that contralateral lung has no function. We report 3 cases of emphysema associated with contralateral destroyed lung managed with the use of video-assisted thoracic surgery (VATS).

Methods: From December 2007 to December 2008, 3 patients of emphysema associated with contralateral destroyed lung were operated on by VATS. There were two pulmonary wedge resections and mechanical pleurodesises for pneumothorax and one lung volume reduction surgery (LVRS) for worsening dyspnea. Their records were reviewed retrospectively.

Results: No postoperative mortality was observed. One case for pneumothorax experienced prolonged postoperative air leakage. Of all the three cases, two cases for pneumothorax had no recurrence and one case for worsening dyspnea had improved lung function.

Conclusions: VATS for emphysema associated with contralateral destroyed lung is feasible in selected patients.

KEY WORDS Video-assisted thoracic surgery (VATS); pneumothorax; emphysema; lung volume reduction

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Introduction

Emphysema is a kind of common and disabling diseases. It is characterized by abnormal, permanent and irreversible enlargement of the air spaces distal to the terminal bronchiole and accompanied by destruction of their walls without obvious fibrosis (1). Initial medical treatments for emphysema include inhaled pharmacologic therapy with bronchodilators or corticosteroids, pulmonary rehabilitation, disease management, and supplemental oxygen.

Lung volume reduction surgery (LVRS) is a therapeutic concept that it has been successfully applied in selected patients with pulmonary emphysema (2). The procedures can be performed by median sternotomy (3), thoracotomy (4), or video-assisted thoracic surgery (VATS) (5,6). VATS has the advantage of less invasions and better recovery of postoperative pulmonary function (7-9). However, the VATS procedure can be quite challenging in condition that contralateral lung has no function (10). We presented 3 cases of emphysema associated with contralateral destroyed lung managed with the use of VATS.

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Patients and methods

Case 1

A 56-year-old emphysema male suffered from a pneumothorax with persistent air leakage drained by chest tube over 1 week on the right side. Before his admission to our institution, he had experienced similar situation 2 months ago and successfully managed with the use of chest tube drainage. The CT scans showed the right pneumothorax most likely due to breakage of bullae and suggested his contralateral destroyed lung (Figure 1), which was confirmed by the patient himself later. He experienced no dyspnea before his episodes or during chest drainage. The chest tube worked well in the appropriate position and was kept for more than 3 weeks, but this time it seemed failed to resolve the situation. Therefore, VATS was performed under general endotracheal anesthesia with a double lumen endotracheal tube in December 2007. A set of cardio-pulmonary bypass apparatus stood by but without final performance. The patient was placed

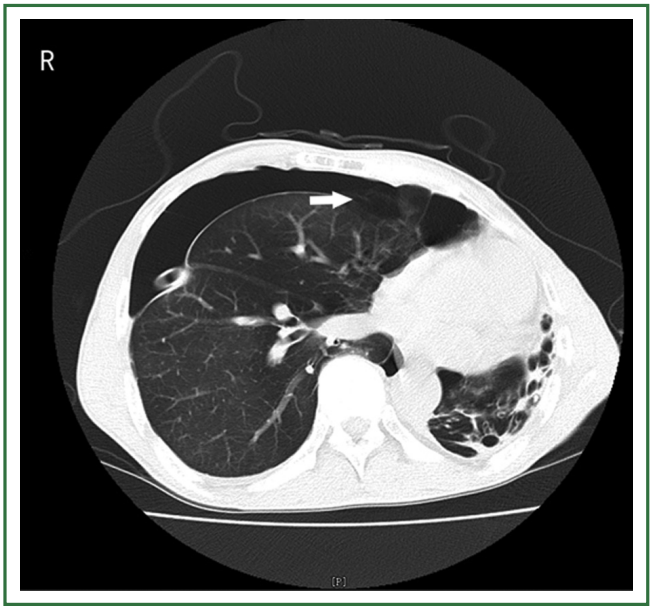

Figure 1. Computed tomography scans showing compressed right emphysema lung by pneumothorax with chest tube drainage and contralateral destroyed lung before VATS (arrow: bullae).

Figure 2. Computed tomography scans showing right asymmetrical bullous lung and contralateral destroyed lung before VATS.

in the lateral decubitus position and 2 incisions were performed: one was 1.5 cm for thoracoscopy and another was 4 cm for operation. A wedge resection of the upper lobe located with bullae was performed with the use of endoscopic linear staplers. Ventilation volume was minimized and intermittent apnea was performed for the action of endoscopic staplers. Polyglycolic acid sheet (PGA) of tube type was used to reinforce the staplers for the prevention from air leak. Mechanical pleural abrasion completed the procedure. Two chest tubes were placed to water seal drainage

The patient was awakened and extubated in the operating room. The air leak was eventually stopped and the chest tubes were removed on day 6 and on day 16 respectively.

He was eventually discharged from the hospital on postoperative day 19. The patient experienced no recurrent pneumothorax or shortness of breath on regular follow up 18 months after surgery.

Case 2

A 57-year-old emphysema male complained of worsening dyspnea for 1 year and walking less than 20 miters. The CT scans confirmed the diagnosis of the right asymmetrical bullous lung and contralateral destroyed lung (Figure 2). His spirometry showed a forced expiratory volume in 1 second (FEV1) of 0.64 L (26% predicted) and a forced vital capacity (FVC) of 1.62 L (53% predicted). A lung volume reduction surgery (LVRS) through VATS was performed in March 2008. His incision and anesthesia was similar to the above case. Two chest tubes were also placed. The patient was mechanical ventilated and extubated on day 1 postoperatively. The two chest tubes were removed on postoperative day 3 and 5 respectively and the patient's dyspnea was improved. He was eventually discharged from the hospital on day 15 postoperatively and experienced no major complications in the postoperative 15 months of follow-up period. His spirometry showed an improved FEV1 of 0.99 L (39.2% predicted) and a FVC of 2.14 L (68% predicted) at 7 months postoperatively. He could still walk for 1 hour and was satisfied with the life situation, which was confirmed in a telephone follow-up at 15 months postoperatively.

Case 3

A 47-year-old emphysema male presented with persistent air leak over 17 days due to recurrent right pneumothorax. He also experienced no dyspnea before his episodes or during chest drainage The CT scans revealed the right bullous and contralateral destroyed lungs. VATS wedge resection of the upper lobe and pleurodesis were performed similar to case 1 with 2 incisions in December 2008. The patient was extubated in the operating room. Both of his two chest tubes were removed on postoperative day 5. He was eventually discharged from the hospital on day 8 postoperatively and his right pneumothorax didn't relapse in the postoperative 6 months of follow-up period.

Discussion

Surgeons have to face two questions when they encounter

such challenging cases as above. One is whether surgery is the option, and another is how to do the surgery. Generally, the initial treatment for emphysema is medical treatments, including inhaled pharmacologic therapy with bronchodilators or corticosteroids, pulmonary rehabilitation, disease management, and supplemental oxygen. These treatments can relief the symptoms but cannot cease or reverse the development of emphysema. Surgery offers an alternative option. Emphysema patients associated with severe dyspnea, hemoptysis, recurrent pneumothorax or pneumothorax with persistent air leak, or repeated infection are suitable for surgical procedures (2). In our group of emphysema patients, case 1 and case 3 suffered from recurrent pneumothorax accompanied by persistent air leak, and case 2 suffered from worsening dyspnea despite of active medical treatment. Therefore, surgery was the consideration.

Different surgical therapies such as chest tube drainage for associated pneumothorax, lung volume reduction and lung transplantation were individually used in the selected patients (2). The therapeutic expectations in our cases were not the same. Case 1 and case 3 had no pre-operative dyspnea and their surgical indication was to solve the persistent air leak. The simplest method, chest tube drainage performed in these two cases, couldn't resolve their problems, and bullectomy advanced treatments were needed. While in case 2, his desire was to solve the worsening dyspnea and LVRS was the option based on his lung function. In fact, the spirometry of case 2 also indicates that he was a marginal candidate for lung transplantation. However, donor shortage and his chest wall deformity due to the destroyed lung terminated the potential.

There is no existed report in the literature about surgical treatment for emphysema associated with contralateral destroyed lung. How to manage these situations with underlying contralateral dysfunctional lungs emerged as a challenge. Similar surgical conditions such as emphysema, pneumothorax and recurrent lung cancer after contralateral pneumonectomy were reported (11-16). In these reported cases, different surgical approaches such as post-lateral thoracotomies, anterior-lateral thoracotomies, muscle-sparing thoracotomies, median sternotomies or VATS were used, and the combined anaesthetic techniques included selective lobar isolation, high-frequency jet ventilation, and cardiopulmonary bypass. We chose VATS for our cases because it is the least invasive approach among the reported literatures. Theoretically, adequate operation space is necessary for VATS. General anaesthesia and single-lung ventilation are usually needed for VATS. Single-lung ventilation will collapse the lung and accommodate adequate operating space. In our cases, emphysema complicated the anaesthesia. Emphysema is the result of destructed pulmonary parenchyma with decreased mass of functioning lung tissue. It has poor elastic recoil and over-expanded volume. In addition, contralateral dysfunctional lung in our cases mandate ventilation of the remaining emphysema lung. These characters make it difficult to deflate to accommodate adequately available space particularly when it has to be mechanically ventilated. Though VATS also could be underwent under local and epidural anaesthesia, or even under local anaesthesia and sedation (17,18), VATS management for emphysema associated with contralateral destroyed lung remains a really big challenge.

Cardiopulmonary bypass is a potential alternative (19). It has the advantage to ensure thoracic surgeons the safe anesthesia and the adequate space, but the cost is more injury, procedures, complications and economic expend associated with cardiopulmonary bypass itself (20). The extra cost makes cardiopulmonary bypass not the first option and it stood by as the last defense to balance safety and mini-invisibility in our cases.

Different with the reported cases after pneumonectomy, the contralateral destroyed lung has additional risk besides its dysfunction. Destroyed lung is usually a result of inflammatory lung diseases such as tuberculosis, whole lung, necrotizing pneumonia, multiple or extensive lung abscesses, fungal infections, lung gangrene, and mycobacteria other than tuberculosis (21-27). It is a potential infection source to the operated contralateral lung. Purulent secretions from the destroyed lung could produce risks to the operated contralateral lung during anesthesia. To minimize the risk, general endotracheal anesthesia with a double lumen endotracheal tube instead of single lumen endotracheal tube is helpful. Double lumen endotracheal tube separates the contralateral lung from the secretions and facilitates cleaning it. None of our cases experienced post-operative infection on the operated lung.

Surgical intervention to the destroyed lungs or not was discussed. Destroyed lung can lead to kinds of acute life-threatening complications such as massive hemoptysis, empyema, secondary fungal infections, secondary amyloidosis, septicemia, and pulmonary-systemic shunting (22,27,28). Surgical removal of destroyed lung tissue has also been considered helpful to resolve complications and improve a patient's quality of life. As to our cases, what they most complained was not directly associated with the destroyed lungs. The goal of their operation for this episode is to resolve the troubles resulted from emphysema. Surgical intervention to the destroyed lungs will not be considered unless urgent complications occur and mandate a pneumonectomy.

The residual lung function post operation also has to be considered. In our cases, case 2 had worst general status. He was the only person with pre-operatively worsening dyspnea and his spirometry showed poor lung function which matched the criteria for LVRS (2) and the operation was successfully completed. The other cases had better pre-operative lung function than case 2, and their medical expectations were to cease persistent air leak. The predicted amounts of lung tissues to

be resected for these two cases were less than LVRS though they had no accurate spirometry due to their persistent air leak. The operation also successfully resolved their problems except that case 1 experienced post-operative air leak over 2 weeks.

In summary, emphysema with contralateral destroyed lung is a rare condition for surgical procedure. VAST can be performed with the use of general endotracheal anesthesia and a double lumen endotracheal tube was helpful to separate the contralateral lung from the secretions to reduce the risk of potential infection. To assess the condition of the patient carefully is the key to successful operation.

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