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Resection of a chondrosarcoma arising in the right first rib: a case report

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Case Report

Resection of a Chondrosarcoma Arising in the Right First Rib: A Case Report

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Primary chest wall tumors are relatively rare, and in individual cases the biological properties and onset site of the tumor must be considered before surgery, and the chest wall defect must be reconstructed. The case of a patient with a chondrosarcoma arising in the right first rib who underwent resection and reconstruction is reported. The patient was a 56-year-old man with a 6 × 7 cm tumor in the anterior chest wall side of the right first rib; biopsy confirmed a grade I chondrosarcoma. During surgery, a safe surgical field was prepared by severing the clavicle inside the periosteum and resecting the tumor with the anterior side of the first and second ribs. The chest wall defect measured about 10 cm, and reconstruction was performed, using the greater pectoral muscle and a polypropylene mesh as covers. In the treatment of chondrosarcoma, chemotherapy and radiotherapy are less effective, and appropriate surgery is needed. In the present patient it was useful to prepare a safe surgical field for resecting the first rib tumor by severing the clavicle and then reconstructing the chest wall, using the greater pectoral muscle and a polypropylene mesh. (Ann Thorac Cardiovasc Surg 2010; 16: 118–121)

Key words: chondrosarcoma, chest wall tumor, first rib tumor, chest wall reconstruction

Introduction

Chondrosarcomas often arise in the pelvis or bones of the trunk, but primary chest wall chondrosarcomas are relatively rare. Since they do not often respond well to chemotherapy or radiotherapy, surgical therapy is usually performed. When performing surgery, depending on the site of onset, the surgeon must establish a safe surgical field, remove the tumor, and reconstruct the chest wall defect. The case of a patient who underwent surgery for a chondrosarcoma arising in the anterior side of the right first rib is reported.

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Case

The patient was a 56-year-old man. During workplace health screening, a chest X-ray showed an abnormal shadow in the right upper chest field, and the patient was referred for thorough investigation. Prior to screening, he had been experiencing slight discomfort in the precordial region. Past medical history included hypertension, and his history was unremarkable. He had smoked for 35 years, and his Brinkman index was 700. His height was 165 cm, body weight 74 kg, blood pressure 134/78 mmHg, and pulse rate 70 beats/min. On auscultation, pulmonary sound was clear, and he had no heart murmurs. A biochemical examination of blood showed no abnormalities. On respiratory function testing, vital capacity (VC) was 3,470 ml, percent VC (%VC) 98.7%, forced expiratory volume (FEV) one 1,220 ml, and FEV1% was 68.4%. A chest X-ray revealed a lesion measuring approximately 7 cm on the anterior chest wall side of the right first rib (Fig. 1), and a chest CT showed a tumor protruding into the thoracic cavity (Fig. 2). We performed

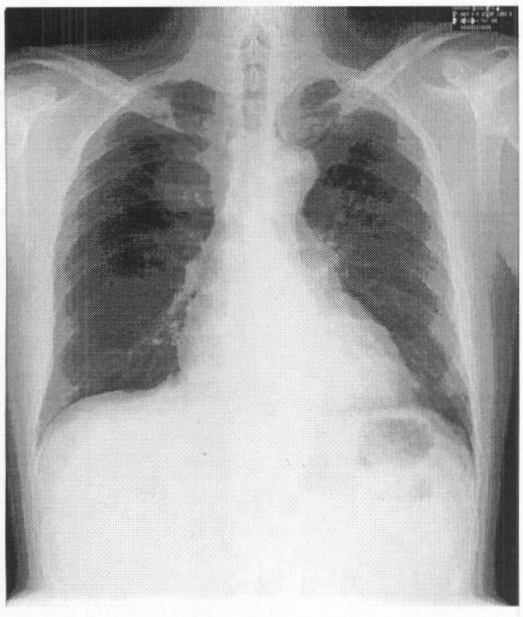

Fig. 1. Chest X-ray.
A tumor 7 cm in diameter can be seen on the right side of the chest wall of the right first rib.

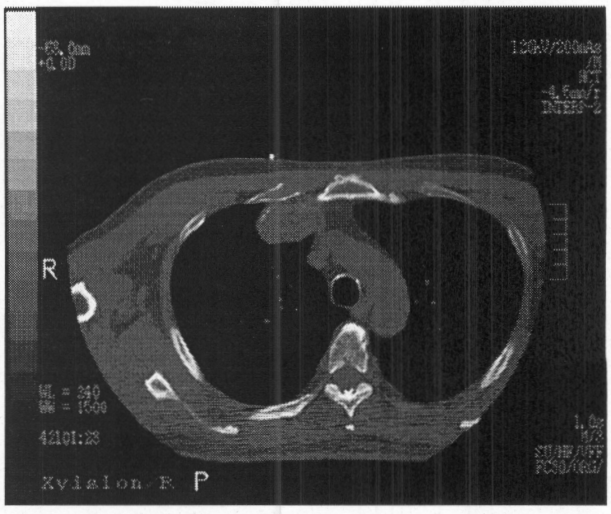

Fig. 2. Chest CT scan.
The tumor protrudes into the thoracic cavity.

core-needle biopsy (CNB) under CT guidance, and the tumor was diagnosed grade I chondrosarcoma.

Surgery was initiated by placing an arched skin incision from under the right clavicle to the parasternum. After the sternocostal part of the major pectoral muscle in the vertical direction had been resected, the interpectoral space was detached to laterally reflect the major pectoral muscle, and the minor pectoral muscle was resected to expose the clavicle and the first rib. Into the fifth intercostal space in the anterior axillary line, a thoracoscope (5 mm in diameter) was inserted, and while the tumor covered by the parietal pleura in the thoracic cavity was being observed, a small thoracotomy was performed through the second intercostal space (Fig. 3a). To prepare surgery in the anterior upper margin of the first rib, the clavicle was severed in the periosteum (Fig. 3b), making it possible to avoid exposing the subclavian vessels and brachial plexus. The anterior sections of the first and second ribs, including the tumor, were resected. After resection, the chest wall defect was about 10 × 8 cm, and the chest wall was reconstructed by use of a polypropylene mesh (Fig. 3c). The severed clavicle was fixed by using a titanium plate, and the reflected greater pectoral muscle was used to cover the wound. Examination of the resected specimen showed tumor diameter to be 4 × 6 cm, and when sliced, the internal surface was slightly uneven and white, but capsular infiltration into the pleura was absent (Fig. 4). On histopathological examination, increased tumor cell cellularity and tumor cell nucleus irregularity in both size and morphology occurred, and enlarged images confirmed tumor cell nucleus irregularity and morphology, as well as binucleated tumor cells (Fig. 5). S100 antibody was positive. Therefore grade II chondrosarcoma was diagnosed. The surgical margin was free of malignant cells, and the patient was given no postoperative adjuvant therapy. The patient now shows no sign of recurrence (2 years and 8 months after surgery).

Discussion

Chondrosarcoma is a malignant tumor exhibiting neoplastic chondrogenesis. It often arises in the pelvis or long bones, and it is relatively rare for chondrosarcoma to arise in the rib. However, of the various primary malignant bone tumors, the incidence of chondrosarcoma is relatively high.[1-3] With respect to clinical symptoms, many patients complain of pain and that they can feel the tumor, and local tumor progression can cause a wide variety of symptoms, but depending on its location, chondrosarcoma can be asymptomatic. This patient had no subjective symptoms prior to screening.

In most cases, X-ray examination shows a radiolucent lesion with an unclear border accompanied by calcification. On CT, the imaging intensity of chondrosarcoma is comparable to that of muscle, and calcification is seen

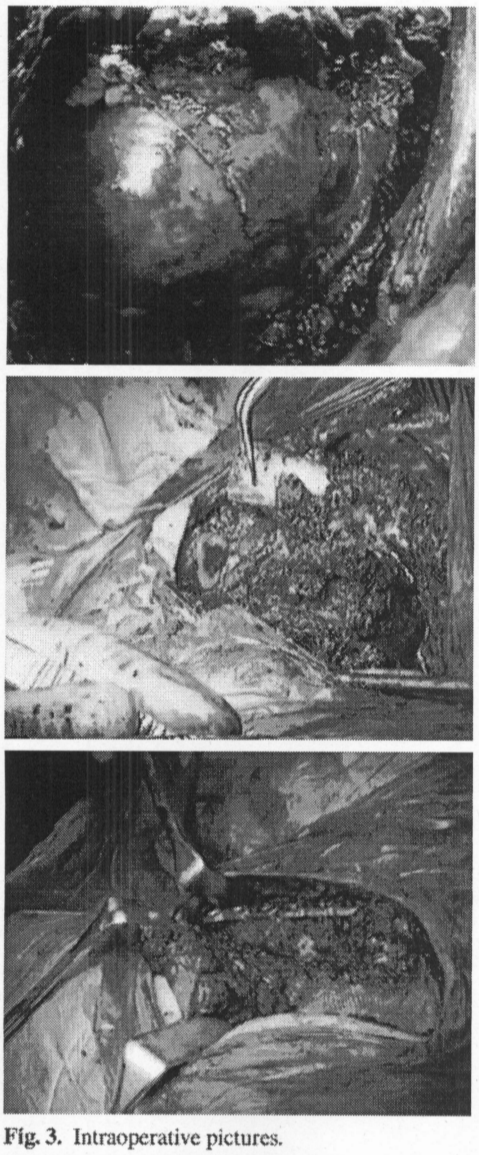

Fig. 3. Intraoperative pictures.
a: Thoracoscopic view of the tumor.
b: Preparation of the surgical field by severing the clavicle.
c: Chest wall reconstruction using a polypropylene mesh, and clavicle reconstruction using a titanium plate.

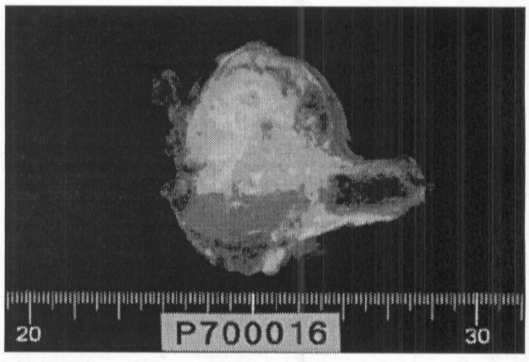

Fig. 4. Resected specimen.
A macroscopic specimen showed that the sliced surface is slightly uneven and white, but pleural infiltration is absent.

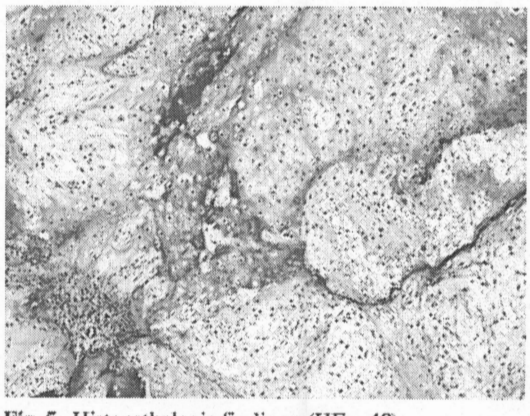

Fig. 5. Histopathologic findings. (HE: ×40)
Histopathologic findings showed increased tumor cell cellularity and tumor cell irregularity in both nucleus size and morphology.

inside. MRI reveals vitreous cartilage matrix, and T1- and T2-weighted images show low- and high-intensity signals, respectively.[4,5] Prior to therapy, it is important to confirm the pathological diagnosis because treatment differs between benign and malignant tumors and between primary and metastatic tumors; even with chondrosarcoma, the prognosis depends on the grade.[6] The accuracy of fine-needle aspiration cytology (FNAC) as a diagnostic method is low, and histological diagnosis by CNB is recommended.[7] As in the present patient, when a tumor protrudes and proliferates into the thoracic cavity, CT-guided biopsy is useful for preventing such complications as pneumothorax.

With respect to treatment, chondrosarcoma is not responsive to chemotherapy or radiotherapy, and extensive resection with a sufficient margin (3–4 cm) is considered first-line therapy.[8] King and colleagues[1] compared various resection methods and reported that prognoses were favorable for patients having extensive resection. Depending on the onset location, however, it may be difficult to have a sufficient safety margin. In the present patient, the medial margin of the thoracic cavity was diagnosed as a marginal margin, and it will be necessary to carefully follow the patient in the future.

Furthermore, when a chondrosarcoma arising in the first rib is resected, it is necessary to pay attention to the vessels and nerves underneath the clavicle and first rib. In this patient, the clavicle was severed inside the periosteum to prepare a safe surgical field, and the tumor could be resected without exposing the vessels and nerves. As an auxiliary technique, it was useful to preoperatively monitor the surgical field from the thoracic cavity with a thoracoscope.

After extensive chest wall resection, it must be reconstructed to prevent instability and to protect the thoracic organs. The decision of whether to perform reconstruction is based on lesion location and defect size. In general, chest wall reconstruction is recommended when at least three ribs are resected or the size of the chest wall defect is $\geq$ 10 cm.[9,10] Materials currently used for reconstruction include artificial materials, such as polypropylene mesh and composite mesh combined with expanded polytetra fluoroethylene (ePTFE) seat and autologous materials, such as a musculocutaneous flap. One disadvantage of polypropylene mesh is that it provides weak mechanical support for the chest wall, but in this patient it was possible to reconstruct the chest wall with adequate mechanical strength by covering the reconstructed area with the laterally reflected greater pectoral muscle.

As prognostic factors, background characteristics, tumor diameter, grade, complete resection, and distal metastasis have been studied, and multivariate analysis has shown that grade and resection-related parameters are significant prognostic factors.[8]

Conclusion

A patient who underwent resection for a chondrosarcoma arising in the first rib was presented. Although surgery is effective for chondrosarcoma, it is necessary to prepare a safe surgical field and perform reconstruction by considering the onset location and resection range.

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