Reconstruction of Sternal Defects with Autologous Bone Grafts and Myocutaneous Flap of the Latissimus Dorsi Muscle

Junichi OGAWA, Hiroshi INOUE, Akira SHOHTSU, Tomoo TAJIMA*, Ryuzaburo TANINO** and Shiro YAMAZAKI***

Department of Thoracic Surgery, School of Medicine, Tokai University
*Department of General Surgery, School of Medicine, Tokai University
**Department of Plastic Surgery, School of Medicine, Tokai University
***Department of Surgery, School of Medicine, Keio University
(Received July 7, 1981)

In one case of sternal metastasis associated with necrotic osteomyelitis from breast carcinoma we performed subtotal sternotomy including adjacent structures. The resulting defect over the pericardium was reconstructed by the fibula, ribs and a myocutaneous flap of the latissimus dorsi muscle for protection and stability of the anterior chest wall after the operation. The usefulness of the myocutaneous flap of latissimus dorsi muscle for skin coverage over a wide defect in the anterior chest wall is discussed.

(Key Words: Reconstruction, Sternal Defect, Myocutaneous Flap, Latissimus Dorsi Muscle)

INTRODUCTION

Metastatic tumors of the sternum are relatively rare. It has been stated that the breast is one of the most common primary sites for sternal metastasis (11). Resection of the sternum together with wide margins of adjacent structures not followed by proper reconstruction will result in a frail chest and cause respiratory problems. Several measures have been reported for reconstruction of sternal defects using various materials such as prosthetic devices and autologous grafts (1, 2, 3, 5, 8).

In our case of metastatic tumor of the sternum with osteomyelitis, we performed subtotal sternotomy and reconstructed the sternal defect using autologous bone grafts and a myocutaneous flap obtained from the latissimus dorsi muscle.

A CASE REPORT

A 59-year-old man was admitted to our hospital on Jan. 29, 1979 because of anterior chest wall swelling, pain, purulent drainage and fever. His past history included left radical mastectomy for breast carcinoma in 1972. Two years after the mastectomy he noticed swelling of the anterior chest wall. The swelling enlarged rapidly with purulent discharge from the swelling. Fever and malaise also appeared. The patient was referred to our hospital for diagnosis and treatment.

On admission, the patient's temperature was 38.5°C, pulse rate 90 beats per minute, and blood pressure 110/70 mmHg. A mass was palpated in the anterior chest wall measuring 10 cm in diameter. The mass had a central ulcer with purulent discharge and was fixed to the skin. The patient was weak and anemic. The blood count showed a hemoglobin level of 9.2 g/dL, white blood cell count of 4,500 cells/cmm with 72% neutrophils, and platelet count of 130,000 platelets/cmm. The blood chemistry examination revealed a serum calcium level of 10.5 mg/dL, alkaline phosphatase level of 1,200 IU/L, and bone marrow examination showed evidence of breast carcinoma.

A diagnosis of metastatic tumor of the sternum with osteomyelitis was made. A subtotal sternotomy including adjacent structures was performed. The resulting defect over the pericardium was reconstructed by the fibula, ribs and a myocutaneous flap of the latissimus dorsi muscle. The patient made an uneventful recovery and was discharged from the hospital 6 weeks after the operation. The patient is now doing well with no signs of recurrence.
1963, radiation therapy for recurrence in 1968, local resections of soft tissue for recurrences in the chest wall in 1976 and 1978 and decompression laminectomy in Oct. 1978, followed by orchietomy. He was followed at the outpatient clinic without further hormonal therapy or chemotherapy.

On admission his local findings were compatible with bone metastasis in the sternum associated with osteomyelitis due to secondary infection. There was also cellulitic change in overlying soft tissue (Fig. 1).

The chest X-ray examination showed destruction of the anterior part of the left 3rd rib with ill-defined soft tissue density over this area. The lateral view showed complete destruction of the manubrium and proximal corpus sterni with osteoblastic reaction. The body of the sternum was fractured (Fig. 2). Bone scan with Tc-MDP revealed areas of increased activity in the manubrium, body of the sternum and left 3rd rib.

The histologic examination of the lesion revealed a metastatic mucinous carcinoma.

Since a work-up showed no metastatic foci other than those in the sternum and left 3rd rib and the infected necrotic lesion gave out an offensive odor, he was operated on Feb. 28, 1979.

Fig. 1 shows the sternal metastasis with osteomyelitis due to secondary infection. There was a fistula in the body of the sternum.
Fig. 2 Chest X-ray shows destruction of the anterior part of the left 3rd rib with ill-defined soft tissue density over this area. The lateral view shows destruction of the sternum in the mid third.

OPERATIVE FINDINGS

Skin incision and resected areas were as shown in Fig. 3. There was a fistula in the body of the sternum, estimated to be 5 by 3 cm in size, which invaded the anterior mediastinum through the sternum. The tumor had an extensive infiltration from the fistula in the sternum to the bilateral 2nd and 3rd ribs. He underwent wide surgical excision including two thirds of the upper portion of the sternum, second to third ribs and costochondral junctions. The thymus and pericardium were free of malignancy.

To prevent postoperative respiratory suppression we framed the chest wall after resection using autologous fibula and right 10th rib between bilateral ribs. We did not use prosthetic devices for fear that the lesion was already infected (Fig. 4A).

Fig. 3 Sketch of the skin incision and resected areas. Black circle shows the fistula.
Fig. 4  Reconstruction of the sternal defects.
A. Rib and fibularis grafts were sutured to the resected 2nd, 3rd and 4th ribs.
B. Myocutaneous flap of latissimus dorsi muscle about 35 by 15 cm in size was mobilized anteriorly.

For skin coverage over the resulting defect we made a myocutaneous flap of the latissimus dorsi muscle, about 35 by 15 cm in size, from the right back preserving supplying vessels and nerves. After swinging this flap anteriorly the skin defect was covered successfully (Fig. 4B).

The patient had an uneventful postoperative course and was weaned off the respirator on the 3rd postoperative day although slight paradoxical movement of the chest was present.

Because partial necrosis occurred in the left margin of the myocutaneous flap one month after the operation, we partially excised the exposed grafted bone under the flap.
When seen in Oct. 1979, the myocutaneous flap was in good condition despite a persistent small fistula in the left margin (Fig. 5). The respiratory function decreased slightly as compared with the preoperative status, but it was of little clinical significance.

![Anterior view of the flap 8 months after the operation. The arrow indicates a small fistula in the left margin.](image)

**DISCUSSION**

Various methods have been employed in reconstruction after resection of the sternum; for example, autologous grafts (1, 3), prosthetic devices (2, 5, 8) and mobilization of peripheral tissues. Satisfactory results have been obtained with autologous grafts and with prosthetic devices. Fibula, rib graft and a myocutaneous flap were used in our patient because the metastatic sternum had already been infected.

The latissimus dorsi myocutaneous flap was first described by Olivari in 1976 (9). The beneficial points of using this flap are as follows; this muscle is one of the largest flat muscles of the body; the latissimus dorsi myocutaneous flap is based on a dominant vascular pedicle from the thoracodorsal vessels which can be raised as a reliable flap; and the loss of the latissimus dorsi muscle is not noticed in normal casual activities such as adductor and medial rotator of the shoulder because of the numerous substitute muscles.

Application of this flap was described by McRaw et al. (7) who used it for repair of major defects of the chest wall and spine. On the other hand, Quillen (10) used this flap for reconstruction in the neck and head areas. Furthermore Maxwell (6) and Harii (4) reported more extensive clinical use of the latissimus dorsi myocutaneous flap in microvascular anastomosis.

In this case we made a large flap, 35 by 15 cm in size, beyond the iliac crest, and small marginal necrosis occurred in the flap one month after the operation. We think because of the vascular territory that the lower skin segment of the flap should not be extended 5 cm below the iliac crest (7).
Proper suction drainage is necessary for effusion accumulated between the grafted bones and pericardium.

REFERENCES