Video-Assisted Contralateral Treatment for Bronchial Stump Diastasis After Left Pneumonectomy*

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Postoperative bronchial stump failure is a life-threatening complication, and several surgical approaches and procedures have been developed to close the stump. In this report, we describe a case of left mainstem bronchial stump diastasis after pneumonectomy for lung cancer, in which the bronchial stump was re-closed using a contralateral approach with video-assisted thoracic surgery, with good success. The left main bronchus was closed with an automatic stapler device, but the stump reopened and left pyothorax developed postoperatively. Emergent intratracheal intubation and ventilation was required due to rapid progression of right pyothorax. Under strict nutritional management by IV hyperalimentation, administration of antibiotics to which the organisms were sensitive, and drainage, the patient recovered from pneumonia. However, thoracic air leak increased daily, and reoperation for bronchial diastasis was performed. Using this approach, the left main bronchus near the carina was easily exposed extrapleurally, with only the azygos vein being incised. Video-assisted contralateral treatment was effective in avoiding sternal osteomyelitis due to a transpericardial approach via median sternotomy in the case of mainstem bronchial stump failure, only after left pneumonectomy.

**Key words:** bronchial stump diastasis; contralateral treatment; lung cancer; video-assisted thoracic surgery

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**Case Report**

A 59-year-old man underwent left pneumonectomy via standard posterolateral thoracotomy, with systematic nodal dissection for squamous cell carcinoma of the upper lobe of the left lung invading the left main pulmonary artery and main bronchus. The left main bronchus was closed with an automatic stapling device (TX30G-4.8; Ethicon Endo-Surgery; Cincinnati, OH). After stapling, the closed bronchus was tested for air leaks at 20 cm H2O of airway pressure. Nine days postoperatively, the patient developed a low-grade fever, but cultures of thoracocentesis specimens were negative. Acute management consisted of tube drainage of the pleural cavity. Systemic antibiotic therapy was administered because high fever developed. The patient complained of dyspnea, and a chest roentgenogram showed right lobar pneumonia. Air leak was noted in the thoracic tubes. Bronchoscopy revealed an approximately 10-mm defect in the residual left main bronchus, and bronchial stump diastasis was diagnosed rather than bronchopleural fistula (Fig 1). Based on arterial blood gas analysis (Paco2, 41 mm Hg; PaO2, 38 mm Hg; oxygen saturation, 68%), emergent intratracheal intubation and ventilation was required. Repeated bacterial cultures of pleural effusion and blood cultures yielded coagulase-negative staphylococcus, *Haemophilus parainfluenzae*, and *Candida albicans*. After 7 days under strict nutritional management by IV hyperalimentation, antibiotics to which the organisms were sensitive...
(imipenem/cilastatin, 1.0 g/d and minocycline hydrochloride, 100 mg/d), and antifungal agents (fluconazole, 150 mg/d), the patient showed a fair recovery from pneumonia and was able to be weaned from the respirator. Arterial blood gas analysis was remarkably improved (PaCO₂, 38 mm Hg; PaO₂, 96 mm Hg; oxygen saturation, 96% at room air).

However, thoracic air leak increased daily, and repeat surgery for bronchial fistula was performed 17 days after the initial surgery.

Reoperation was carried out in the left lateral position (Fig 2). With a posterior incision, right minithoracotomy on the triangle of auscultation was performed. The smallest skin incision needed was 6 cm to insert a stapling device into the intrathoracic space. A 12-mm thoracoport was placed at the fifth intercostal space at the anterior axillary line, and another was placed at the sixth intercostal space at the posterior axillary line. A thoracoscope was inserted through the posterior port as a light guide. Using a lung spatula through the anterior port, the azygos vein was incised, the posterior field of the vein was spread, and the vagus nerve, right bronchial arteries, and lower part of the trachea were isolated between two tapes to prevent injury. The left main bronchus was exposed at the posterior mediastinum and separated from connective tissue. The left bronchial stump was stapled using another stapler device (TLH30–4.8; Ethicon Endo-Surgery) that allowed the operator to control the intensity of the grasping power applied to the bronchus. By intraoperative bronchoscopy, we ascertained that the trachea had not become stenotic due to stapling (Fig 1). The bronchial leak disappeared postoperatively. Recovery was uneventful, and the temperature gradually returned to normal in the course of 5 days. The drainage system was removed on the 14th postoperative day after pleural cultures and arterial blood cultures did not show any growth of pathogens, and serum C-reactive protein was within normal limits. The patient remained functionally well for 18 months postoperatively.

**Comment**

Bronchial stump failure is the most troublesome complication in thoracic surgery. Once bronchial stump failure occurs, especially after pneumonectomy, contralateral pneumonia develops due to ipsilateral pyothorax and may frequently be a fatal event. The etiology of bronchial stump failure is complex and related to several factors. Numerous studies indicate that the causes of bronchial failure include devitalization and devascularization of the bronchial stump by excessive dissection, peribronchial infection related to nonabsorbable suture, residual bronchial disease, poor approximation of the mucosa, the length of the stump, and the experience and technique of the surgeon. Automatic stapling devices are widely used for bronchial stump closure, and, in general, the incidence of fistula is considerably reduced by the use of such automatic suture devices. However, it is reported that the incidence of bronchopleural fistula changes according to the type of automatic stapler devices. We routinely use a 4.8-mm stapling device to close the main bronchus.
after pneumonectomy. In the case being reported here, the stump was checked by pressure proof test intraoperatively but was reopened 9 days postoperatively. A thickened and inflamed bronchus is a relative contraindication for using a stapler, but this was not found in the present case. Bronchoscopically, bronchial failure was judged to involve diastasis rather than fistula. The cause of this failure remains unknown, but one speculation is that closure of the bronchus by the staple device was too tight and may have caused devitalization and devascularization of the bronchial stump.

A contralateral approach was first described in a case of chronic empyema by Maassen. Using this approach, the left main bronchus near the carina was easily exposed extrapleurally, with only the azygos vein being incised. Maassen’s procedure and ours are fundamentally the same, but his thoracotomy was a general posterolateral procedure, while our procedure involved a minithoracotomy with video-assisted thoracic (not thoracoscopic) surgery. The thoracotomy was located at the triangle of auscultation to keep the respiratory muscles intact.

Some technical skills are required for this approach. First, this procedure must be performed concurrently with ventilation of the right lung, as it is necessary to prevent collapse of the right lung by the spatulas as much as possible. Second, the vagus nerve and bronchial arteries must be carefully isolated to avoid injuring these structures.

Other procedures for direct left main bronchial closure include the ipsilateral approach and transpericardial approach. It is dangerous to expose the left main bronchus stump by an ipsilateral approach because the stump is covered with fibrous adhesion and because it lies near the descending aorta and left main pulmonary artery. Moreover, the recurrent nerve is present in the pulmoaortic window, and the nerve may be injured during exposure of the left main bronchus stump. The transpericardial approach is a generally recommend technique. An outstanding problem of this median approach is the production of sternal osteomyelitis. Using a median approach, sternal incision is performed, and connective tissue of the anterior mediastinum is separated to expose the left bronchial stump between the superior vena cava and the ascending aorta. If subcarinal and hilar lymph nodes are dissected during systematic nodal dissection during lung cancer surgery, the left mediastinal pleura are disrupted through the left pleural cavity. Therefore, intrathoracic bacteria may extend to the anterior mediastinum and sternum.

Indications for the contralateral approach are limited. Respiratory function must be adequate for contralateral thoracotomy, and this approach must be avoided when pyothorax is active. If a stapling device will be used during this approach, bronchoscopic examination is necessary to measure the stump length because the length must be greater than the thickness of the device. However, to avoid sternum osteomyelitis due to a transpericardial approach via median sternotomy, this approach is worth considering in some patients with bronchial stump failure after left pneumonectomy for lung cancer and systematic nodal dissection.

References