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Graft Repair of a Pulmonary Artery Aneurysm

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ABSTRACT

Aneurysm of the main pulmonary artery is a rare anomaly with a poorly understood pathogenesis. We report the successful surgical resection and repair of a pulmonary artery aneurysm using aneurysmectomy and replacement of the pulmonary artery with Dacron, a procedure with excellent long-term outcome that eliminates the risk of recurrence. The 65-year-old male patient presented with a marked decrease in exercise tolerance and worsening dyspnea. He had a history of pulmonary stenosis diagnosed during childhood, episodic shortness of breath beginning during his teenage years, hypertension, and smoking. On physical examination, the patient appeared generally well. Computed tomographic scan of the chest revealed an 8-cm aneurysm involving the main pulmonary artery and pulmonary artery bifurcation. Coronary angiography showed a massive aneurysm of the main and left pulmonary arteries, with mild dilation of the proximal right pulmonary artery. Surgery was performed through a median sternotomy with the use of normothermic, bicaval cardiopulmonary bypass. The aneurysm of the main pulmonary artery and dilated bifurcation of the pulmonary artery was excised and reconstruction was performed using a 22-mm Dacron graft. The patient's postoperative course was uneventful. He was discharged to home on postoperative day 5 and was well at 1-month follow-up.

INTRODUCTION

Pulmonary artery aneurysms are rare pathological entities that may be idiopathic or associated with congenital or acquired structural cardiac abnormalities, pulmonary hypertension, or infections. We report the successful surgical resection and repair of a pulmonary artery aneurysm.

CASE REPORT

A 65-year-old male patient had a history of pulmonary stenosis that was diagnosed when he was a 3-year-old child and occasional episodes of shortness of breath that had occurred since he was a teenager. Recently he noted a marked decrease in exercise tolerance and worsening dyspnea. Exercise stress revealed no ischemic changes; however, it was terminated early, at 6 minutes, because of general fatigue. A computed tomographic scan of the chest revealed an 8-cm aneurysm involving the main pulmonary artery and pulmonary artery bifurcation (Figure 1).

The patient also had a history of hypertension and a remote history of smoking 40 years ago. Pulmonary function tests revealed a forced expiratory volume in 1 second (FEV1) that was 54% of predicted. On physical examination, he appeared generally well. He had no carotid bruits or jugular venous distension. Auscultation revealed a 2/6 holosystolic murmur. Electrocardiogram results showed sinus bradycardia, and blood chemistry analysis results were normal. Transesophageal echocardiography showed normal right ventricular function, a mildly dilated right atrium and ventricle, and trace mitral, tricuspid, and pulmonic valve regurgitation. Cardiac catheterization documented right atrial mean pressure of 4 mm Hg, right ventricular pressure of 40/5 mm Hg, pulmonary artery pressure of 30/10 mm Hg, pulmonary wedge pressure of 10 mm Hg, and aortic pressure of 151/74 mm Hg. There was a 10 mm Hg gradient across a mildly regurgitant pulmonic valve. Coronary angiography showed no significant stenosis and normal left ventricular function. There was a massive aneurysm of the main and left pulmonary arteries, with mild dilation of the proximal right pulmonary artery (Figure 2).

Surgery was performed through a median sternotomy with the use of normothermic, bicaval cardiopulmonary bypass. The aneurysm of the main pulmonary artery and dilated bifurcation of the pulmonary artery were excised. A mildly stenotic bicuspid pulmonary valve was identified. Reconstruction was performed using a 22-mm Dacron graft as shown in Figure 3. Histology of the pulmonary artery wall was normal. The patient's postoperative course was uneventful. He was discharged to home on postoperative day 5 and was well at 1-month follow-up.

DISCUSSION

Aneurysm of the main pulmonary artery is a rare anomaly. An extensive review by Deterling and Clagett determined the incidence to be approximately 1 per 13,696 autopsies [Deterling 1947]. The majority occur in the main pulmonary artery trunk with varying degrees of extension onto the peripheral pulmonary arteries.

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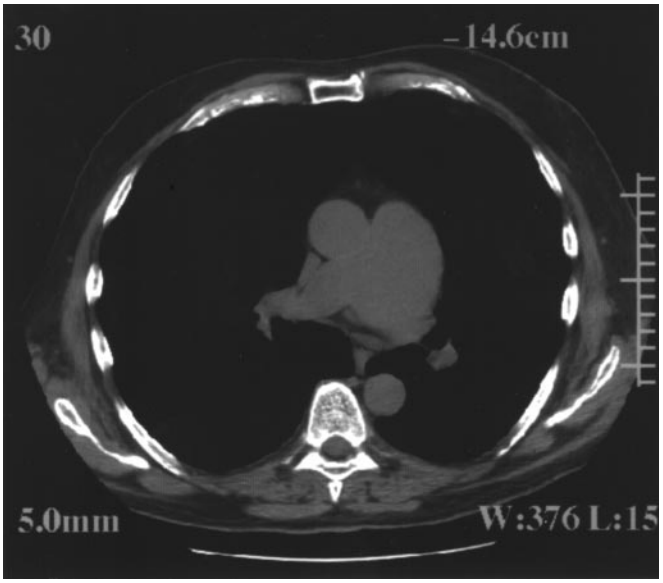

Figure 1. Computed tomographic scan with intravenous contrast of aneurismal main pulmonary artery bifurcation.

The pathogenesis of pulmonary artery aneurysm is poorly understood. The aneurysms can be classified as congenital or acquired. Congenital etiologies are usually seen in the setting of significant pulmonary hypertension and anomalies such as patent ductus arteriosus, ventricular septal defect, and atrial septal defect. Acquired aneurysms may be secondary to septic emboli in the presence of right-sided bacterial endocarditis. Aneurysm association with tuberculosis and syphilis has also been postulated, in addition to the more common associations with atherosclerosis, cystic medial necrosis, Behcet syndrome, Marfan syndrome, and trauma.

This case of pulmonary artery aneurysm was most likely associated with the mildly stenotic bicuspid pulmonic valve. Aneurysms have been reported in association with pulmonary valve gradients of 10 to 110 mm Hg, akin to the poststenotic aortic dilation often seen with stenotic bicuspid aortic valves [Casselman 1995, Chen 1996]. Perhaps a more detailed molecular examination of pulmonary artery aneurysms in this setting may reveal a collagen deficiency similar to that seen with poststenotic aortic dilation [Bonderman 1999, De Sa 1999].

A majority of pulmonary artery aneurysms have been found incidentally during an evaluation for exertional dyspnea, cough, hemoptysis, or chest pain. Screening chest roentgenogram may demonstrate a mediastinal mass, a result leading to a more detailed examination with a computed tomographic scan or magnetic resonance imaging. Echocardiography is valuable in assessing the status of right-sided structures and function. If surgery is to be performed, pulmonary angiography at the time of cardiac catheterization will clearly define the boundaries of the aneurysm and allow more detailed preparation of a surgical plan [Chen 1997].

When pulmonary artery pressures are normal or the patient is asymptomatic, conservative nonsurgical management of pulmonary artery aneurysms has been advocated. More than a decade of uncomplicated follow-up has been documented [Dennison 1985, Tami 1994]. However, given the law of Laplace and documented cases of spontaneous

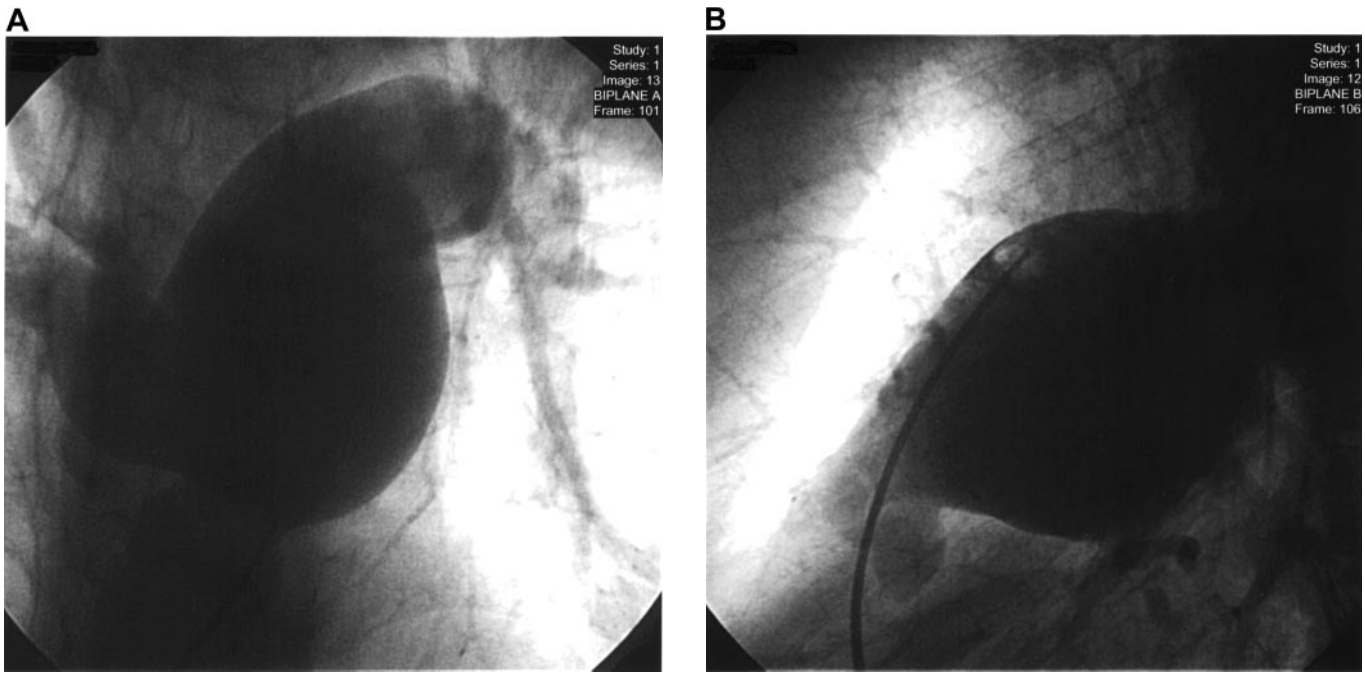

Figure 2. Pulmonary arterial angiography showing dilated main pulmonary artery and minimal pulmonary valve regurgitation; A, anterior-posterior view; B, lateral view.

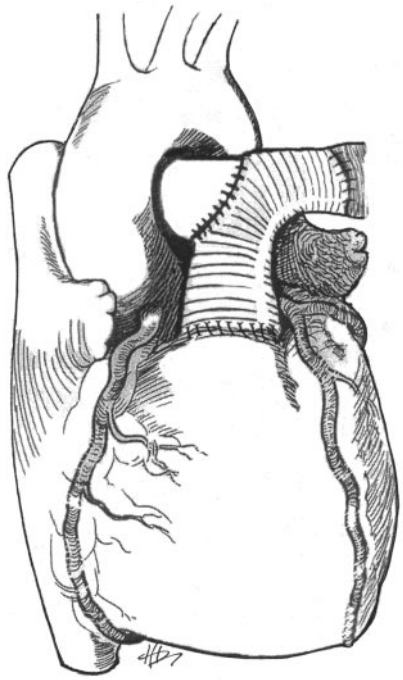

Figure 3. Diagram of graft repair of aneurysm of main and left pulmonary arteries.

rupture and dissection [Senbaklavaci 2001], we advocate surgical repair of all pulmonary artery aneurysms greater than 5 cm in diameter, regardless of etiology.

A multitude of surgical techniques for aneurysm repair have been described, all with excellent surgical outcome. Aneurysm plication is the simplest technique, but the long-term risk of aneurysm recurrence is uncertain, especially in the setting of pulmonary hypertension [Kuwaki 2000]. Aneurysmectomy and replacement of the pulmonary artery with allograft or Dacron [Casselman 1995, Kuwaki 2000] is our procedure of choice. It is reproducible with excellent long-term outcome and eliminates the risk of recurrence.

REFERENCES

Bonderman D, Gharehbaghi E, Wollenek G, Maurer G, Baumgartner H, Lang I. 1999. Mechanisms underlying aortic dilation in congenital aortic valve malformation. Circulation 99:2138-43.

Casselman F, Deferm H, Peeters P, Vanermen H. 1995. Aneurysm of the left pulmonary artery: surgical allograft repair. Ann Thorac Surg 60:1423-5.

Chen YF, Chiu CC, Lee CS. 1996. Giant aneurysm of main pulmonary artery. Ann Thorac Surg 62:272-4.

Chen YF, Lee CS. 1997. Pulmonary artery aneurysm [letter]. Ann Thorac Surg 64:586.

Dennison AR, Watkins RM, Gunning AJ. 1985. Simultaneous aortic and pulmonary artery aneurysms due to giant cell arteritis. Thorax 40:156-7.

De Sa M, Moshkovitz Y, Jagdish B, David T. 1999. Histologic abnormalities of the ascending aorta and pulmonary trunk in patients with bicuspid aortic valve disease: clinical relevance to the Ross procedure. J Thorac Cardiovasc Surg 118:588-96.

Deterling RA, Clagett O. 1947. Aneurysm of the pulmonary artery: review of literature and report of a case. Am Heart J 34:471-99.

Senbaklavaci O, Kaneko Y, Bartunek A, et al. 2001. Rupture and dissection in pulmonary artery aneurysms: incidence, cause, and treatment-review and case report. J Thorac Cardiovasc Surg 121:1006-8.

Tami LF, McElderry MW. 1994. Pulmonary artery aneurysm due to severe congenital pulmonic stenosis. Case report and literature review. Angiology 45:383-90.