out resection of the artery or pneumonectomy (as was accomplished in our patient), is feasible since the tumor rarely invades the pulmonary artery wall. The bilateral nature of the disease in this case made an attempt at curative resection impossible. Our patient had an uneventful postoperative recovery associated with dramatic improvement in his pulmonary hemodynamics and in his symptomatic status. Consideration of chemotherapy was underway at the time of discharge.

We conclude that the development of digital clubbing in a patient with suspected thromboembolic pulmonary hypertension should cast doubt on that diagnosis and should raise the possibility of pulmonary artery sarcoma.

REFERENCES
8 Britton PD. Primary pulmonary artery sarcoma—a report of two cases, with special emphasis on the diagnostic problems. Clin Radiol 1990; 41:92-4
10 Mandelstamm M. Ueber primaere Neubildungen des Herzens. Virchows Arch Pathol Anat 1923; 245-43

Percutaneous Technique for Management of Persistent Airspace With Prolonged Air Leak Using Fibrin Glue*

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A 68-year-old white man with lung carcinoma underwent removal of the lower lobe of the left lung. Four months later, the patient developed a hemothorax requiring exploratory thoracotomy, evacuation of hemothorax, and decortication. Postoperatively, a persistent airspace with prolonged air leak developed. Bronchoscopic application of fibrin glue failed to seal the leak. Percutaneous transthoracic application of fibrin glue with CT scan guidance partially obliterated the space and completely sealed the leak. We describe this simple and effective technique for management of this special problem. (CHEST 1996; 109:1653-55)

Key words: air leak; fibrin glue; hemothorax

Abbreviations: BPFs=bronchopleural fistulas; CT=computed tomography

Persistent airspace with prolonged air leak can sometimes occur following pulmonary resection. Management can be conservative, with the hope that both problems will resolve spontaneously, or aggressive, with the philosophy that an air leak will not seal unless the airspace is eliminated.

Various methods have been used in an attempt to solve the problem of a persistent airspace with prolonged air leak in a minimally invasive manner. As opposed to surgically identifying the leak and closing it directly adding pleural, pericardial, intercostal, or omental flap reinforcement, several studies have used bronchoscopic identification of the leak with instillation of chemical sealant under direct vision. Although endoscopic management has been successful in such specific settings as small bronchopleural fistulas (BPFs) following lobectomy, universal application of this technique in other scenarios has been unsatisfactory.

We describe a percutaneous transthoracic approach using CT scan guidance to instill fibrin glue in a 68-year-old man who developed a persistent airspace with prolonged air leak following evacuation of a hemothorax four months after lobectomy for bronchogenic carcinoma.

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CASE REPORT

A 68-year-old white man, a cigarette smoker, was found to have a 2.5-cm mass in the lower lobe of the left lung during a routine medical examination. After a negative metastatic evaluation, the patient was taken to the operating room for surgical resection.

The patient underwent a standard left posterolateral thoracotomy and removal of the lower lobe of the left lung without incident. The operative findings included a well-circumscribed, 2.5-cm lesion within the lower lobe of the left lung. No extraparenchymal involvement was identified. The bronchus was closed with a stapling device. The patient had an uneventful recovery and was discharged from the hospital to home on the sixth postoperative day. The final pathologic finding was adenocarcinoma, T1N0M0, stage I.

Four months postoperatively, the patient was admitted to the hospital with acute onset of fever, chills, productive cough, and shortness of breath. He had a low-grade fever, mild tachycardia, and moderate tachypnea. No breath sounds were present on the left side. A chest roentgenogram showed near-complete opacification of the left side of the chest. A CT scan showed the presence of a large pleural effusion of the left lung with underlying entrapped lung. A thoracentesis was positive for bloody fluid. Cytologic and microbiologic studies were negative for bacterial organisms. Bronchoscopic examination was negative for tumor recurrence or disruption of the bronchial stump.

The patient was taken to the operating room for thoracotomy, evacuation of hemothorax, and decortication. Operative findings included a large hemothorax with a peel entrapping the upper lobe of the left lung. The cause of the hemothorax could not be identified. Extensive dissection of the remaining lung with lysis of adhesions produced considerable raw parenchymal surfaces with diffuse tiny air leaks. Apical, basilar, and posterior chest tubes were placed. The patient was extubated on the first postoperative day and remained stable thereafter. The cultures and cytologic studies of the operative specimens were negative for bacterial organisms. The posterior and basilar chest tubes were removed by the seventh postoperative day. The anterior chest tube had a prolonged air leak. Chest roentgenograms showed a small persistent airspace in the anterior-apical region of the left lung field.

After two weeks with an air leak, a CT scan of the chest was obtained. The chest tube was within the persistent airspace, which measured 10×6×8 cm. (Fig 1). Bronchoscopy failed to show a defect. Through the bronchoscope, blind application of fibrin glue into the anterior segment of the upper lobe of the left lung was unsuccessful in obliterating the leak. After 3 weeks without resolution, the patient was taken to the CT scan suite. He was positioned on the table to allow placement of 21-g spinal type needles under CT scan guidance into the airspace (Fig 2). A 250-mL mixture of

Figure 1. CT scan of air space with chest tube before application of fibrin glue.

Figure 2. CT scan of air space with spinal type needle catheters inserted.

Figure 3. CT scan of air space after application of fibrin glue. Note the coating of lung surface and the position of the chest tube.

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fibrin glue was prepared by mixing fresh frozen plasma, calcium chloride, and thrombin. The solution was injected into the space through separate catheters in order to allow the thrombin to bind with the fresh frozen plasma and calcium within the cavity. The amount of fibrin glue instilled was determined by the serial CT scan images, demonstrating complete coating of the lung surface without occluding the tip of the chest tube (Fig 3). During the injections, the chest tube was removed from suction and for 15 min thereafter. After satisfactory coating of the lung surface was achieved, the chest tube was placed back on suction. No further air leak through the chest tube was present. A final CT scan image confirmed adequate coating of the cavity surface and position of the chest tube above it. The chest tube was removed the following day and the patient was discharged from the hospital to home 5 days later. Follow-up visits at 1 week and 6 months disclosed complete resolution and elimination of the airspace.

DISCUSSION

Persistent airspace with prolonged air leak following pulmonary resection is a complication associated with increased morbidity and length of hospital stay. Several attempts to manage these problems have resulted in variable rates of success. The conservative approach has been to wait for the air leak to close spontaneously. In most instances, the air leak will close eventually, provided it is small, the visceral and parietal pleural surfaces are adherent, no foreign element is preventing closure, and no acute infection or residual malignancy is present. If any of the aforementioned factors are present, an air leak is likely to be prolonged, and more aggressive measures are required for closure. Reoperation, direct closure with reinforcement of pleural, pericardial, intercostal, or omentum flaps often are necessary. In an attempt to manage this problem in a less-invasive manner, several investigators have used fibrin glue.

In 1983, Roksåvag and colleagues reported the use of histoacyrl (N-butyl-2-cyanoacylate) injected bronchoscopically in two patients with postoperative BPFs. Jessen and Sharma suggested using fibrin sealant in small BPFs. In five patients, direct visualization of the BPF was performed with a bronchoscope through which one to five applications of fibrin glue were made. All fistulas sealed. Matthew and colleagues applied fibrin sealant to staple lines after pulmonary resections and found it useful in reducing air leaks and avoiding major operative procedures when air leaks were prolonged. Glover and colleagues reported a similar experience with foley urinary line closures. Fleisher and coworkers, on the other hand, examined the effect of fibrin glue on the duration of air leaks following lobectomy. They found no difference between the control group and fibrin glue group with respect to the duration of air leak, chest tube drainage, or hospital stay. Matthew and colleagues, however, found the use of fibrin glue to be effective in 94% of the patients and 88% effective in reducing air leaks from bronchial anastomoses or stumps. The efficacy rate in closing BPFs with application of fibrin sealant through the bronchoscope was only 60%. None of the patients was reported to have associated persistent airspaces. Lastly, Yasuda and coworkers described 20 cases of persistent pleuropulmonary fistulas following thoracic procedures treated successfully with fibrin glue injection into the thoracic cavity through a thoracostomy tube. All but one fistula closed. In their comments, they stated that the effectiveness of their technique is limited in lungs that have not expanded sufficiently.

In our case, prolonged air leak was associated with a persistent airspace. This situation is unlikely to resolve spontaneously. In addition, because the cause of the leak was parenchymal surface injury during the dissection and decortication, the likelihood of success with a bronchoscopic approach was small. Because the patient was elderly, debilitated, and deconditioned from two previous operations, we chose a transthoracic percutaneous approach similar to the one described by Yasuda and colleagues. However, instead of instilling the agent through the thoracostomy tube, we placed separate catheters with CT scan guidance. This procedure allowed us to inject the fibrin glue into the airspace in a controlled fashion and to coat the lung surface completely without occluding the chest tube. If an air leak was still present, more fibrin glue would have been instilled until the air leak was gone. If the chest tube became occluded, a new tube easily would have been placed in the CT scan suite under direct guidance. In this manner, we were able to visualize the airspace and monitor its obliteration as the fibrin glue was being injected.

In conclusion, we support the use of fibrin glue for prolonged air leaks following pulmonary resections. It has proved to be worthwhile when applied bronchoscopically, particularly when the leak can be visualized directly. When endoscopic application fails, then transthoracic instillation should be considered, particularly if a small, persistent airspace accompanies the prolonged air leak. We have found that this procedure offers a simple and effective technique for management of this special problem.

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REFERENCES