Case Report

A Subtotal Sternectomy Successfully Reconstructed with Composix Mesh™

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Sternal tumors are uncommon, which often require extended resections with reconstructions. Various techniques have been used, including a choice of prostheses and the use of musculocutaneous flaps for reconstructions. A 74-year-old male presented with a metastatic sternal tumor. He underwent a subtotal sternectomy with partial resection of bilateral clavicles and ribs. A sternal reconstruction was performed with Composix mesh™ and pectoralis major (PM) muscle flaps. This prosthesis was thought to be very suitable due to the ease of handling, good stability, and prevention of adhesion. In comparison to conventional prostheses, these points could be advantageous. (Ann Thorac Cardiovasc Surg 2006; 12: 420–4)

Key words: sternal tumor, reconstruction, Composix mesh™, muscle flap

Introduction

Malignant sternal tumors are uncommon. Radical resection can provide an opportunity for a complete cure. Various prostheses have been used for sternal reconstruction, depending on the experience of the surgeon and the need to guarantee the stability of the chest wall. We may also sometimes consider a re-operation depending on its local aggressiveness and the high local recurrence rate. We herein detail a 74-year-old male case, who underwent a successful subtotal sternectomy, followed by reconstruction with Composix mesh™ (C. R. Bard, Inc., NJ, USA) and pectoralis major (PM) muscle flaps .

Case

A 74-year-old male visited a community hospital complaining of anterior chest pain in 2004. He was diagnosed with a sternal tumor on Chest CT and referred to our hospital for an operation. He had a polypectomy of the colon in 2000. The usual tumor markers, including I-CTP, were not apparent, apart from slight elevation of CEA (4.8 ng/ml). Respiratory function and arterial blood gas analysis were normal. Lateral view chest x-ray showed a thickened manubrium. A chest CT revealed a manubrium filled with a soft tissue tumor, 42×14×55 mm in size. The cortex of the sternum was not invaded. On chest MRI, the tumor showed low density in T1W1, high in T2W1 (Figs. 1A and 1B), and invasion to the bilateral second ribs and the fracture of the manubrium (Fig. 1C). PET revealed a strong accumulation in the upper portion of the sternum, with no accumulation elsewhere in the body (Fig. 2). As these findings indicated a primary sternal tumor, and serious anterior chest pain, an operation was performed without a biopsy of the tumor. A median sternotomy was performed. A tumor occupying the whole manubrium was revealed in almost half of the sternal body and appeared to be invading both parts of the clavicles and 1-3 ribs. The intra-operative frozen section of the tumor showed a metastasis of adenocarcinoma, the origin of which was not detected. A subtotal sternectomy, with partial resections of both clavicles and the 1-3 ribs with bone margins of 3 cm, was performed (Fig. 3A). The sternal reconstruction was undertaken with Composix mesh™, reinforced by Marlex mesh (Fig. 3B). Soft tissue coverage was obtained with a PM muscle translation (Fig. 3C). The postoperative course was uneventful. Flail chest was not observed. A chest drain tube was removed on day 5 after the operation.

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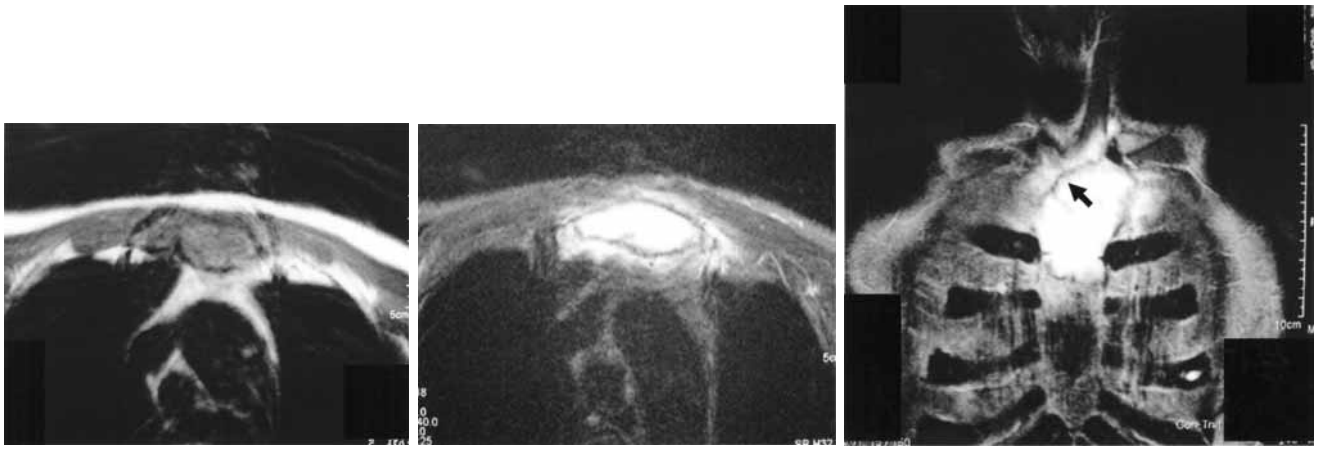


A **B** **C**

Fig. 1.
Chest MRIs showed a low density tumor in T1W1 (**A**), high in T2W1 (**B**), and invasion to the bilateral second ribs and the fracture in the manubrium (arrow)(**C**).

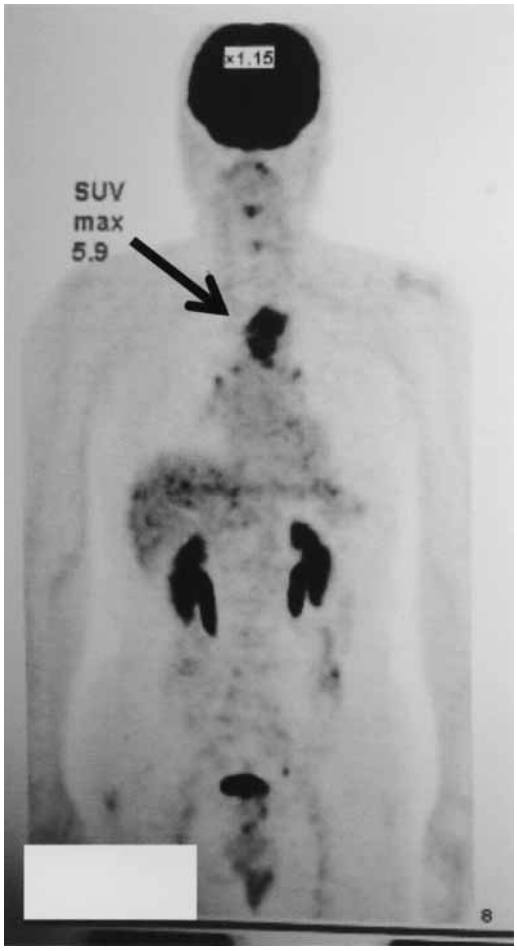


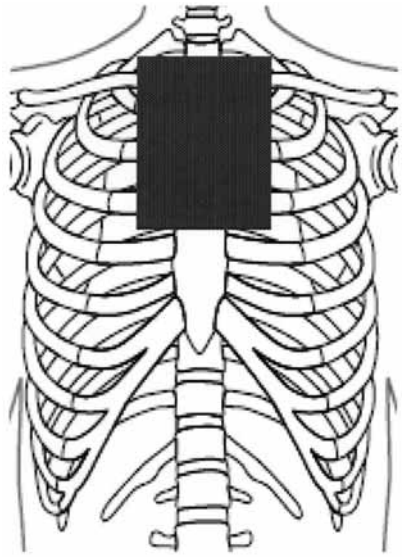
Fig. 2. PET revealed a strong accumulation in the upper portion of the sternum (arrow) with no accumulation in other sites.

Pathohistology showed atypical epithelial cells, appearing glandular in structure, proliferating invasively. These round nuclei were swelling with clear nucleoli. An immunohistochemical stain was positive for prostate specific antigen (PSA). These results indicated a metastatic sternal tumor from prostate cancer.

Since being diagnosed postoperatively with prostate cancer by needle biopsy, he is now undergoing out-patient hormone therapy. On chest CT 6 months after the operation, the site of the sternal defect was filled by soft tissue without excess fluid (Fig. 4).

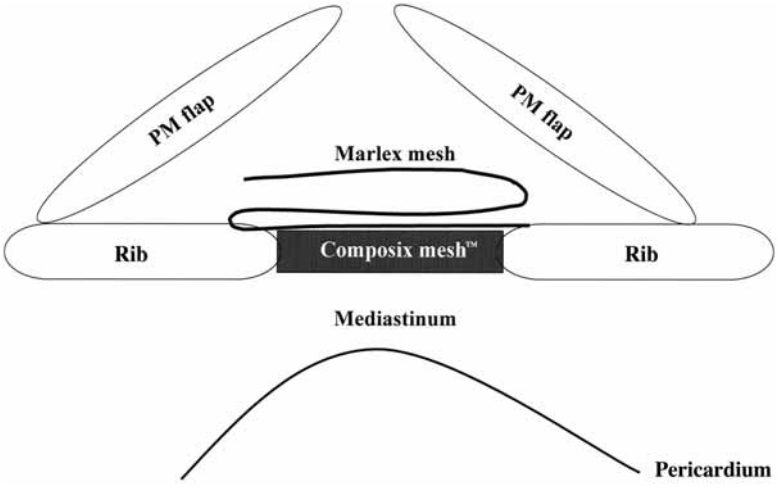
Discussion

Primary malignant sternal tumors are uncommon, and most of them are sarcomas. A radical sternectomy is the first priority for a primary tumor.[1)] For a successful resection to prevent local recurrence of a sternal tumor, a wide and full-thickness resection remains the key. The line of resection should be at least 2.5–3 cm beyond the margin of the tumor in patients with malignant disease.[1,2)] Despite these efforts, the management of malignant sternal tumors, especially sarcomas, may prove difficult because of their local aggressiveness and the high recurrence rate. Depending on the tumor, a re-operation to remove recurrent lesions could cause the prolonged prognosis.[3)] With this in mind, we may consider re-operation when we choose the prosthesis for the reconstruction in the first operation.



A

B



C

Fig. 3.
A: A subtotal sternectomy with partial resections of both clavicles and the 1-3 ribs with bone margins of 3 cm were performed. ▩, resected area.
B: The sternal reconstruction was undertaken with Composix mesh™ reinforced by Marlex mesh.
C: Scheme of a sternal reconstruction (cross section). The defect was reconstructed with Composix mesh™, Marlex mesh, and pectoralis major (PM) flaps.

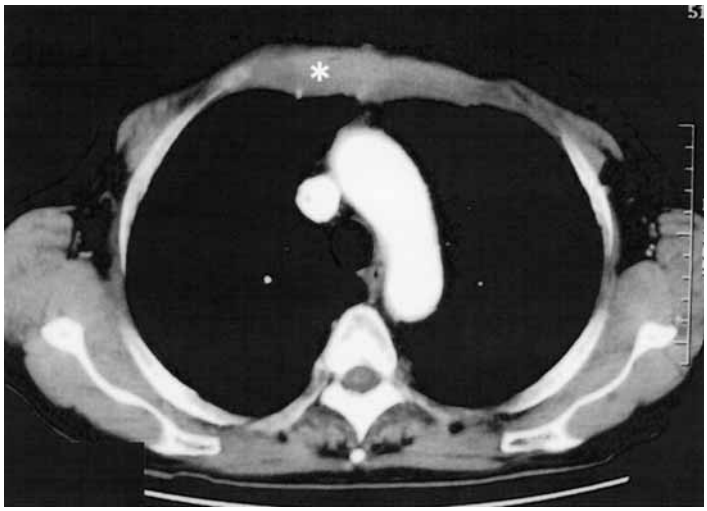


Fig. 4. On chest CT at 6 months after the operation, the site of the sternal defect was filled by soft tissues (*).

For a secondary sternal tumor, such as a metastatic tumor, an appropriate therapeutic approach depends on the primary tumor. Some authors suggest that a histological diagnosis is now required to identify patients with high-grade tumors, whose primary treatment should be chemotherapy.[4,5] For prostate cancer with bone metastasis, hormonal therapy and/or chemotherapy should basically be the first priority. In our case, we performed an operation to relieve serious chest pain due to a sternal fracture. Lequaglie et al. described that the surgical option can be considered within the framework of a multimodal approach to the treatment of solitary bone metastasis, that includes radiotherapy, chemotherapy, and hormonal therapy.[6] Some authors have pointed out that the surgical treatment of a solitary bone metastasis of breast cancer provides a better prognosis in the absence of metastasis to the mediastinal lymph nodes.[3,6,7] For the other secondary sternal tumors, when local control cannot be obtained by radiotherapy or chemotherapy, a surgical approach may also be considered to provide palliation for chest pain and infections. In such cases, surgery with palliative intent can improve the quality of life.[2,6,8]

Various techniques have been used in the past to repair defects in the sternum.[6] The combination of prosthetic materials and soft tissue coverage and muscular or musculocutaneous flaps is advantageous, and offers more options for resolving the situation effectively in each individual patient.[9–11] Musculocutaneous flaps provide an airtight closure and a reliable, well vascularized sternal reconstruction. Prostheses for sternal reconstructions are required to restore ventilatory mechanics and to protect the intrathoracic organs. Various materials were used to achieve this. Chest-wall stability after a wide sternectomy can often be obtained with polypropylene nets, such as Marlex (C. R. Bard, Inc., NJ, USA), Prolene (Ethicon, Inc., NJ, USA) mesh, expanded polytetrafuloroethylene (ePTFE) patch or methacrylate. Polypropylene nets are widely used because of their resistance, manageability, and durability.[1,6] They are also hardly ever rejected or cause septic complications. After total sternectomy, the use of a rigid prosthesis, like methacrylate, may be considered.[1] Methacrylate is usually spread between two layers of Marlex mesh.[12,13] Complications, however, such as the strong risk of infection or of causing a reaction, means we occasionally have to remove the methacrylate after replacement. Copmosix mesh™ is meant to achieve the benefits of both polypropylene ingrowth and the minimization of adhesions provided by ePTFE. This mesh is composed of two layers of Marlex mesh with a thin, heat-sealed layer of ePTFE, on one side of the polypropylene surface. This structure provides more elasticity, easier handling (than methacrylate) and greater stability than conventional polypropylene nets. These points can ease surgical management. Although Composix mesh™ was reinforced by more Marlex mesh to ensure stability in our case, it may not have been necessary. Moreover, less mechanical stress, and adhesion to intrathoracic organs, is obtained by an ePTFE layer. This particular point could be advantageous when re-operation is considered, because not only may the unnecessary resection of adhering organs be avoided, but also performing a re-operation is made safer.

In our actual case, the postoperative course was uneventful. There were no infections, no strong reaction, and no respiratory trouble, like flail chest. Despite several experiences using Marlex meshes, this was the first case where we used Composix mesh™ for a sternal reconstruction; longer follow-up and more clinical experience are clearly required. However, we believe it to be a suitable prosthesis for a sternal reconstruction, due to the advantages described above.

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