Unilateral Diaphragmatic Paralysis Following Bronchial Artery Embolization for Hemoptysis

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Bronchial artery embolization is an effective treatment for patients with hemoptysis. Serious complications are rare, but may occur if the arterial supply to other structures is compromised. We present a case of unilateral diaphragmatic paralysis following bronchial artery embolization in a patient with cystic fibrosis. We believe that the diaphragmatic paralysis was due to the inadvertent obstruction of the left pericardiacophrenic artery during the embolization procedure, with compromise of the phrenic nerve blood supply. This resulted in a significant loss of lung function in our patient, who did not recover despite the subsequent return of diaphragmatic function.

Key words: bronchial arteries; cystic fibrosis; diaphragm; embolization; hemoptysis; phrenic nerve; therapeutic

Bronchial artery embolization is a well-accepted and effective form of treatment for massive and recurrent hemoptysis. Overall, the success rate for control of active hemoptysis is 90%; however, recurrence of hemoptysis is seen in up to 27% of cases. The most commonly reported complication is that of chest pain, which occurs in as many as 90% of cases. Other reported complications are rare and are related to the inadvertent compromise of the arterial supply to other organs. Such complications include spinal cord infarction, esophagobronchial fistula, and cerebrovascular accident. We present a case of hemoptysis treated with bronchial artery embolization, which was complicated by the development of unilateral diaphragmatic paralysis.

CASE REPORT

A 29-year-old woman with cystic fibrosis and severe cystic bronchiectasis presented with recurrent hemoptysis. There was a 2-year history of minor hemoptysis < 50 mL in association with exacerbations of her bronchiectasis, and there was an episode of recurrent hemoptysis of between 50 and 200 mL for 4 days that had resolved with rest and IV antibiotics.

She presented with further hemoptysis, having hemorrhages of between 200 and 300 mL on 3 consecutive days, and underwent bronchial angiography and embolization. Angiography of the right lung showed that the upper two thirds was supplied by a tortuous bronchial artery that was being fed from both the aorta and internal mammary artery. The feeding vessels were both partially occluded by the placement of polyvinyl alcohol particles in both vessels and by a single 5-mm steel coil in the aortic origin. Flow was reduced, but abnormal blood vessels remained. Further embolization was deferred due to the long duration of the procedure. After the procedure, she developed right-sided pleuritic chest pain that lasted for 4 days.

Recurrent hemoptysis of between 50 and 100 mL developed 2 months later and failed to settle with conservative therapy. Further bronchial artery angiography and embolization were arranged. During this procedure, the left bronchial artery arising from the internal mammary artery was embolized using numerous polyvinyl alcohol particles. Complete occlusion of the abnormal vessels was achieved, and completion aortic images showed only very small residual vessels supplying the lungs. She was discharged from hospital 2 days postprocedure and was apparently well at that time.

On review 2 weeks later, she described increased dyspnea since...
Unilateral diaphragmatic paralysis is often asymptomatic, but up to 24% of people with this condition experience persistent shortness of breath, particularly if they have underlying lung disease or obesity. Orthopnea is frequently reported, and oxygen desaturation may be seen on exercise or when asleep. Our patient experienced significant dyspnea, particularly on exertion, but had no orthopnea. No oxygen desaturation was detected on overnight oximetry.

Unilateral diaphragmatic paralysis is usually due to phrenic nerve dysfunction, which is often idiopathic in origin. In cases in which a cause is identified, the most common etiologies are malignant infiltration due to bronchogenic carcinoma, postsurgical complications of neck or thoracic surgery, trauma, infection, and neurological disease. Following coronary bypass surgery, between 8% and 17% of patients are estimated to have some degree of unilateral diaphragmatic paralysis, with higher incidences seen in patients receiving internal mammary artery grafts.

The phrenic nerve is accompanied by the pericardiacophrenic artery in the thorax. This is one of the first branches of the internal mammary artery. Studies in animals have confirmed that the phrenic nerve blood supply is largely derived from this artery, with perfusion of the left phrenic nerve reduced by 71% following left internal mammary artery dissection with ligation of this branch.

We think that the left phrenic nerve infarction and consequent left diaphragmatic paralysis observed in our patient were secondary to the inadvertent obstruction of the left pericardiacophrenic artery, during the embolization of the left bronchial artery feeder from the left mammary artery. This had serious consequences in our patient, with significant loss of lung function, which failed to return to baseline despite subsequent diaphragmatic recovery. To our knowledge, this complication of bronchial artery embolization has not been described previously. We believe that awareness of this complication and identification of the pericardiacophrenic artery before the embolization of abnormal bronchial arteries arising from the internal mammary artery should enable this complication to be avoided.

**References**