and ranges from an incidental finding to severe symptoms—typically, recurrent respiratory symptoms in the affected lung or dyspnea owing to pulmonary hypertension from long-standing shunting. Indications for repair are (1) pulmonary hypertension owing to left-to-right shunt with a shunt fraction greater than 50% as determined by cardiac catheterization and (2) recurrent pulmonary infections.[5]

This case demonstrates the technical difficulty of pneumonectomy after failed repair of scimitar syndrome in the setting of recurrent infection. It points out that surgical resection of a lung should not be delayed when a propensity to become infected is evident. Inflammation can lead to dense pleural adhesions. Although an extrapleural approach may be radical, it potentially reduces the risk of postpneumonectomy space infection in patients with loculated fluid collections or ongoing parenchymal infection. Additionally, it may reduce postoperative bleeding from collateral blood supply. Preoperative imaging with magnetic resonance angiography of the vascular anatomy is critical to avoid intraoperative surprises. Pneumonectomy is unlikely to adversely affect pulmonary function and may actually improve it.

References

1. Halasz NA, Halloran JH, Liebow AA. Bronchial and arterial anomalies with drainage of the right lung into the inferior vena cava. *Circulation*. 1956;14:826-46.
2. Dupuis C, Charaf LA, Breviere GM, Abou P, Remy-Jardin M, Helmius G. The "adult" form of the scimitar syndrome. *Am J Cardiol.* 1992;70:502-7.
3. Najm HK, Williams WG, Coles JG, Rebeyka IM, Freedom RM. Scimitar syndrome: twenty years' experience and results of repair. *J Thorac Cardiovasc Surg.* 1996;112:1161-8; discussion 1168-9.
4. Kamiyama M, Kamata S, Usui N. Scimitar syndrome treated with pneumonectomy: a case associated with bronchospastic attack. *Pediatr Surg Int.* 2004;20:65-6.
5. Schramel FM, Westermann CJ, Knaepen PJ, van den Bosch JM. The scimitar syndrome: clinical spectrum and surgical treatment. *Eur Respir J.* 1995;8:196-201.

Successful perioperative management of a middle mediastinal paraganglioma

Jun Matsumoto, MD, Jun Nakajima, MD, Eriho Takeuchi, MD, Takeshi Fukami, MD, Kan Nawata, MD, and Shin-ichi Takamoto, MD, Tokyo, Japan

Dr Matsumoto

Middle mediastinal paragangliomas are very rare, slow-growing tumors, but almost all of them are very hypervascular tumors. Complete surgical resection is difficult to achieve because of their proximity to the heart, great vessels, and trachea. We report successful complete resection incorporating preoperative embolization and a clamshell bilateral thoracotomy.

Clinical Summary

A 52-year-old woman was found to have an abnormal shadow on a chest radiograph for a medical checkup. Chest computed tomography at another hospital revealed a large well-enhanced mass with a cystic lesion located between the superior vena cava, aortic arch, right pulmonary artery, left atrium, and trachea (Figures 1 and 2). A video-assisted thoracoscopic biopsy was performed at another hospital to make the diagnosis, but massive bleeding occurred during the procedure, and the biopsy was abandoned. The patient was then referred to our department. We strongly suspected a paraganglioma of the middle mediastinum. The serum noradrenaline level was slightly increased, and an iodine 123–meta-iodobenzylguanidine scan showed uptake in the tumor. An angiographic study showed many feeding arteries, and the main feeders were 3 thick bronchial arteries. Preoperative embolization with Gelfoam (Pfizer, Ann Arbor, Mich) and several microcoils was performed the day before the operation. At operation, we were ready to perform cardiopulmonary bypass; however, complete resection of the tumor without cardiopulmonary bypass was performed via the clamshell approach. Finally, intraoperative blood loss was reduced to 1070 mL. Histologic diagnosis was reported as a typical paraganglioma, 7 cm in size. There was no sign of recurrence on a computed tomography scan 1 year after surgery.

From the Department of Cardiothoracic Surgery, Faculty of Medicine, University of Tokyo, Tokyo, Japan.

Received for publication Jan 23, 2006; accepted for publication Feb 22, 2006.

Address for reprints: Jun Matsumoto, MD, Division of Surgery, Asahi General Hospital, I-1326 Asahi, Chiba, Japan (E-mail: matsumoto@hospital.asahi.chiba.jp).

J Thorac Cardiovasc Surg 2006;132:705-6

0022-5223/$32.00

doi:10.1016/j.jtcvs.2006.02.061

Comment

Aorticopulmonary paragangliomas are rare neoplasms; 79 anterior and middle mediastinal paragangliomas, which represent a surgical challenge, were reviewed.[1] Because of their location close to the great vessels and trachea, complete resection is very difficult. Paragangliomas are locally invasive and have a high local recur-

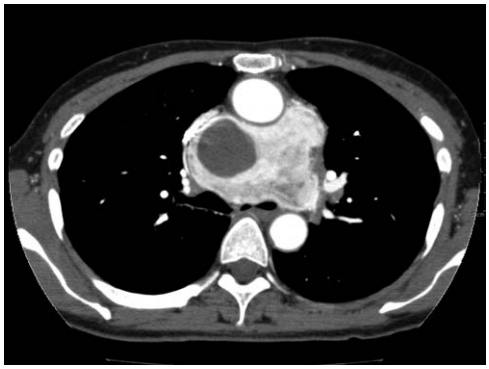

Figure 1. Computed tomography scan showing a large tumor with a cystic region located around the aortic arch and compressing the left main bronchus posteriorly.

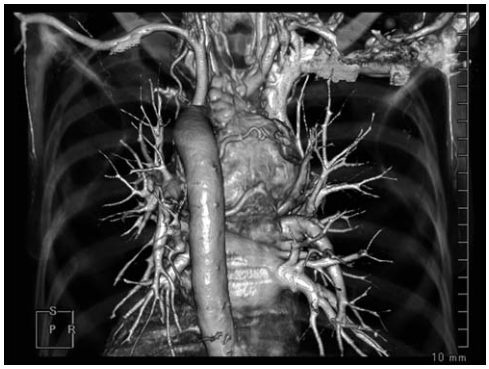

Figure 2. Three-dimensional computed tomography showing 2 thick feeding vessels (right bronchial arteries) on the back side of the tumor.

rence rate (55.7%) and metastatic potential (26.6%). Radiation and chemotherapy seem to be ineffective. Complete resection is an important prognostic factor.[1]

Preoperative embolization for posterior mediastinal paraganglioma was first described in 1987[2] and minimizes perioperative vascular complications.[3] In our case, preoperative embolization of the three main feeders (bronchial arteries) was performed the day before surgery, and it reduced intraoperative blood loss and permitted dilated bronchial arteries behind the tumor to be ligated and divided more safely.

The surgical approach we selected was the clamshell approach, which was described by Bains and coworkers.[4] It provides a better view of lateral and posterior aspects of the tumor than median sternotomy, but it causes longer-lasting pain and more impaired postoperative respiratory function than median sternotomy. In our case, the intraoperative view was excellent, and complete resection was achieved more safely than it would have been by median sternotomy.

In a few of the cases that have been reported, surgery was performed with the help of cardiopulmonary bypass.[1,5] Cardiopulmonary bypass should be available and used if necessary for complete resection in cases in which there is local invasion to vital structures.

Almost all aorticopulmonary paragangliomas are aggressive and locally invade vital structures. A careful perioperative strategy (eg, preoperative embolization, an appropriate surgical approach, and cardiopulmonary bypass) is required to resect them completely.

References

1. Lamy AL, Fradet GJ, Luoma A, Nelems B. Anterior and middle mediastinum paraganglioma: complete resection is the treatment of choice. *Ann Thorac Surg.* 1994;57:249-52.
2. Drucker EA, McLoud TC, Dedrick CG, Hilgenberg AD, Geller SC, Shepard JO. Mediastinal paraganglioma: radiologic evaluation of an unusual vascular tumor. *AJR Am J Roentgenol.* 1987;148: 521-2.
3. Rakovich G, Ferraro P, Therasse E, Duranceau A. Preoperative embolization in the management of a mediastinal paraganglioma. *Ann Thorac Surg.* 2001;72:601-3.
4. Bains MS, Ginsberg RJ, Jones WG II, McCormack PM, Rusch VW, Burt ME, et al. The clamshell incision: an improved approach to bilateral pulmonary and mediastinal tumor. *Ann Thorac Surg.* 1994;58: 30-3.
5. Kern JA, Milbrandt TA, Rolf S, Tribble CG. Resection of multiple mediastinal paragangliomas with cardiopulmonary bypass. *Ann Thorac Surg.* 1997;64:1824-6.