Immediate volume replacement using a modified free dermal fat graft from the lateral abdomen for a patient with early breast cancer

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Abstract We have reported excellent results for immediate volume replacement using autologous tissues. In particular, volume replacement using a free dermal fat graft from the lower abdomen is thought to be appropriate for treating patients with breast cancer in the upper inner quadrant area. We have modified this technique and report the results of oncoplastic surgery in four Japanese patients with early breast cancer. Their breasts were non-ptotic, and each lesion was considered to be suitable for breast conservative surgery. Immediate volume replacement therapy using a free dermal fat graft from the lateral abdomen into the breast cavity was performed as breast-conserving surgery. The technique was easy to perform, and the cosmetic outcome was excellent.

Keywords Breast cancer · Oncoplastic surgery · Free dermal fat graft · Cosmesis · Volume replacement

Introduction

Immediate volume replacement of the breast using soft parenchymal tissue is classified as oncoplastic surgery [1]. We have performed and reported the wide excision of cancer lesions of the upper inner quadrant and immediate reconstruction using a free dermal fat graft (FDFG) from the lower abdomen [2]. It was concluded that reconstruction

using an autologous FDFG was easy to perform and produced excellent cosmetic results [3]; however, the scar that forms on the lower abdomen remains a drawback in the frontal view.

Case presentation

A 43-year-old Japanese female had a past history of breast-conserving surgery 5 years ago at our institution. She received partial mastectomy and lymphadenectomy with immediate breast volume replacement therapy using an inframammary adipofascial flap to repair the defect left by surgery for T1N0M0 stage I breast cancer (according to the TNM classification) in the upper quadrant area. She had received postoperative hormone therapy involving LH-RH analogue and tamoxifen up to the present time. A breast mass, which was suspected of being non-invasive ductal carcinoma, was detected in the inner upper quadrant area of her right breast during annual screening by palpation and ultrasonography. She had a history of three pregnancies and had breast-fed her children. A preoperative study using mammography, ultrasonography, computed tomography, histological examination by core needle biopsy (CNB), bone scintigraphy, and magnetic resonance imaging was performed. The lesion was found to have an invasive component, to be restricted to the inner upper quadrant, and was considered to be suitable for breast conservative surgery. The clinical diagnosis was T1N0M0 stage I, and the lesion including the areas of ductal spread measured 25 × 20 × 15 mm. The patient did not suffer from systemic disease or distant metastasis. She was slim, and her breasts were non-ptotic. Informed consent was obtained from the patient for the immediate repair of the partial defect that would be caused by excision of the tumor using

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an autologous dermal fat graft from the lateral abdomen prior to the oncoplastic surgery.

On the day before surgery, the patient was seen by a breast surgeon so that she could plan the operation, make drawings, and explain the different surgical options. The patient signed informed consent forms before participating in this study; approval was obtained from the Ethical Committee of Kagoshima University Graduate School of Medical and Dental Sciences. The inframammary line of the right breast was not as clear as that of the left breast, which had been artificially redefined during the previous operation. However, her breast size, shape, and nipple level were symmetric (Fig. 1a). With the patient in the supine position, the edge of the tumor was determined by ultrasonographic examination and marked on the skin surface using red ink. Then, the partial mastectomy line was marked using permanent black ink (dotted line), in the form of a circle extending 2 cm beyond the tumor edge. The planned resection area measured 8×6 (width $\times$ length) cm in the supine position and 7×6 cm in the standing position (Fig. 1b). We determined that the implanted FDFG should measure 7×6 cm in size, as described previously, and marked the region from which the FDFG would be harvested on her right lateral abdomen (Fig. 1c).

Sentinel lymph node biopsy was performed via another scar in the axillary area (Fig. 2a). Partial mastectomy involving sufficient surgical margins and full-thickness glandular excision was performed (Fig. 2b). The fascia of the pectoral major muscle just below the resected area was completely removed. During the operation, several surgical margins were histologically examined to ensure that the

cancerous lesion had been completely removed. The FDFG was harvested using a vertical incision in the lateral abdomen (Fig. 2c). After in situ de-epithelialization, sharp dissection, and trimming, the FDFG was implanted into the defect with the dermis facing the surface of the pectoralis major muscle (Fig. 2d–f) [4]. The dermis of the FDFG was peripherally sutured to the edge of the fascia of the major pectoral muscle using 3-0 Vicryl sutures (Fig. 2g). Closed suction drainage lines were placed onto the surfaces of the implanted FDFG and the subdermal space (Fig. 2h, i). The histological diagnosis was TisN0 (SN) M0 stage 0, and she received postoperative radiotherapy. The macroscopic findings are shown in Fig. 3. She was satisfied with her breasts because symmetry was obtained, and the vertical scar on her lateral abdomen was inconspicuous.

Discussion

After locoregional control and survival, a good cosmetic outcome is one of the main aims of breast-conserving therapy (BCT) [5, 6]. Many factors influence the cosmetic outcome [7–9], such as tumor size and location in the breast parenchyma. Poor cosmetic results are associated with larger tumors, especially relative to breast size, and with inner quadrant tumors. The factors influencing cosmetic outcome after BCT for breast cancer have long been established. Both tumor-related factors and treatment-related factors are suggested to be important [10]. We have introduced some simple cosmetic techniques for repairing cancer lesions in various locations that can be performed

Fig. 1 A 43-year-old patient. Preoperative marking of the resected area. **a** Her bilateral breasts were non-ptotic. Breast size, the levels of both nipples, and the inframammary line were symmetric, even though she had a past history of breast conservative surgery and immediate reconstruction of the left breast. **b, c** Lesions were detected

by ultrasonography with the patient in the supine position. The surgical area was drawn together with a 2.0-cm surgical margin and was found to measure 8×6 cm in the supine position and 7×6 cm in the standing position

Fig. 2 **a** Macroscopic findings of the breast and donor site with the patient in the operative position. **b** A cylindrical area of breast tissue including the fascia of the pectoralis major muscle was removed. Pathological examinations of three points along the surgical margin performed during the operation were negative. **c** De-epithelialization was then performed according to the conventional technique. **d, e** A

cylindrical FDFG composed of de-epithelialized dermis and subdermal fatty tissue was harvested. **f** The FDFG was turned over and implanted into the breast deformity facing the dermis and the surface of the pectoral major muscle. **g–i** Volume replacement with the FDFG and skin closure

Fig. 3 Local findings at 10 months after surgery

during BCT and have achieved excellent results [11–15]. Since 2003, we have performed wide excision for cancer lesions of the upper inner quadrant and immediate reconstruction using an FDFG from the lower abdomen with/without axillary lymphadenectomy. We reported the early experiences of our surgical method in detail and concluded that this method is useful for immediate reconstruction of partial defects during BCT [2]. For slim patients, it is sometimes difficult to repair partial defects in the inner upper quadrant of the breast using breast tissue alone. We reported the cosmetic results obtained using conservative surgery for early cancer lesions in the inner upper quadrant of the breast involving one of three immediate reconstructive methods after partial mastectomy: reconstruction using an autologous FDFG from the lower abdomen, rotation and fixation of the parenchymal adipose tissue or gland, or replacement using a mini latissimus dorsi flap. It was concluded that reconstruction using an autologous FDFG was easy to perform and produced excellent cosmetic results [3]. The formation of horizontal scars on the lower abdomen, which is a suitable donor site when delayed breast reconstruction using transverse rectus abdominis myocutaneous flaps or a deep inferior epigastric perforator flap is recommended, remains a drawback of this technique, although such a possibility of delayed reconstruction for patients receiving this procedure might be very low but not zero. Fortunately, we did not experience any local recurrence or cases requiring total mastectomy after BCT with immediate breast reconstruction using an FDFG from the lower abdomen in patients who wanted to delay breast reconstruction. We demonstrated that on CT scans, the mean width of the FDFG was 95, 81, 79, 73, 68, and 47 % and the mean thickness was 125, 121, 120, 115, 104, and 103 % at 6 months and 1, 2, 3, 4, and 5 years postoperatively, respectively [16]. Changes in the width and thickness change the shape of the implanted FDFG from an oval to a spherical shape. We started to restrict the thickness of the FDFG to within 1 cm in this series of patients who received immediate breast reconstruction using modified FDFG from the lateral abdomen. No

clinico-pathological factors or technical factors were related to FDFG outcome and the proportion of fat tissue in the CNB sample from the implanted FDFG postoperatively, except for axillary dissection. Nineteen of 21 patients displayed good to excellent cosmesis. According to these results, we guess that a change of the FDFG, atrophy, fibromatous change of the implanted FDFG, and cosmetic result in the immediate breast reconstruction using FDFG from the lateral abdomen may result in the same clinical course as that of the original technique. A thickness of chest is felt to be thinner but firmer than that of the lower abdomen in this study; fat absorption or fibromatous change might be less than that of from the lower abdomen.

We performed partial mastectomy following by immediate volume replacement using FDFG from the lateral abdomen in four Japanese patients whose breasts were non-ptotic and bodies were slim (Table 1). They all had an invasive cancerous lesion on their upper inner quadrant lesion without intense intraductal spread. The total operation period and plastic period ranged from 122 to 172 min with a median of 166 min, and from 45 to 60 min with a median of 47 min, respectively. They were shorter than those we reported previously in our first report of oncoplastic breast surgery with immediate volume replacement using FDFG from the lower abdomen [2].

Other clinical records are shown in Table 1. The surgical procedures were done without any complaints during and shortly after operation.

Immediate breast reconstruction using an FDFG from the lateral abdomen is thought to be effective for patients with early breast cancer in the upper inner quadrant or central area of normal sized breasts. The manual skill required and the safety of the graft after implantation are equal to those of grafts harvested from the lower abdomen. The length of scar formed at the donor site was shorter in this study group than those of the group whose grafts came from the lower abdomen. This is thought to make the total operation period shorter than those of the previous study group. The scar produced at the donor site is inconspicuous from the anterior view; however, tension at the scar site

Table 1 Demographic surgical record

Case	Age (years)	% IBW	Total operation period (min)	Plastic period ^a (min)	Bleeding (g)	Weight of resected tissue (g)	Size of resected tissue ^b (cm)	Weight of FDFG (g)	Size of FDFG ^b (cm)
1	43	95.9	159	45	30	78.9	8 × 7 × 1	37.8	7 × 6 × 1
2	42	90.4	122	45	10	36.3	6 × 6 × 1	23.4	6 × 6 × 1
3	66	101	172	60	70	120.5	8 × 8 × 2	84.3	9 × 6 × 2
4	49	113.4	172	48	20	62.2	7 × 8 × 1.5	36.2	7 × 9 × 1

IBW ideal body weight

^a Plastic period was counted from the start of harvesting the FDFG to the end of the operation

^b Medio-lateral distance × cranio-caudal distance × thickness

might be higher than that in slim patients whose grafts came from the lower abdomen, as shown in Fig. 3. In case 4, a breast defect which occupied one-third of the whole breast in a patient with a slim body was successfully reshaped with a modified FDFG and good symmetry of bilateral breasts was obtained even after radiation therapy to the remnant breast (Fig. 4).

Postoperative radiation therapy is essential to reduce a local recurrence in a remnant gland [4]. Some research groups recently rigorously evaluated and selected patients with low- to intermediate-grade DCIS with margins 3 mm or wider who had an acceptably low rate of ipsilateral breast events at 5 years after excision without irradiation. There might be a possibility for selected patients being allowed to omit postoperative radiation therapy but they need to provide informed consent for it [17, 18]. Recently a comparative analysis of the safety between standard breast-

conserving surgery and oncoplastic breast conservation was reported [19]. Although no statistical significance was noted for either local recurrence or overall survival between the two groups, the rates of a repeat surgical procedure, margin re-excision, and mastectomy were lower in the oncoplastic breast-conserving surgery group than in the standard breast-conserving group. Chakravorty et al. [19] noted that the application of aesthetic techniques for therapeutic purposes must never compromise the main objective of breast cancer surgery: clear margins with good local disease control. We carefully selected not only pre-operatively but also intraoperatively patients having indications for oncoplastic surgery and having a possibility to avoid postoperative radiation therapy. It seems to be easier to obtain sufficient surgical margins—a pathological margin over 10 mm in our series (data not shown)—for patients receiving oncoplastic surgery combining partial

Fig. 4 A 42-year-old patient. Local findings at preoperative (a, b) and 13 months after surgery (c, d)

mastectomy with immediate breast reshaping using FDFG or other extramammary tissue than partial mastectomy without any oncoplastic procedure.

Although only four cases were reported in this paper and the follow-up periods were short, we have revealed that immediate breast reconstruction using a modified FDFG from the lateral abdomen produces excellent symmetry in slim patients with non-ptotic breasts. Oncoplastic surgery combining partial mastectomy and immediate breast volume replacement using an FDFG from the lateral abdomen is a relatively simple procedure that yields very satisfactory cosmetic results, and it should therefore be considered as a viable therapeutic option.

Conclusion

Our results indicate that oncoplastic techniques using an FDFG from the lateral abdomen might be superior to the original technique using an FDFG from the lower abdomen from the viewpoint of cosmesis and the ability to delay breast reconstruction.

Conflict of interest We declare that there are no financial relationships or other interests with regard to this manuscript that might be construed as constituting a conflict of interest for any author.

Written informed consent was obtained from the patient for publication of this manuscript and accompanying images. A copy of the written consent is available for review by the editor-in-chief of this journal.

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