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The fourth operation for chest wall malignant tumor: Resection and reconstruction with MatrixRIB

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Abstract
Operation of chest wall tumor is generally divided into two parts, namely tumor resection and chest wall reconstruction. Tumor resection requires complete removal of the tumor, so as to maximize the prevention of recurrence. If the tumor is not completely removed, the tumor is likely to recur. Chest wall reconstruction is generally required after a large range of chest wall structures are removed. We recently received a 29-year-old male patient with chest wall malignant tumor. In the past three years, he had undergone three tumor resection operations and multiple chemotherapy at the local hospital. However, the tumor recurred again six months ago and grew rapidly. We performed the fourth operation for him. In addition to removing the tumor itself, we also partially removed the 7th, 8th, 9th and 10th ribs connected with the tumor, and then reconstructed the chest wall with MatrixRIB plates. This article reports the operation of this patient.

Keywords: Chest wall tumor, resection, reconstruction, MatrixRIB

Introduction
Chest wall tumor is a common chest wall disease, and its surgical treatment has a history of many years [1-3]. The operation generally includes two parts, namely tumor resection and chest wall reconstruction [4]. Tumor resection requires that the tumor tissue be removed as clean as possible, so as to prevent recurrence. We recently received a patient with chest wall malignant tumor, who had undergone 3 resections and multiple chemotherapy in the local hospital, but the tumor eventually recurred. We performed the fourth operation for him, which not only completely removed the tumor, but also reconstructed the chest wall satisfactorily. This article reports the operation of this patient.

Case Report
The patient was a 29-year-old male. Three years ago, a mass appeared on his left chest wall, and it was surgically removed in the local hospital. The operation only removed the mass itself, without removing any ribs. The pathological diagnosis was my fibroblastic sarcoma. After the operation, the patient received several times of chemotherapy, but the tumor recurred six months later. He underwent a second operation one year after the operation. In this operation, only focus resection was performed without reconstruction, and chemotherapy was given again after operation. However, it recurred again 9 months later, so the third operation was performed 2 months later. During the operation, only the recurrent tumor was removed, and the deep ribs were not treated. The patients still received chemotherapy after operation, but the effect was not ideal. Half a year ago, the patient found tumor recurrence again. The tumor grew beyond the scope of the primary focus, with surface ulceration and local pain. The patient was admitted to our hospital recently for the fourth operation. Preoperative physical examination showed that there were 3 surgical scars on the lower left chest wall, with 3 masses on the surface. The upper mass was about 9X9cm in size, and the surface skin was normal; The median mass protruded from the body surface, about 8X8cm in size, with cauliflower like shape; The mass below was about 3x3cm in size, and its position was relatively fixed (Fig 1). Imaging examination showed that there were 3 masses on the left chest wall, two of which were partially fused, and the masses invaded the 7th, 8th, 9th and 10th ribs on the left side. No visceral organs in the chest were involved (Fig 2, 3). The operation was performed under general anesthesia, and right lateral decubitus position was adopted. Fusiform incision was made around the masses.

After the masses and the surrounding structures were removed, the connected 7th to 10th ribs were removed partially, with the cutting edge about 3cm away from the masses. 4 MatrixRIB plates were used to reconstruct chest wall. The reconstruction method is shown in Fig 4D. After the ends of the MatrixRIB plates were fixed on the ribs, steel wires were used to weave mesh between the MatrixRIB plates to eliminate the gap in the middle, and fiber membranes were used to make cushion on both sides of MatrixRIB plates. Drainage tubes were placed in the thoracic cavity and surgical field, and the operation was completed after the incision was closed (Fig 4). The operation was smooth without complications. X-ray examination showed the chest shape was satisfactory after operation (Fig 5). The patient recovered well and was discharged 10 days later.

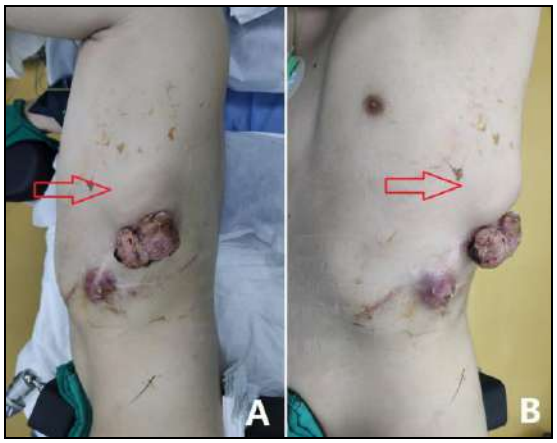

Fig 1: The location of the tumor and the appearance of the chest wall

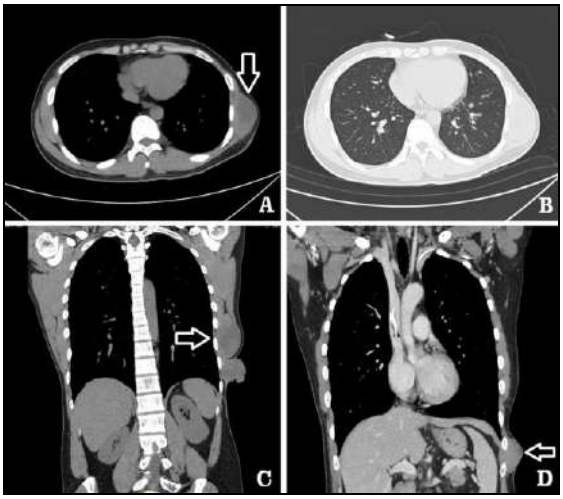

Fig 2: Preoperative CT examination. A, B. Horizontal plane; C, D. Coronal plane

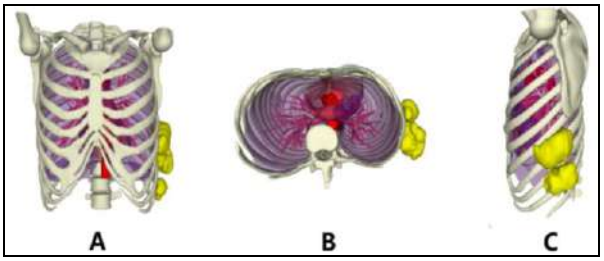

Fig 3: Preoperative three-dimensional pictures. A. Front view; B. Bottom view; C. Side view

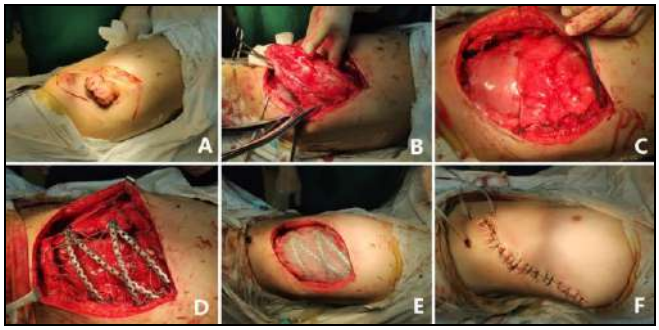

Fig 4: Surgical pictures. A. Implementation of incision; B. Tumor resection; C. Chest wall defect after tumor resection; D. Reconstruction of chest wall with MatrixRIB plates; E. MatrixRIB plates were covered with fiber membranes; F. Postoperative appearance of chest wall.

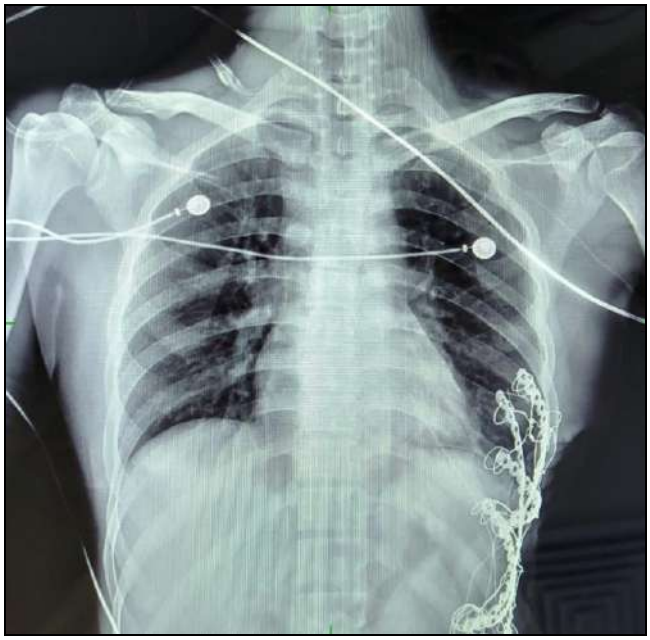

Fig 5: Postoperative X-ray examination

Discussion

Chest wall tumor is a basic disease in thoracic wall surgery [1-3]. Once it is found, surgical resection should be considered first. However, because of the special function of the structures, it is necessary to reconstruct the chest wall after the removing of the tumor [4]. Generally, tumor resection and chest wall reconstruction are two basic contents of chest wall tumor surgery.

Tumor resection is the most basic operation, which requires complete removal of the tumor. The resection range of benign tumor can be limited to the tumor itself, but the range of malignant tumor must include nearby structures, the most important of which are the ribs. If the resection scope of these structures is insufficient, it may cause recurrence [5-7].

This patient had undergone 3 tumor resection operations in the past, and the resection scope was only limited to the tumor itself. Since there was no sufficient resection, it became the root cause of tumor recurrence. After examination, we found that the patient's tumor had invaded the deep ribs and intercostal structures, so it was necessary to completely remove these structures.

After tumor resection, the chest wall appeared secondary defects. In order to reconstruct the chest wall, we used

MatrixRIB plates for reconstruction. Because the physical properties of this material can meet the physiological needs of the chest wall, and it is convenient to use in the operation, the reconstruction can be easily completed with it [4]. We also use digital material to reconstruct the bone structures of the chest wall, which is an excellent reconstruction material [8]. However, because the reconstructed bone structures of this patient are ribs and not sternum, MatrixaRIB is the most ideal material for him.

Chest wall reconstruction includes not only the reconstruction of bone structures, but also that of intercostal structures, skin and soft tissues. When the ribs are reconstructed with MatrixRIB plates, there are usually large gaps between the plates. If such gaps were not treated, they may lead to abnormal respiration, so intercostal structures also need to be reconstructed. The intercostal structures reconstruction we implemented consists of two parts. First, steel wires is used to weave a mesh between the MatrixRIB plates to make a large gap into a small grid, and then fiber membranes are used to cushion the internal and external sides of the MatrixRIB plates. Such treatment can completely eliminate the gap between MatrixRIB plates. The reconstruction of skin and soft tissues mainly comes from the tissues around the incision. If the resection scope is not large, the incision can be sutured directly. If it cannot be directly sutured or the tension is too large, skin flap should be used for reconstruction. In the operation of this patient, after the tumor is removed, the incision skin could be easily closed, so we directly sutured the incision without using flap for reconstruction.

Conclusion

Our experience shows that for chest wall malignant tumors, the resection scope must be sufficient, especially for deep ribs. This is an effective guarantee to prevent tumor recurrence. If only the tumor itself is removed or the scope of resection is limited, the effect of surgery cannot be guaranteed.

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Author's Contribution

Not available

Conflict of Interest

Not available

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