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Resection of Giant Tumor of Chest Wall under Cardiopulmonary Bypass after Neoadjuvant Chemoradiotherapy: A Case Report

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ABSTRACT

Osteosarcoma, one of the most common sources of bone malignant tumors, often occurs at the epiphysis, such as in the distal femoral and proximal tibia, but seldom occurs at the costa. Here, we present the case of a 15-year-old girl with giant osteosarcoma on the chest wall. Osteosarcoma is extremely malignant and has a high death rate. We surgically resected the osteosarcoma using cardiopulmonary bypass and administered neoadjuvant chemoradiotherapy.

INTRODUCTION

Osteosarcoma is the most common type of primary bone cancer, and the tumor cells directly form osteoid tissues or a bone substance [Zhang 2021]. The cancer, which is most common among 11- to 30-year-old individuals, often occurs at the epiphysis, such as in the distal femoral and proximal tibia, but seldom occurs at the costa [Anoop 2014; Haridas 2020]. Osteosarcoma of the costa accounts for <3% of cases and can be completely removed via surgery only [Sabanathan 1997; Ogundiran 2006]. Researchers have reported that rib osteosarcoma, having a poor prognosis [Bacci 2010], comprehensively depends on surgical resection and chemoradiotherapy.

CASE REPORT

A 15-year-old girl was admitted to a local hospital because of a history of low-grade fever and fatigue, with right-side chest and back pain for more than half a year. Chest computed tomography (CT) showed signs of a huge tumor occupying the right chest wall, and the superior vena cava was likely to be full of tumor embolus.

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The biopsy and pathology report showed osteosarcoma, which is known for its high fatality rate. The doctors of the local hospital advised the patient to be treated at a superior hospital. The patient came to the Oncology Department of our hospital to seek further diagnosis and treatment. After the patient was admitted to our department, she received physical examination, which showed jugular vein engorgement. The result showed that the sound of the left lung breath was clear, whereas that of the right lung breath was low. Dry and wet sounds were not heard in both lungs.

Auxiliary Examination

The echocardiography results showed abnormalities in the superior vena cava, right atrium, right ventricle, and pulmonary artery. The tricuspid valve was mildly closed. Enhanced CT scanning showed that the right side of the chest wall had a tumor that protruded out of the chest and affected the right atrial wall and right ventricular wall (Figure 1). The right side of the middle artery involved in papillary muscles was affected, and right-side pleural effusion was found locally. Upon bone scanning, the lesions were in the third to fifth right rib in accordance with the osteosarcoma. No obvious abnormality was found on the rest of bone scanning results. Cranial CT, electrocardiogram, routine ultrasound of the abdominal and lower limbs, and blood clotting and biochemical examinations showed no abnormalities.

After we fully communicated with the patient's family about the disease, we treated the tumor with neoadjuvant chemoradiotherapy consisting of 15 mg Endostar (days 1 to 14) and 2 g ifosfamide (days 5 to 9). On the basis of the same chemotherapy, we added 120 mg etoposide (days 5 to 9) with the former therapy as a second therapy after 3 weeks and a third therapy after 6 weeks. Surprisingly, after 3 courses of chemotherapy, the chest CT showed that the tumor in the fourth rib of the chest wall became smaller, and the tumor embolus in the superior vena cava was also smaller. Thus, we continued to treat the patient with another 3 courses of the same chemotherapy (each course interval was 21 days).

After 6 courses of chemotherapy, we provided radiotherapy (59.4 Gy/33 fractions) on the tumor at the right fourth rib. After neoadjuvant chemoradiotherapy, the chest CT showed that the tumor was located in the first anterior rib of the chest wall, with pleural invasion. Right pleural effusion formed a parcel, and the tumor embolus in the superior vena cava could hardly be seen.

Surgery

After we evaluated the girl's physical condition, no obvious surgery contraindication could be found. Therefore, we decided to perform extracorporeal circulation and right chest wall tumor resection, right atrium tumor resection, and chest wall revascularization.

First, we prepared for extracorporeal circulation of the blood vessels. Intraoperatively, 30° on the left side of the inclined decubitus, we made a longitudinal incision on the right groin separately to expose the right strands of the arteries and veins. Second, we made a posterior lateral incision to explore the chest wall tumor, whose diameter was approximately 15 × 12 × 10 cm (Figure 2). The tumor was qualitatively hard, with surrounding tissue adhesion and fully lesioned ribs. We performed truncation at approximately 2 cm on both ends of the neoplasm, with rib membrane excision (front end along the rib cartilage). Third, we started line heparinization on the femoral artery for blood vessels, double cavity drainage tube on the femoral vein, and internal jugular vein catheter puncture to establish extracorporeal circulation.

For the ultrasound-guided esophageal cut right atrium, we observed funicular, yellow, hard, basal parts connected to the atrial pectinate muscles probing up in the first vena cava, with unknown vein openings above. We also found funicular extension without the first vena cava. We cut the pulmonary trunk and found funicular material that extended to the left pulmonary artery bifurcation, which we fully explored after complete removal of the emboli.

Finally, for chest wall reconstruction, we performed extracorporeal circulation and chest wall reconstruction with a titanium plate (15 × 15 cm) to repair the chest wall defect (Figure 3) by using steel wire with frame and rib cartilage suture fixation. Postoperative histopathology of the chest wall tumor showed that the source of rib bone sarcoma and right atrium floccule was the tumor emboli. The patient recovered after 16 days of treatment and continued to receive adjuvant chemotherapy. After postoperative follow-up of 6 months, the patient recovered perfectly, and no tumor recurrence or metastasis was found.

DISCUSSION

Osteosarcoma is one of most common sources of bone malignant tumors [Botchu 2006], whose tumor cells directly form osteoid tissues or bones. It tends to occur at the epiphysis, such as in the distal femoral and proximal tibia, of 11- to 30-year-old individuals, but seldom occurs at the costa [Deitch 2003]. Comprehensive surgical treatment is the priority in treating osteosarcoma [Yaman 2017]. Rib osteosarcoma has a worse survival rate than long-bone osteosarcoma: its 5-year survival rate is only 15% [Suárez 2010].

In the case of rib osteosarcoma of our 15-year-old patient, the difficulty in surgical treatment lay in the following 3 points. First, the giant tumor was 15 cm in diameter and 900 g in weight. Second, the tumor emboli in the superior vena cava and the right atrium could detach at any time, which could lead to patient death from pulmonary embolism during the operation. Finally, reconstructing the line of the chest wall was necessary due to the large defects on the chest wall after tumor resection.

We first treated the huge tumor with 6 courses of chemotherapy and neoadjuvant radiotherapy to quickly narrow down the volume and provide good conditions for the operation. We decided auxiliary extracorporeal circulation was necessary during the operation to prevent the tumor emboli on

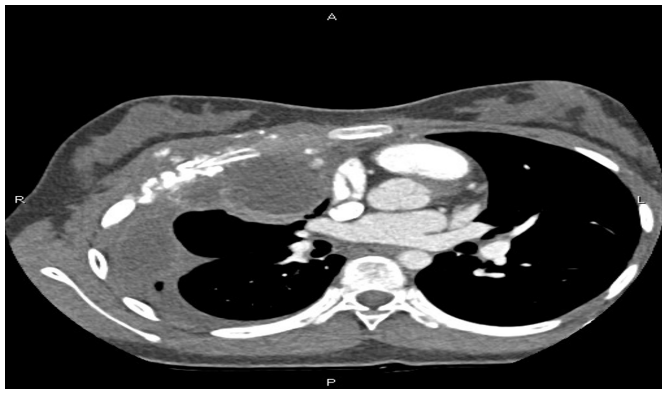

Figure 1. Preoperative chest wall CT, enhanced scanning.

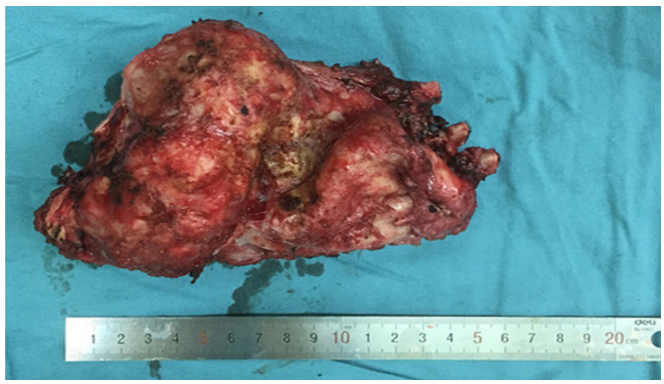

Figure 2. Surgical removal of giant tumor on chest wall.

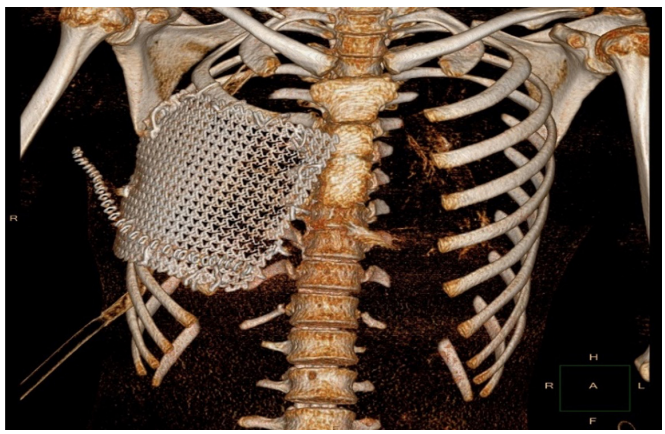

Figure 3. Postoperative chest wall reconstruction.

the superior vena cava and the right atrium from detaching. If the tumor emboli did detach, we could cut the pulmonary artery and remove the emboli immediately. In addition, we added a titanium plate to fill the chest wall defect as a supplement. We treated the patient with more adjuvant chemotherapy as consolidation treatment to prevent tumor recurrence.

All in all, this case report demonstrated a new perspective for giant chest-wall osteosarcoma, which could not be surgically resected directly but required the help of neoadjuvant chemoradiation and auxiliary extracorporeal circulation. The procedures provided opportunities for complete resection and made it possible for the 15-year-old patient to have quality long-term survival.

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