Endobronchial Vascular Occlusion Coils for Control of a Large Parenchymal Bronchopleural Fistula*

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Angiographic occlusion coils placed endobronchially under fluoroscopic guidance succeeded in controlling a large parenchymal bronchopleural fistula after failure of surgical treatment and transbronchoscopic fibrin glue application. (Chest 1990; 98:233-34)

Parenchymal air leaks following pulmonary resection are common. Although they usually seal within a few days, prolonged fistulas occasionally develop, particularly in patients with severe fibrosis, emphysema, postresection space, and pleural sepsis. Recent reports have described fistula obliteration by endoscopic means.1-8 We present a case in which angiographic occlusion coils placed endobronchially succeeded in controlling a large air leak after failure of other techniques. To our knowledge, no previous report describes the use of coils in therapeutic airway closure.

**CASE REPORT**

A 41-year-old man with sarcoidosis underwent right upper and middle lobectomies for recurrent hemoptysis. During the 14 months prior to operation, he experienced three episodes of massive bleeding localized by bronchoscopy to the right upper lobe. On two occasions, he required intubation with a double lumen endotracheal tube and angiographic embolization of extensive systemic collaterals.

During the first postoperative week, the patient became febrile and pus drained from the thoracic catheters. A small air leak became progressively larger. Operative cultures of the right upper lobe cavity showed *Pseudomonas aeruginosa*, and the same organism was present in the chest drainage. Bronchoscopy revealed intact middle and lower lobe stumps. Systemic antibiotics and irrigation of the apical space failed to reverse the sepsis. On the 20th postoperative day, a five-rib thoracoplasty was performed to reduce the postresection space. A pectoralis muscle flap was used to fill the cavity. Although this procedure solved the empyema problem, an air leak recurred four days later.

On two occasions, an attempt was made to close the fistula by transbronchoscopic instillation of tissue adhesives. A 4 Fr Fogarty balloon catheter was passed through the suction channel of a fiberoptic bronchoscope. The air leak was localized to subsegments of the apical lower lobe segment by performing serial occlusion by balloon inflation and observation of a decrease in the air leak. Two milliliters each of warm thrombin solution and cryoprecipitate were injected into these subsegments through a 6 Fr irrigation catheter. The resulting plug of fibrin "glue" obliterated the air leak only temporarily; recurrence was noted after 12 hours. At the second endoscopy, small strips of moist Gelfoam were used as well, but improvement was again transient. The sharp angle needed to cannulate the apical segment made it impossible to pass the injecting catheter more than a few millimeters into the subsegments. In order to provide access to more distal airways and placement of a lasting airway blocker, we decided to place Gianturco angiographic occlusion coils under fluoroscopic guidance.

The subsegmental bronchi contributing to the air leak were again identified using a balloon-tipped catheter with simultaneous fluoroscopic and bronchoscopic monitoring. These bronchi were selectively catheterized with a cerebral angiographic catheter. Small aliquots of dilute contrast material were hand-infused with the catheter positioned in various subsegmental airways. The small bronchi contributing to the air leak transmitted contrast to the pleural space during inspiration. A 5 mm Gianturco steel embolization coil was introduced through the catheter into each culpable airway, employing the techniques used in standard vascular embolization9 (Fig 1). This was followed immediately by thrombin and cryoprecipitate injection. The two step (coil and fibrin) embolization procedure was performed in three separate subsegmental bronchi.

Following the procedure, there was almost total obliteration of the air leak. Complete cessation occurred by the tenth day. The patient was discharged from the hospital one month later. He is currently doing well one year after operation, with no recurrence of hemoptysis or fistula. The chest x-ray film shows good expansion of the remaining lobe (Fig 2).

**DISCUSSION**

The simultaneous occurrence of a persistent high-volume fistula and a postresection space after partial pulmonary resection represents a challenging problem. Local infection compounds the difficulty. If tube drainage alone is ineffective, operation may be required. A variety of procedures have been employed, including direct repair, thoracoplasty,
injectate produced permanent control, presumably by inducing local mucosal inflammation and edema. Nonabsorbable bronchial occlusion devices have been used to provide more lasting control. Ratliff et al. occluded a large fistula with a lead fishing weight. Occlusion by indwelling balloons has also been reported both clinically and experimentally.\(^{1,18}\)

In our case, fibrin glue alone provided temporary fistula blockade. Two applications were followed by recurrence. The Gianturco coils likely contributed to lasting control by three mechanisms: providing permanent partial blockage of the small bronchi in which they were placed, providing a matrix for retaining the fibrin glue, and possibly inducing local inflammation. Coils have the advantage of being mechanically fixed in place when extruded from the catheter, thereby reducing the likelihood of migration of the fibrin glue. In addition, the use of the angiographic catheter technique allows accurate placement of the coils in more peripheral airways, rather than the more proximal placement achievable using standard bronchoscopic techniques. Placement of the coils in peripheral bronchi is less likely to cause significant atelectasis and pneumonia than central blockade. If such problems occur, the coils are potentially removable using flexible forceps under fluoroscopic guidance.

**References**