Abstract  A primary giant cell tumor (GCT) originating from the sternum is extremely rare. We report a case of a GCT originating from the sternum in a 45-year-old man who was referred to us for a mass in the anterior chest wall that had been growing slowly. Computed tomography revealed a soft tissue mass involving a large osteolytic and destructive lesion of the sternum body. Subtotal sternectomy and reconstruction with methylmethacrylate were performed. The tumor was 8.5 × 4.5 × 2.5 cm, and the histopathological examination confirmed GCT. Radical wide resection of primary sternum tumors and reconstruction with an appropriately rigid prosthetic material are necessary to minimize local recurrence.

Key words  Tumor, Giant cell · Sternum

Introduction  
A giant cell tumor (GCT) accounts for 5%–10% of all primary bone tumors and 20% of all benign tumors. It occurs primarily in young adults, with a slight predilection for females. A giant cell tumor mostly occurs at the end of long bones, and 55% of GCTs involve an epiphysis around the knee; the sternum is a rare site for a GCT, with an incidence of less than 0.2%. In this article, we report an extremely rare case of GCT originating from the sternum.

Case  
A 45-year-old man presented with anterior chest pain that had lasted more than 6 months. He felt a bony mass of the anterior chest wall that had been growing slowly. The mass was hard, fixed to the chest wall, and mildly tender. The surface was felt to be smooth, but the border was unclear; the afflicted area measured approximately 12 × 6 cm. The patient had no history of hemodialysis or hyperparathyroidism. A lateral view radiograph of the sternum revealed a radiolucent, expanding, osteolytic lesion on the body of the sternum. Computed tomography (CT) demonstrated a soft tissue mass involving the lateral cortex of the sternum. The mass showed heterogeneous contrast enhancement and attachment to the right parietal pleura. CT findings demonstrated no evidence of lung metastasis (Fig. 1). The results of baseline laboratory tests were normal, and the tumor marker levels of α-fetoprotein and the carcinoembryonic antigen (CEA) and CA19-9 were also in normal ranges.

We performed an incisional biopsy of the sternum tumor while the patient was under general anesthesia. Because the pathological diagnosis by intraoperative incisional biopsy was giant cell-type bone neoplasm, subtotal sternectomy was performed. Briefly, a midline incision was made, and a portion of the major pectoral muscles close to the sternum tumor was resected. The sternum below the first intercostal space was resected with 3 cm wide sections of cartilage on each side. An intraoperative rapid cytological examination reported that the surgical margin appeared to be negative. The right parietal pleura and both internal thoracic vessels were resected because they had tumor involvement. The defect in the chest wall was reconstructed with methylmethacrylate (Fig. 2). The tumor was 8.5 × 4.5 × 2.5 cm.
2.5 cm soft, friable, and yellowish-dark. Hemorrhage, necrosis, and cyst formation with a yellow capsule were noted in the cross section. The histopathological diagnosis of the surgical specimen disclosed GCT. Spindle-shaped or ovoid stromal cells were heavily intermingled with multinucleated giant cells and variable amounts of vessel invasion (Fig. 3).

One year after surgery, the patient is doing well without any evidence of GCT recurrence.

**Discussion**

A giant cell tumor of bone is an unusual neoplasm, accounting for 5%–10% of all primary bone tumors. Malignant GCT can arise de novo or via transformation from a benign neoplastic giant cell lesion. The ends of long bones and epiphysisal portions of bone are the predicted sites for GCT; 55% of lesions occur around the knee. However, a GCT originating from the sternum is rare, with an incidence of less than 0.2% (2 cases among 1093 patients). Treatment of GCT depends on the extent of the disease. Although surgical management may be difficult because of the local aggressiveness of these tumors and a high local recurrence rate (27.6%), radical wide resection of primary malignant sternum tumors can offer a definitive cure. Sternum resection with a clear margin of at least 3 cm is advocated to minimize the risk of local recurrence. Chest wall stability after wide sternectomy can be obtained with prosthetic materials. A rigid prosthetic replacement is recommended to limit paradoxical motion. Various types of prosthetic material are presently used: methylmethacrylate, Prolene mesh, Marlex mesh, polytetrafluoroethylene patch (PTFE), or Vicryl nets are well tolerated, are easy to handle, and can be sutured under tension, thus improving the stability of the thoracic wall. Among the various prosthetic meshes with similar physical properties, Marlex mesh remains the most widely used because of its solidity, manageability, and long-term tolerability, the visual absence of foreign body reactions or septic complications, and the low cost. However, it has limited resilience, even when sutured in traction; and it sometimes produces a permanent, harmful flail chest. After total sternectomy or large resections involving the lateral aspect of the chest wall and more than four ribs, methylmethacrylate (with Marlex mesh) offers the best results in terms of fixation, protection of endo thoracic organs, and lung expansion. In the case reported here, we used methylmethacrylate, which compensated for limited resilience and allowed good intrathoracic organ protection in all areas of the defect. With the use of rigid prostheses, pulmonary function is preserved, early extubation is possible in nearly all patients, and hospitalization is shorter because of fewer complications. On the other hand, patients have the potential risk of infection (e.g., infection with radionecrosis). Especially in the patient with radiation-induced sarcoma, large sternum defects are safely reconstructed with a musculocutaneous flap. In addition, the omentum has been proposed as a valid alternative to muscular flaps for excellent blood supply and good performance in potentially infected areas. The clinical results are favorable. The obvious disadvantages are the need for addi-