Case Report

Resection of Thymic Carcinoma in a Patient with Thoracic Aortic Aneurysm

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A 72-year-old man with a history of brain infarction presented with left sided anterior chest pain secondary to a thymic carcinoma. He received induction radiotherapy, 45 Gy. Preoperative computed tomography showed the tumor was adherent to a thoracic aortic aneurysm (TAA) which had extensive mural thrombus and calcification. To obtain adequate exposure without exerting tension on the fragile aneurysmal wall, ribs were resected to allow us to separate the tumor from the TAA, after which median sternotomy was performed uneventfully, creating generous exposure. The tumor had invaded the sternum, ribs, innominate vein, phrenic and recurrent laryngeal nerves, and lung. The tumor was removed en bloc, and the chest wall was reconstructed. Intra- and post-operative brain infarction and rupture of the TAA were avoided. The patient is alive and well without recurrence 10 months after surgery. (Ann Thorac Cardiovasc Surg 2002; 8: 188–92)

Key words: thymic carcinoma, mediastinal tumor, thoracic aortic aneurysm, induction radiotherapy, chest wall reconstruction

Introduction

Thymic carcinoma was defined as a thymic tumor exhibting clearcut cytologic atypia and a set of cytoarchitectural features no longer specific to the thymus, but rather analogous to those seen in carcinomas of other organs.[1)] Thymic carcinoma is rare and is more invasive than thymoma.[2)] We report the case of a surgically treated thymic carcinoma in a patient with a thoracic aortic aneurysm (TAA). The unique problems of obtaining adequate exposure without disturbing the TAA are discussed.

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Case Report

A 72-year-old man with a past history of brain infarction was referred to our hospital with left-sided anterior chest pain. A chest roentgenogram revealed a TAA. Chest computed tomography (CT) showed TAA and a left-sided anterior mediastinal mass, which had invaded and destroyed the sternum (Fig. 1). Tumor adhesions to the TAA with mural thrombus and calcification were observed. No pleural effusion was detected. Percutaneous needle biopsy specimen revealed that the tumor was a squamous cell carcinoma. The serum concentration of CEA was 8.0 ng/mL (normal, <5.0 ng/mL), SCC was 15.0 ng/mL (normal, <1.5 ng/mL), and TPA was 420 U/L (normal, <70 U/L). The patient did not have myasthenia gravis or a paraneoplastic syndrome.

After 45 Gy of induction radiotherapy, the serum concentration of CEA was 6.2 ng/mL, SCC was 1.6 ng/mL, and TPA was 41 U/L. The tumor size decreased slightly, but the response rate was classified as NC (no change).

Median sternotomy is usually used for malignant an-

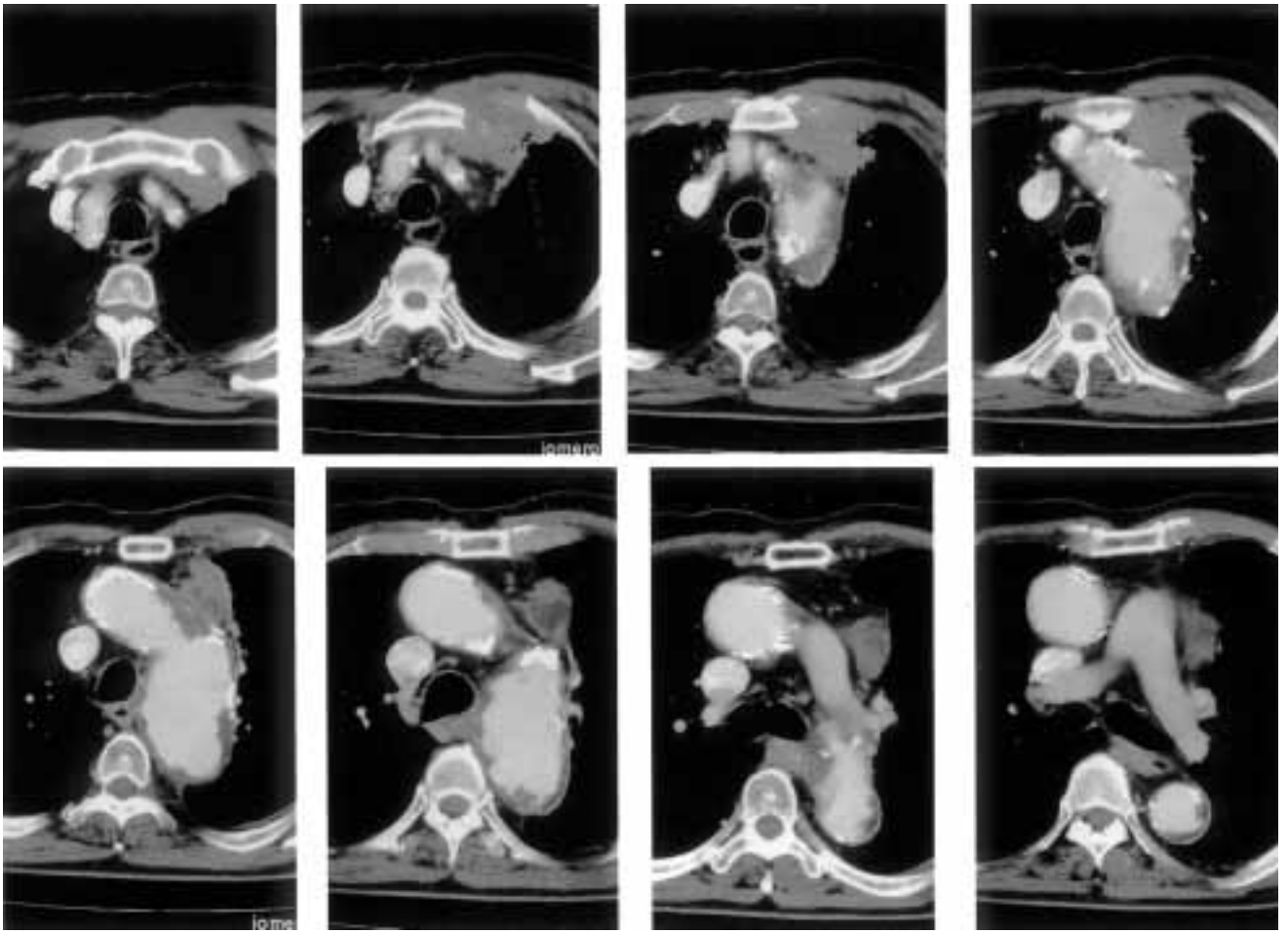

Fig. 1. Chest computed tomography in a patient with a thymic carcinoma and a thoracic aortic aneurysm. Note invasion and destruction of the sternum.

terior mediastinal tumors in our hospital. However, in this case, it was feared that traction on the sternum might cause tension on the fragile aneurysmal wall and rupture the TAA because the tumor was adherent to it (Fig. 2a, 2b). Additionally, risk of brain thromboembolism caused by disturbing the TAA during tumor dissection was high. For these reasons, we planned to obtain sufficient exposure to separate the tumor from the TAA by resecting the chest wall before attempting a median sternotomy (Fig. 2c).

Under general anesthesia with the patient in the supine position, a left anterior incision through the fourth intercostal space was performed. No intrathoracic metastases were identified. Since there was no invasion of the third intercostal muscle, the fourth rib was not resected. Using an extended skin incision (Fig. 3a), the third intercostal muscle, third rib, second intercostal muscle, and second rib were divided 3 cm from the lateral border of the tumor (Fig. 3b). The tumor had invaded the left lung, so a partial resection of the left upper lobe was performed. Since the cephalad portion of the tumor was overlying the left clavicle, though preoperative CT had not shown this relationship, the clavicle, first rib, and first intercostal muscle also were excised (Fig. 3b). The tumor had invaded the left side of the sternum, but the midline of the sternum was free of tumor and a median sternotomy was performed (Fig. 3c). The en bloc section of sternum and clavicle was preserved aseptically for reimplantation (Fig. 3d).

The innominate vein had been invaded by the tumor and was sacrificed without reconstruction. The tumor was firmly adherent to the TAA. A combination of sharp and blunt dissection separated the mass from the aortic wall. Inflammatory adhesions were present, but invasion by the tumor had not occurred. During the procedure, traction on the tumor and the TAA was not necessary because

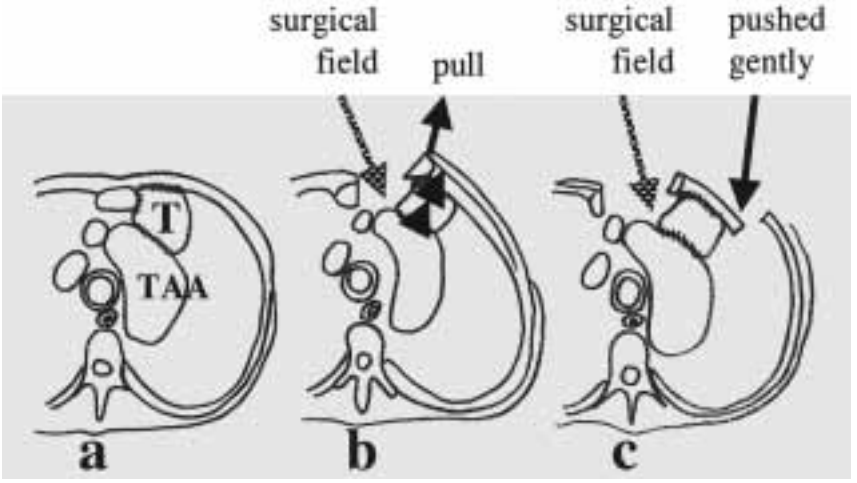

Fig. 2. a: The tumor (T) is suggested to be adhered to the chest wall and thoracic aortic aneurysm (TAA). b: After median sternotomy, a retractor may pull the tumor and TAA. c: To avoid the traction, ribs are incised first and then median sternotomy is performed.

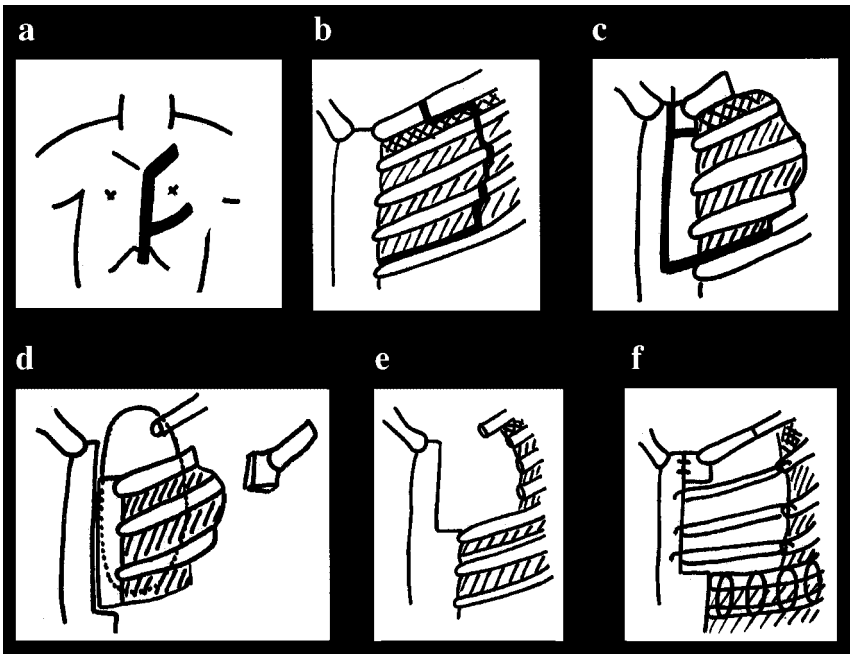

Fig. 3. Schematic diagram showing the surgical approach to thymic carcinoma in a patient with a thoracic aortic aneurysm. a: Skin incisions. b: Lateral incision on the anterior chest wall. c: Median sternotomy. d: Claviclar head and attached sternum are preserved for reimplantation. e: Extent of chest wall resection. f: Chest wall defect closes with wire, mesh and reimplantation of clavicular head.

excision of the ribs had created a wide operation field (Fig. 2c). The tumor was free from the pulmonary artery. The phrenic nerve and the recurrent laryngeal nerve had been invaded and were partially resected. The tumor was removed en bloc with the first, second, and third ribs, sternum, left lung, innominate vein, phrenic nerve, recurrent laryngeal nerve, and fat tissue including lymph node (Fig. 3e).

The chest wall was reconstructed by wiring the ribs and sternum (Fig. 3f). The claviclar head and sternum were reimplanted. Double polypropylene mesh sheets were used to close the defect in the chest wall. The sheets were fixed with the wire and chest wall. The patient was extubated immediately after surgery without complication.

The tumor was elastic and measured 6×5×3 cm. The cut surface of the tumor was solid and milky-white (Fig. 4). Histological examination revealed that the tumor was a moderately well differentiated squamous cell carcinoma (Fig. 5a). The carcinoma was surrounded by dense fibrous and thymic tissue (Fig. 5b). The final histopathological diagnosis was thymic carcinoma. The periphery of the tumor was necrotic, presumably due to the induction radiation therapy. However, the central area of the tumor appeared identical to the preradiation biopsy specimen. Viable cells were observed in more than 66% of the tumor. Surgical margins were tumor-free, and there were no lymph node metastases.

Fig. 4. The cut surface of the tumor with sternum.

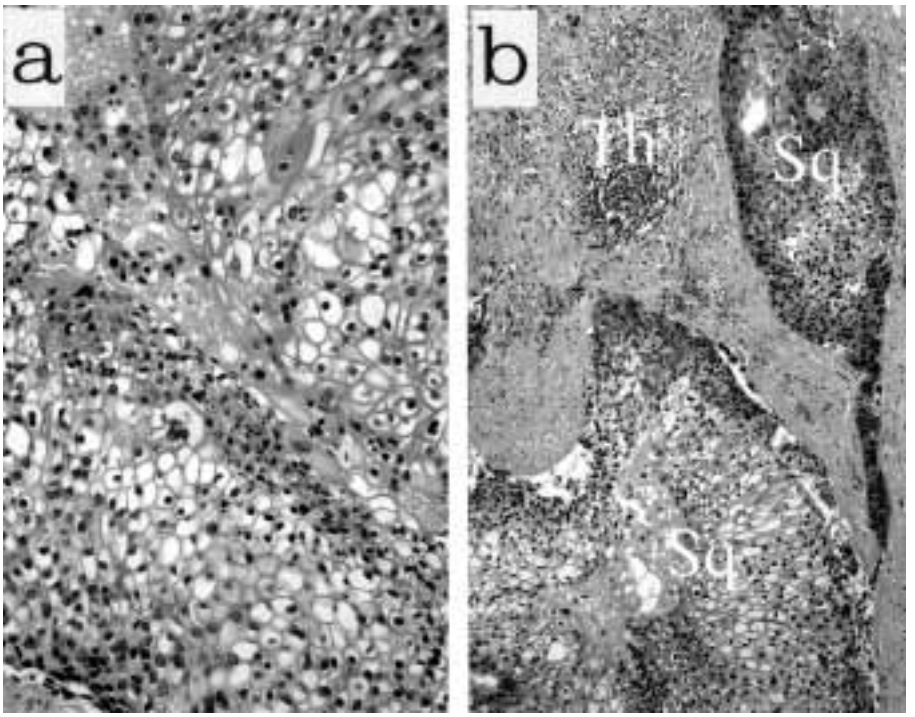

Fig. 5. Microscopic findings. Th: Thymic tissue, Sq: Squamous cell carcinoma. Hematoxylin and Eosin. Magnification: a; ×50, b; ×25.

The postoperative course was uneventful except for the need to perform bronchofiberscopy to suction secretions during the first week. Left arm edema was prevented by prophylactic use of an elastic compression bandage. The postoperative serum concentration of CEA was 3.6 ng/mL, SCC was 0.6 ng/mL, and TPA was 35 U/L. Adjuvant therapy was not selected. The patient is alive and well without recurrence 10 months after surgery.

Discussion

Thymic carcinoma is a rare neoplasm and accounts for 10% of all thymic neoplasms.[2,3] This tumor has a more aggressive histologic appearance and clinical course than thymoma.[2,4] Paraneoplastic syndrome is often associated with thymoma, but rarely with thymic carcinoma[2-6] such as in our case.

Adhesions between the thymic carcinoma and the TAA precluded the use of a standard median sternotomy. Since the tumor had invaded the sternum, traction might have transmitted tension to the TAA, possibley rupturing it. A paramedian approach via resection of the chest wall provided adequate exposure to free the tumor from the aorta before attempting to dissect it.

Shimosato et al. reviewed thymic carcinoma invading the lung and found were no cases of pulmonary lymph node metastases, although metastases to the anterior mediastinal lymph nodes were common.[6] Murakami et al. studied the lymph vessels, which form the bronchomediastinal trunks and showed that the course on the left side is variable.[7] The authors identified three groups of lymph nodes on the left side: the uppermost paratracheal nodes near the recurrent laryngeal chain nodes, the anterior mediastinal nodes surrounding the phrenic nerve anterior and inferior to the aortic arch, and the left tracheobronchial nodes.[7] Lymph node dissection for thymic carcinoma should include all three groups.

Preoperative radiotherapy is an effective alternative to extended resections.[3] The relative merits of induction and adjuvant radiotherapy are unclear. Our patient received only 45 Gy preoperatively because full-dose radiotherapy would disturb postoperative wound healing. Additionally, since radiotherapy causes fibrosis, ischemia, and calcification of the aortic wall,[8] we do not plan to administer postoperative radiation therapy.

Surgery and radiation therapy are the mainstays of the treatment for thymic carcinoma,[6] although chemotherapy also has been reported to be effective in some cases.[9] Induction chemotherapy has been recommended especially for invasive tumors,[4] but only a few case reports

have been published.[3,4] Most chemotherapy regimens for thymic carcinoma are platinum-based.[3,4] Nakamura et al. found no association between histological subtypes and prognosis in patients with advanced thymic carcinoma who received chemotherapy and showed that platinum-based chemotherapy is only marginally effective for advanced thymic carcinoma.[5] Suster and Rosai similarly found no beneficial effect.[10] Bronchial intra-arterial infusion has been proposed as a treatment option to increase efficacy.[11]

The histological type and pathological stage are the key determinants of outcome.[3,4] Squamous cell carcinoma has a better outcome than other histological types,[3,10] and an asymptomatic presentation does not improve the prognosis.[12] Since Blumberg et al. showed that the prognosis in patients with thymic carcinoma depends solely on tumor invasion of the innominate veins[13] as in our case, long-term follow-up is indicated though complete resection was achieved.

References

1. Rosai J, Sobin LH. Histological Typing of Tumors of the Thymus. International Histologic Classification of Tumors, 2nd ed. New York: Springer, 1999; pp 13–5.
2. Okumura M, Miyoshi S, Fujii Y, et al. Clinical and functional significance of WHO classification on human thymic epithelial neoplasms. *Am J Surg Pathol* 2001; **25**: 103–10.
3. Lucchi M, Mussi A, Basolo F, Ambrogi MC, Fontanini F, Angeletti CA. The multimodality treatment of thymic carcinoma. *Eur J Cardiothorac Surg* 2001; **19**: 566–9.
4. Takahashi K, Yoshida J, Nishimura M, Nagai K. Thymic carcinoma. *Jpn J Thorac Cardiovasc Surg* 2000; **48**: 494–8.
5. Nakamura Y, Kunitoh H, Kubota K, et al. Platinum-based chemotherapy with or without thoracic radiation therapy in patients with unresectable thymic carcinoma. *Jpn J Clin Oncol* 2000; **30**: 385–8.
6. Shimosato Y, Kameyama T, Nagai K, Suematsu K. Squamous cell carcinoma of the thymus. *Am J Surg Pathol* 1977; **1**: 109–21.
7. Murakami G, Sato T, Takiguchi T. Topographical anatomy of the bronchomediastinal lymph vessels: their relationships and formation of the collecting trunks. *Arch Histol Cytol* 1990; **53**: 219–35.
8. Mesurolle B, Qanadli SD, Merad M, et al. Unusual radiologic findings in the thorax after radiation therapy. *Radiographics* 2000; **20**: 67–81.
9. Hsu CP, Chen CY, Chen CL, et al. Thymic carcinoma. *J Thorac Cardiovasc Surg* 1994; **107**: 615–20.
10. Suster S, Rosai J. Thymic carcinoma. A clinicopathologic study of 60 cases. *Cancer* 1991; **67**: 1025–32.
11. Kaseda S, Shimizu K, Yamane T, Sugiura H. Bronchial arterial infusion with cisplatin followed by irradiation successfully treats recurrent stage IVb thymic large cell carcinoma. *Eur J Cardiothorac Surg* 1999; **16**: 471–4.
12. Truong LD, Mody DR, Cagle PT, Jackson-York GL, Schwartz MR, Wheeler TM. Thymic carcinoma: a clinicopathologic study of 13 cases. *Am J Surg Pathol* 1990; **14**: 151–66.
13. Blumberg D, Burt ME, Bains MS, et al. Thymic carcinoma. *J Thorac Cardiovasc Surg* 1998; **115**: 303–9.