Case Report
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Preserved Respiratory Function after Reconstruction of a Large Chest Wall Defect

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A case report of a patient who developed radiation-induced sarcoma in the left chest wall is presented. The patient had partial mastectomy and adjuvant radiation therapy (total dose, 5,220 cGy) and chemotherapy. Five years later, she visited with rapidly growing mass with central ulceration in the irradiated chest wall. The mass was diagnosed as malignant fibrous histiocytoma. The chest wall mass resected en bloc (23×18 cm) including five consecutive ribs. After the defected thoracic cage was reinforced using a polytetrafluoroethylene patch, omental flap and split thickness skin graft was done for soft tissue coverage. We applied negative pressure wound closer system for effective suction of omeantal exudate. The wound healed without complications. The patient suffered no perioperative pulmonary complications. Pulmonary function tests showed no significant changes. Each of Gore-Tex, omental flap, negative pressure wound therapy and skin graft is widely used method. However, If these methods are used in combination, we can reconstruct the large defect of chest wall including multiple ribs without any repiratory function problems.

Key Words: Sarcoma, Radiation-induced, Respiratory function tests, Thoracic wall, Omentum

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Radiation therapy to the breast is a modality frequently used against local recurrence of advanced breast cancer. Unfortunately, it is known to cause secondary malignancies, such as soft-tissue sarcomas, at incidences around 0.03% to 0.2%.[1] Among patients with secondary malignancies of the chest wall, large post-resection defects present a significant reconstructive challenge. The irradiated field often does not yield adequate recipient vessels, and potential local flaps often are fibrosed from the radiation treatment. Furthermore, resection of sarcoma-laden multiple rib cages can decrease the elastic recoil of pulmonary cage. In this report, we present such a patient, in whom pulmonary function remained relatively unchanged after a large chest wall reconstruction.

CASE REPORT

A 42-year-old woman had undergone partial mastectomy of the left breast and axillary node dissection. Pathologic finding was that of invasive ductal carcinoma without lymph metastasis (0 out of 10 nodes). The patient underwent adjuvant radiotherapy (total dose, 5,220 cGy) and chemotherapy (cyclophosphamide, methotrexate, and 5-fluorouracil).

Five years later, the patient presented with a rapidly growing mass with a central ulceration in the irradiated area of the chest wall (Fig. 1). Punch biopsy under local anesthesia revealed the lesion to be a malignant fibrous histiocytoma. In computed tomography scan, this lesion was seen as a large heterogeneously enhancing mass with lobulated margin in the

Fig. 1. A 47-year-old female with sarcoma on the left breast. The patient had a history of invasive ductal carcinoma and had undergone local resection and adjuvant radiation therapy five years prior.

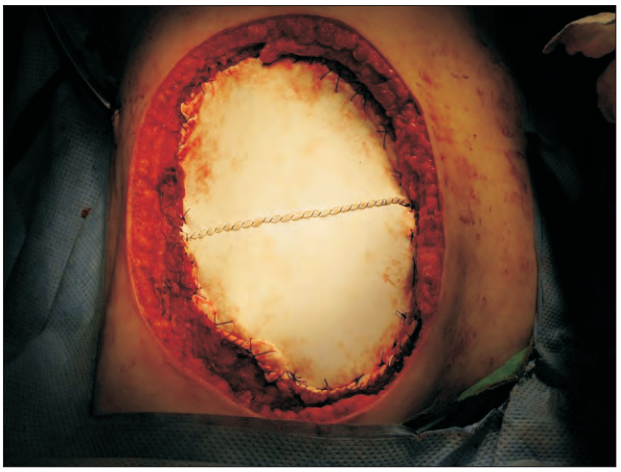

Fig. 3. Intraoperative photo after polytetrafluoroethylene patches.

Fig. 2. Intraoperative photo of the specimen, pleural side. The en-bloc resection includes ribs 3th to 7th.

Fig. 4. Postoperative photo 8 months after surgery. Grafted chest wall was strong. The patient had a port-a-cath in her chest for chemotherapy.

left breast with direct invasion into the anterior arc of 5th and 6th ribs and anterior diaphragm.

Upon patient consent, preoperative planning, and pulmonary function tests, the tumor was resected en-bloc. The resected mass included five ribs (3th to 7th ribs), and left a 23×18 cm sized chest wall defect (Fig. 2). Intraoperative examination revealed that the tumor had invaded into the pectoralis minor muscle, 5th to 7th costal cartilage, and parietal pleura. However, the left pulmonary lobes and mediastinal structures were grossly uninvolved.

The pleural defect was significant. Two polytetrafluoroethylene (PTFE) patches (2 mm thickness; W. L. Gore & Associates Inc., Flagstaff, AZ, USA) were sewn to each other with a running 1-0 prolene suture. Around the margin of defect, the patch was secured using interrupted 1-0 prolene sutures with enough tension to maintain the recoil of remaining lung cage (Fig. 3).

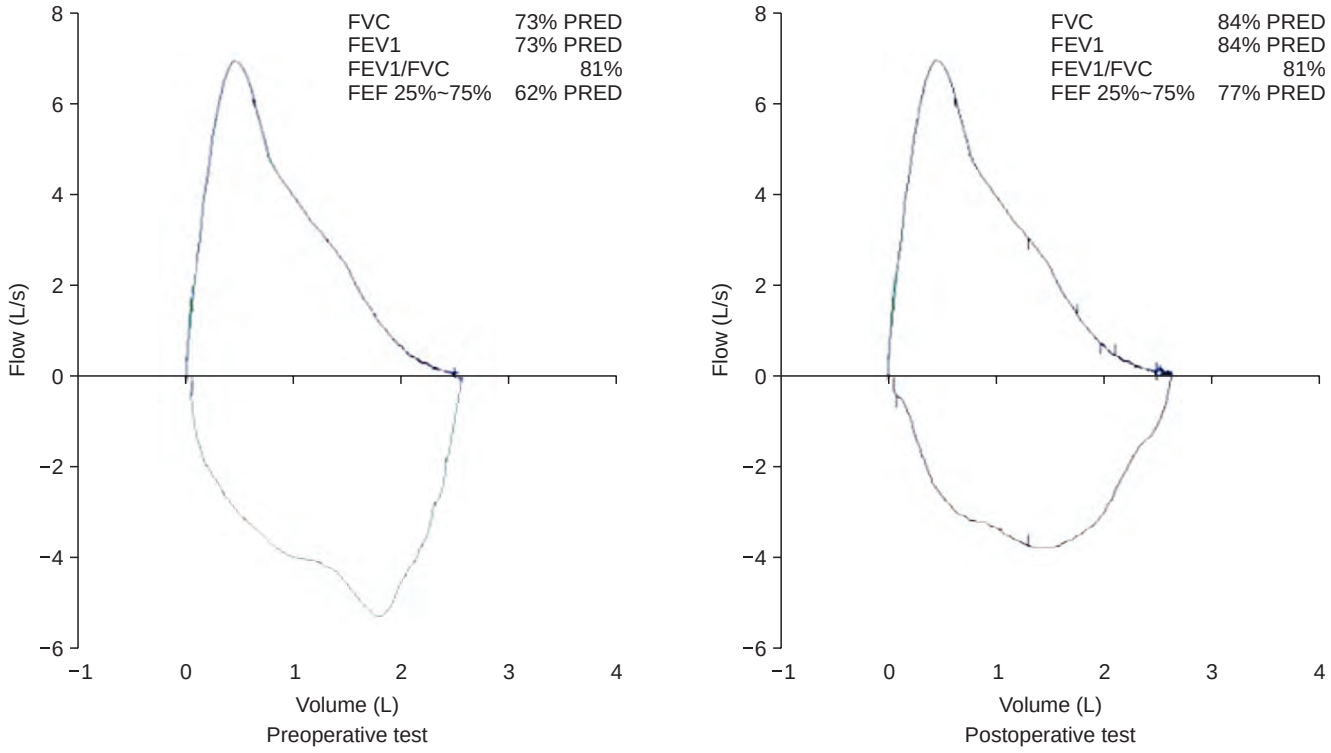

Fig. 5. Flow-volume loop from preoperative (left) and postoperative (right) tests. No clinically significant changes are observed. FVC: forced vital capacity, FEV1: forced expiratory volume at 1 second, FEF: forced expiratory flow, PRED: predicted.

The greater omentum was mobilized over the patch, after the size of skin defect was reduced with 2-0 nylon purse-string suture. Several silastic drains were placed over the omental flap, and the defect was covered with meshed split-thickness skin graft. Negative pressure wound therapy (NPWT) was used with continuous negative pressure of 80 mmHg. The wound dressing was changed every 3 days, and NPWT were discontinued after the 15th postoperative day. With fibrosis of the split-thickness skin graft, the chest wall movement became more coherent (Fig. 4).

At 8-month postoperative follow-up visit, a repeat pulmonary function test showed no significant changes with forced expiratory volume at 1 second (FEV1) over 2.0 L and FEV1/forced vital capacity (FVC) ratio over 0.8 for both preoperative and postoperative measurements (Fig. 5). Clinically, the patient did not complain of shortness of breath or exertional dyspnea.

DISCUSSION

Wide en bloc resection including four or more consecutive ribs often dictates the need for soft tissue reconstruction and chest wall support to avoid flail chest.[2] Options include alloplastic mesh, bone graft, and vascularized bone free tissue transfer. Soft-tissue coverage depends on the availability of regional pedicled flaps and sometimes free tissue transfer can be considered.

Skin grafts represent the minimum amount of biologic tissue required to separate the pleural space and the atmosphere but require a vascular wound bed. While the latissimus dorsi flap is an option,[3] radiation-induced changes to the thoracodorsal artery and vein were a deterrent in this patient with history of radiation–a suspicion which was confirmed during the operation. Likewise, free abdominal flaps could be disastrous in the setting of fibrosed recipient vessels. Pedicled abdominal flaps were unavailable due to thinned superior epigastric artery and vein in this case. In contrast to these muscle flaps, the greater omentum is malleable, provides a wide surface area, and has a long and more pliable vascular pedicle. The flap can easily be tunneled subcutaneously. For these reasons, the omentum was used as the useful biologic component over which meshed split-thickness skin were grafted.[4]

Many studies recommend that resection of four or more consecutive ribs or a lateral chest wall defect spanning 5 cm

or greater requires chest wall stabilization to avoid flail chest.[1] But there are not many reoprts show the results of respiratory function test after reconstruction so far. The comparison of preoperative and 8-month postoperative pulmonary function test demonstrated that pulmonary capacity and function did not markedly change. While secondary split thickness skin grafting contraction has received much notoriety, this observation showed such contraction did not alter pulmonary function.

The combination of prosthetic materials and flaps vary significantly in the reconstruction of chest wall defects, but all such reconstructions have two principle objectives–mechanical integrity of the wall and complete sealing of the pleural space. In the immediate postoperative period, PTFE patch is able to withstand the mechanical tension placed across the wound margin and provides a static base against which soft tissue coverage is possible. PTFE patch has soft surface, less irritate the neighboring tissue. It will be informative to make decision when the surgeon meet large defect including multiple ribs and the parietal pleura.

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