Sternal Resection and Reconstruction for Recurrence of Breast Cancer

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We report 4 cases of sternal resection and reconstruction for para-sternal recurrence after radical mastectomy for breast cancer. All 4 had partial sternotomy combined with rib resection. Double Marlex mesh and muscular or myocutaneous flap were employed to close the sternal defect. Postoperative complications occurred in 2 cases : respiratory failure and partial skin necrosis. All patients are alive 12, 59, 77 and 117 months after sternal resection.

Surgical management for parasternal recurrence after radical mastectomy can provide long-term survival and improve the quality of life of patients, especially those with solitary recurrences.

Key words : breast cancer, local recurrence, sternal resection, chest wall reconstruction, myocutaneous flap

Introduction

Chest wall recurrence after mastectomy for breast cancer occurs in 7-30 per cent of patients in different report series (1-4). Local recurrence is usually connected with systemic distant metastasis. Therefore, the patients are usually treated with systemic chemotherapy combined with chest wall rediation. However, a solitary mass in the chest wall represents the only evidence of recurrent disease in a significant number of patients. Surgical treatment for these solitary recurrences has been reported to prolong the survival period and improve the quality of life of these patients (5-9). In reported cases, a full-thickness chest wall resection has often been performed on the ribe but rarely on the sternum.

The purpose of this study is to review our experience with sternal resection for locally recurrent breast cancer.

Material and methods

Between 1984 and September, 1993, 16 cases with chest wall recurrence excluding axillary and cervical node recurrence were seen in our department. Of these, 4 cases underwent sternal resection for a solitary recurrent mass adjacent to the sternum (a so-called parasternal recurrence). All had examinations of routine blood chemistry and carcinoembrionic antigen, as well as chest x-ray, bone scintigraphy and liver ultrasonography to confirm the abscence of distant metastasis. Needle aspiration biopsy revealed the lesions to be recurrent cancer. Computed tomography examination of the chest was performed to evaluate the extent of disease in the chest wall and invasions to the lungs, pleura, pericardium and anterior mediastinum.

Operative procedurss

An elliptical skin incision was made with a 3 cm margin of normal skin around the lesion. Subcutaneous tissue, ribs, intercostal muuscle, sternum and pleura were widely resected in en-bloc fashion. Ordinally, bilateral parasternal lymph nodes were dissected in continuity with the sterno-costal resection. The sternum was divided at one intercostal space above and below the lesion. The chest wall defect after full-thickness resection was ordinally large and covered with a double layer of Marlex mesh and myocutaneous flap.

Results (Table and Fig.)

Case 1 was a 59-year-old female. She had been treated 5 years previously with an extended radical mastectomy for right breast cancer (T2NOMO, Stage II). Pathological examination revealed invasive ductal carcinoma (solid-tubular) and no axillary or parasternal node metastasis. Three years later, swelling appeared in the middle portion of the anterior chest wall. The mass was noted and gradually increased in size (7 × 4.5 cm) and aspiration needle biopsy revealed a recurrent cancer. Bone scintigraphy showed a central defect of the sternum and a chest CT scan revealed a large mass with osteolytic change of the sternum, but without invasion to the lungs or heart. Two years after the appearance of the swelling, a resection was performed. The resection included a full-thickness chest wall resection of the ribs, 3, 4, 5, 6, and 7 as well as the body of the sternum. The large defect of the anterior chest wall (13 × 11 cm) was reconstructed using Marlex mesh covered with a major pectoral muscle flap and mobilized skin of the left anterior chest. No postoperative

Table Sternal Resection and Reconstruction for Recurrent Breast Cancer

Patient No	Year	Age (yr)	Previous Treatment	Diagnosis	Disease Free Interval (mo)	Management of Recurrence	Sternal Reconstruction	Postoperative Complications	Adjuvant Therapy	Outcome	
										Months	States
1	1985	59	Extended radical Chemotherapy	Invasive ductal ca. n_0	39	1/2 Sternum 5 Ribs	Marlex mesh Muscular flap (MPM)		Chemotherapy	117	Alive NED
2	1988	46	Extended radical 1979 Right upper lobectomy 1981	Invasive ductal ca. n_1	98	1/3 Sternum 2 Ribs	Marlex mesh Myo-cutaneous flap(MPM)	Partial skin necrosis	Chemotherapy	77	Alive Chest wall resection 1992
3	1990	46	Radical mastectomy Chemotherapy 1989	Invasive ductal ca. n_1	12	1/2 Sternum 3 Ribs	Marlex mesh Myo-cutaneous flap (MPM)		Chemotherapy	59	Alive NED Right upper lobectomy 1991
4	1993	72	Modified radical 1983	Invasive ductal ca. n_0	117	1/3 Sternum 2 Ribs	Marlex mesh Myo-cutaneous flap (LDM)	Respiratory failure		12	Alive NED

MPM : major pectoral muscle, LDM : Latissimus dorsi muscle, NED : no evidence of disease

complication occurred. The patient is well without disease 9 years and 9 months after sternal resection.

Case 2 was a 55-year-old female. Nine years previously she had undergone an extended radical mastectomy for a 5.5 cm primary breast tumor with negative lymph nodes. Two yeats later, she had a right upper lobectomy for a metastatic lung tumor. A further three years later a recurrent mass was noted at the parasternal area at the second rib which increased in size to 3.4 × 3 cm. A full-thickness chest wall resection of ribs 1 and 2, the bilateral clavicles and the manubrium and upper part of the sternum was performed. The size of the chest wall defect was 10 × 7 cm and chest wall reconstruction was completed with Marlex mesh and a major pectoral myocutaneous flap. A small part of the skin flap became necrotic, but was healed conservatively. Pathological examination showed that recurrent cancer had invaded the skin, ribs, and sternum, and there were small foci under the subpleural area.

She had recurrence at the left anterior chest wall and cervical lymph nodes 4 years after this sternal resection. Left anterior full-thickness chest wall resection of part of clavicle, the first and second ribs and the pectoral muscle was performed with left neck dissection. The defect was covered with Marlex mesh and major pectoral muscle and skin. After one course of chemotherapy (5-FU, adriamycin and cyclophosphamide), she was discharged. She is alive 6 years and 5 month after sternal resection and one year and 5 months after the fourth operation.
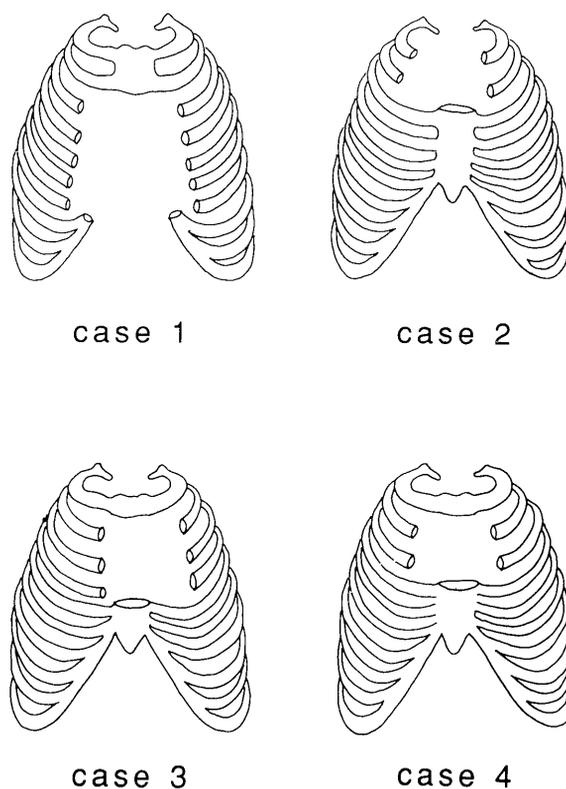

case 1   case 2

case 3   case 4

Fig. Schematic representation of sternal resection in four patients.

Case 3 was a 47-year-old female. She had a radical mastectomy for a 5.5 cm left breast tumor with positive axillary lymph nodes at the age of 46. Estrogen receptor (ER) and progesterone receptor (PR) were negative. One year later, a 2×2 cm mass lesion appeared at the left parasternal area of the second rib. She was treated by chemoendocrine therapy (cyclophophamide, adriamicin and medroxy progesterone acetate) and a partial response was obtained. However, regrowth of the recurrent tumor was observed and a full-thickness chest wall resection of the ribs, 2, 3, and 4 and the manubrium and body of the sternum was performed. The defect of the anterior chest wall (9×7.5 cm) was reconstructed with a double layer of Marlex mesh and a major pectoral myocutaneous flap. Her postoperative course was uneventful. Histologically, recurrent cancer was found to have invaded into the ribs and sternum. Twenty months later, she had a right upper lobectomy and mediastinal node dissection for metastatic lung cancer followed by chemo-endocrine therapy.

She is now well without disease 4 years 11 months after chest wall resection, and 2 years and 11 months after lobectomy.

Case 4 was a 72-year-old female who presented an ulcerated mass lesion at the mid portion of the right parasternal area and a swelling of the left axillary lymph nodes. Nine years previously she had undergone a modified radical mastectomy for a 3.5 cm right breast tumor without axillary node metastasis. ER and PR were positive. She had bronchiectasis and liver cirrhosis. Preoperative pulmonary function study showed a vital capacity of 1.06 L (49.9% of the predicted level) and forced vital capacity in one second of 0.65 L (65.7% of predictied) and arterial blood gas analysis revealed that PH was 7.359, Pa CO_2, 55.7 torr and PaO_2, 54.8 torr. A full-thickness chest wall resection including the skin, the second and third ribs and the body of the sternum was performed along with left axillary node dissection. The defect of the anterior chest wall was 11×10 cm and was covered with a double layer of Marlex mesh and a right latissimus dorsi myocutaneous flap. Histologically, recurrent cancer was found to have invaded into the skin, intercostal muscle, and subpleural tissue.

Postoperatively, hypercapnea and difficulty of expectoration occurred and respiratory support with a respirator was necessary for 10 days. She was discharged from hospital 3 months later. She is still alive 12 months after operation.

Discussion

Chest wall local recurrence accounts for 7-30% among patients followed for 10 years after mastectomy for breast cancer (1-4). The rate of local recurrence has been reported to be high in patients with large primary tumors and metastatic axillary nodes (10, 11). The mechanisms of local recurrence lying adjacent to the sternum are 1) incomplete excision of breast cancer, 2) implantation at operation of emboli dislodged from cut vessels and lymphatics, or implatation by use of contaminated instruments after cutting through, and 3) retrograde dissemination, most commonly from intercostal or intermammary chain vessels (1). Urban stressed the importance of the internal mammary chain of lymph nodes (12). Multiple lesions almost always manifest as signs of systemic metastasis while a solitary lesion represents an incomplete excision or implantation at operation or one of a number of systemic metastatic lesions. In this series, the lesions of 2 patinents (cases 2 and 3) were possibly part of a systemic spread, because lung metastasis or axillary node lesions become apparent before or after sternal resection.

Shah and Urban (5) reported on long-term survivors with full thickness resection of the chest wall for recurrent tumors. The proper indications for surgical management of chest wall recurrence are 1) good general condition of the patient, 2) solitary lesion, and 3) no distant organ metastasis (8). However, even though the patient has distant metastatic lesions, full-thickness chest wall resection is a reasonable treatment option to palliate disabling symptoms such as pain, ulceration, bleeding or foul odor and improve the quality of life (7). Sternal resection and reconstruction has been reported less frequently than costal resection (2, 8). Recently, reported cases have increased following the progress of chest wall reconstruction techniques (6, 7, 13). Reconstruction of large full-thickness chest wall defects including the sternum is necessary to restore a semi-rigid thoracic wall to allow for proper pulmonary dynamics, to protect underlying vital structures and to restore the contour of the chest wall. Materials that have been utilized are Marlex mesh (14), Goretex (15), Vicryl (16), methyl metacrylate (17), and autologus rib. Among these, Marlex mesh has good elastic properties, shows a low incidence of wonud infection and is easy to sculpt to the size and shape of the defect. Marlex mesh was employed to close the sternal defects in our series and no postoperative complications such as flail chest or atelectasis were experienced, except for patient 4 who had impaired respiratory function. These findings suggest that Marlex mesh is a suitable material for sternal reconstruction.

Biological or artificial materials have to be covered by tissue, and usually myocutaneous flaps are used for this purpose. As myocutaneous flaps, major pectoral muscle (18), latissimus dorsi muscle (19) and rectus abdominis muscle (20) are used. Among them, we used major pectoral myocutaneous flaps for preference, because manipulation can be done in the same operative field, changing the patient's position is unnecessary and postoperative loss of function is minimal. Sternal resection for recurrent cancer is accompanied by resections of the bilateral internal

vessels and therefore blood supply to the rectus abdominis muscle cannot be anticipated. In case 4, a latissimus dorsi myocutaneous flaps was used to reconstruct the defect because blood supply to the left major pectoral myocutaneous flap was a cause for concern after left axillary node dissection for axillary node metastasis.

Postoperative complication rates are low in cases with sternal resection and reconstruction. In this series, one case with respiratory disturbance due to bronchiectasis developed respiratory management for 10 days following surgery. Partial skin necrosis ocurred in one patient, but healed secondarily. Mansour et al (13) reported that the postoperative course was smooth in patients with partial sternal resection, but in cases with total sternal resection, high postoperative complication rates were observed (70%). Therefore, in the cases with total sternal resection, selection of the patients for operation and postoperative management are both important.

Prognoses for patients with full-thickness chest wall resection and reconstruction including the sternum are relatively good. Shah and Urban (5) reported a 5 year survival rate of 43%, Magno et al (21) a rate of 75% and Snyder and associates (2) a rate of 46%. The prognostic factors for prolonged survival are a long free interval between mastectomy and the appearance of local recurrence and negative axillary node metastasis at mastectomy (21, 22). Mansour et al (13) reported that among 6 patients with sternal resection (5 of whom had total sternal resection), 3 died within 5 months. The poor prognosis might have been due to total sternal resection or the advanced stage of disease at the time of operation. In our 4 cases, 3 are alive at 59, 77 and 117 months after operation, while the follow-up period for the fourth-patient is as yet too short for a definitive opinion on prognosis. Good control of local recurrence has been achieved by the use of partial sternal resection.

References

1) Zimmerman KW, Montague ED, Fletcher GH : Frequency, anatomical distribution and management of local recurrence after definitive therapy for breast cancer. Cancer 19 : 67-74, 1966.

2) Snyder AF, Farrow GH, Masson JK, Spencer PW : Chest wall resection for locally recurrent breast cancer. Arch Surg 97 : 246-253, 1968.

3) Roseman J, Bernard S, Kober C, Lerand W, Varia M, Newsome J : Local recurrences in patients with breast cancer at the North Carolina Memorial Hospital (1970-1982). Cancer 57 : 1421-1425, 1986.

4) Probstfeld M, O'Connell T : Treatment of locally recurrent breast carcinoma. Arch Surg 124 : 1127-1130, 1989.

5) Shah JP, Urban JA : Full thickness chest wall resection for recurrent breast carcinoma involving the bony chest wall. Cancer 35 : 567-573, 1975.

6) Nash AG, Tuson JRD, Andrews SM, Stacey-Clear A : Chest wall reconstruction after resection of recurrent breast tumors. Ann Roy Col Surg Engl 73 : 105-110, 1991.

7) Kluiber R, Bines S, Bradley C, Faber LP, Witt TR : Major chest wall resection for recurrent breast carcinoma. Am Surg 57 : 523-530, 1991.

8) Brower ST, Weinberg H, Tartter PI, Camunas J : Chest wall resection for locally recurrent breast cancer : Indications, technique and results. J Surg Onclo 49 : 189-195, 1992.

9) Miyauchi K, Koyama H, Noguchi S, Inaji H, Yamamoto H, Kodama K, Iwanaga T : Surgical treatment for chest wall recurrence of breast cancer. Eur J Cancer 28 : 1059-1062, 1992.

10) Conway H, Newman CG : Evaluation of skin grafting in the technique of radical mastectomy in relation to local recurrence of carcinoma. Surg Gynecol Obstet 88 : 45-49, 1949.

11) Auchincloss H : The nature of local recurrence following radical mastectomy. Cancer 11 : 611-619, 1958.

12) Urban JA : Radical excision of the chest wall for mammary cancer. Cancer 4 : 1263-1285, 1951.

13) Mansour KA, Anderson TM Hester TR : Sternal resection and reconstruction. Ann Thorac Surg 55 : 838-843, 1993.

14) Graham J, Usher FC, Perry JL, Barkley HT : Marlex mesh as a prosthesis in the repair of thoracic wall defects. Ann Surg 151 : 469-479, 1960.

15) Grosfeld JL, Rescorla FJ, West KW : Chest wall resection and reconstruction for malignant conditions in childhood. J Pediat Surg 23 : 667-673, 1988.

16) Zoetmulder FAN, van Dongen JA : Chest wall resection in the treatment of local recurrence of breast cancer. Eur J Surg Oncol 14 : 127-132, 1988.

17) Eschapasse H, Gaillard J, Fournial G,: Utilisation de prostheses en resume pour la reparation des vastes pertes de substance de la paroi thoracique. Acta Chir Belg 76 : 281-285, 1977.

18) Arnold PG, Pairolero PC : Use of pectoralis major muscle flaps to repair defects of the anterior chest wall. Plast Reconst Surg 63 : 205-213, 1979.

19) Tobin GR, Mavroudis C, Howe R, Gray LA : Reconstruction of complex thoracic defects with myocutaneous and muscle flaps. J Thorac Cardiovasc Surg 85 : 219-228, 1983.

20) Miyamoto Y, Hattori T, Niimoto H, Toge T : Reconstruction of full thickness chest wall defects using rectus abdominis musculocutaneous flaps : A report of 15 cases. Ann Plast Surg 16 : 90-94, 1986.

21) Powlias KT, Dockerty MD, Ellis FH : Late local recurrent carcinoma of the breast. Ann Surg 148 : 192-198,1958.

22) Magno L, Bignardi M, Micheletti E, Bardelli D, Plebani F : Analysis of prognostic factors in patients with isolated chest wall recurrence of breast cancer. Cancer 60 : 240-244, 1987.