Breast Cancer (2019) 26:595–601
https://doi.org/10.1007/s12282-019-00959-2

ORIGINAL ARTICLE

Lateral thoracoaxillar dermal-fat flap for breast conserving surgery: the changes of the indication and long-term results

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Received: 21 December 2018 / Accepted: 28 February 2019 / Published online: 7 March 2019
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Abstract

Background Oncoplastic breast conserving surgery had been challenged to achieve both of local control and the cosmetic appearance of preserved breast. We developed the lateral thoracoaxillar dermal-fat flap (LTDF) as an oncoplastic procedure to fill the defect of breast-conserving surgery in 1999.

Methods A total of 2338 breast cancer patients underwent surgery from January, 2000 to December, 2017. Mastectomy was performed in 706 patients (30%), and breast conservative surgery (BCS) was performed in 1634 patients (70%). The LTDF was adopted in 487/1634 (30%) of BCS cases to fill the large defect left by partial resection. we divided all patients into 3 groups: breast total mastectomy (BT group), the breast partial resection (BP) with LTDF (LTDF group), and Bp without LTDF (BP group) and compared the clinical characteristics, and recurrence rate.

Results The Indications for LTDF increased up to 40% in 2010, while they decreased to 20%–30% in the most recent period, in accordance with the frequency of breast reconstruction increased. Patients who underwent BP + LTDF (LTDF group) included significantly higher proportions of stage II diseases and cases treated by neoadjuvant chemotherapy than those in BP or BT groups.. We found no marked difference of local recurrence and distant metastases between the LTDF and Bp groups. However, the rate of distant metastasis was significantly higher in BT group than in the Bp or LTDF group. Concerning the complications of LTDF, we experienced a few complications of Grade 3–4 requiring surgical management, namely one case of dislocation of the LTDF, three cases of bleeding, and five cases each of skin necrosis and fat necrosis.

Conclusions We reported satisfying long-term outcomes of 487 cases treated by LTDF. LTDF is a suitable oncoplastic technique for BCS.

Keywords Breast-conserving oncoplastic surgery · Lateral thoracoaxillar dermal-fat flap · Long-term results

Introduction

Breast-conserving therapy (BCT), a combination of breast-conserving surgery (BCS) followed by whole-breast irradiation is an established standard therapy for early-stage breast cancer. Many clinical trials, including meta-analyses have provided clear evidence that BCT achieves a long-term survival equivalent to mastectomy [1–4]. The indications and surgical procedures of BCT vary among patients and breast surgeons, and are affected by concerns regarding hereditary breast cancer.

The long-term success of BCT is assessed based on two end points: the rate of local control and the cosmetic appearance of the preserved breast. Many strategies for improving both the curability and cosmetic results have, therefore, been proposed, such as ensuring the correct diagnosis of the extent of tumor burden [5, 6], making an accurate pathological diagnosis of the resected breast margin [7, 8], and choosing a suitable method of filling the defect left by partial resection [9].

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In our efforts to improve the cosmetic results and ensure the curability of tumor excision with the oncoplastic BCS [10, 11], we have adopted several procedures for filling the defect left by partial resections such as using surrounding and distal fat tissues. Among these approaches, the lateral thoracoaxillar dermal-fat flap (LTDF) was developed in our hospital in 1999 [12]. We have used the LTDF very frequently to fill large defects after BCS.

In the present study, we reviewed the changes of surgical procedures and long-term results of local control over 10 years. The advantages of BCT using an LTDF for patients required wide resection are described in this article.

Patients and methods

A total of 2338 breast cancer patients underwent surgery from January, 2000 to December, 2017. Mastectomy was performed in 706 patients (30%), and breast conservative surgery (BCS) was performed in 1634 patients (70%). The LTDF was adopted in 487/1634 (30%) of BCS cases to fill the large defect left by partial resection. We reviewed the changes of indication and long-term results of LTDF.

Surgical procedure of LTDF

The LTDF procedure has already been reported [13]. In brief, as shown in Fig. 1, a triangle skin incision is made at the lateral thoracoaxillar region with its apex at the posterior axilla. From the anterior point of the incision, wide partial resection and axillary lymph-node resection are performed. A thoracoaxillar dermal-fat flap is then made by a posterior incision. The skin of this flap is denuded and inserted into the defect left by partial resection resulting in the LTDF. The indications for using this flap increased for the wide resection of lateral part of the breast from a 1/4 to a 2/3 resection of the breast. The blood supply of the LTDF is maintained by random epidermal vessels, and fat necrosis rarely develops even after irradiation therapies.

The size of the LTDF can be changed based on the coordinates of the triangle skin incision. Cosmetic appearances of four cases after several years after the surgery are shown

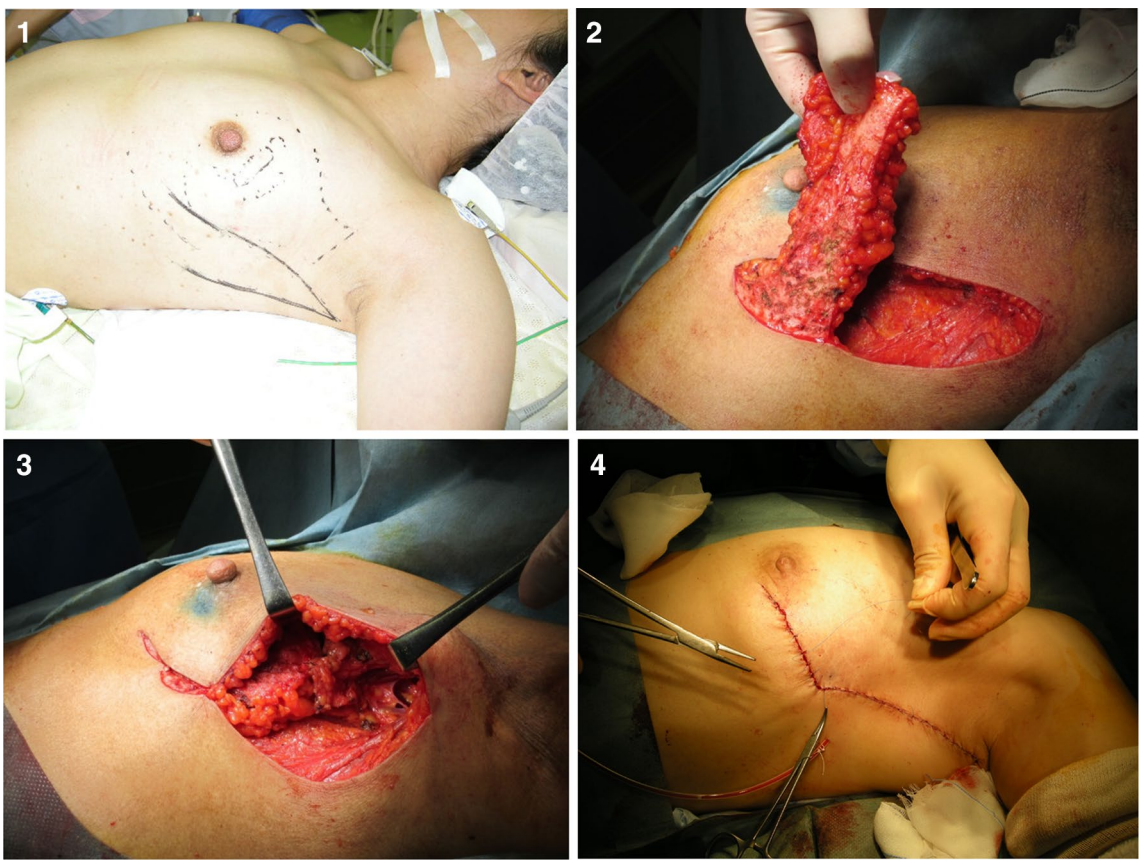

Fig. 1 Surgical procedure of lateral thoracoaxillar dermal-fat flap (LTDF). A triangle skin incision is made at the lateral thoracoaxillar region with its apex at the posterior axilla. From the anterior incision, wide partial resection and axillary lymph-node resection are performed (1). A thoracoaxillar dermal-fat flap is then made by a posterior incision. The skin of this flap is denuded (2) and inserted into the defect left by partial resection (3)(4)

in Fig. 2. The shape of breast were preserved in spite of the wide resection (A-2 and B-2) and surgical scars were not seen by front views (A-1 and B-1). However, nipple areolar complex was deviated to lateral side in several cases (B-1). Furthermore, we could repair the skin defects using the LTDF with a skin island (C and D).

We reviewed the indication of LTDF for BCT from 2000 to 2017, along with the incidence of complications after LTDF. The rate of dislocation of LTDF, bleeding, skin necrosis and fat necrosis in the early and late phases was reviewed.

Subsequently, we divided all patients into 3 groups, as follows: breast total mastectomy (BT group), the breast partial resection (BP) with LTDF (LTDF group), and Bp without LTDF (BP group); 706 (30%), 487 (21%), and

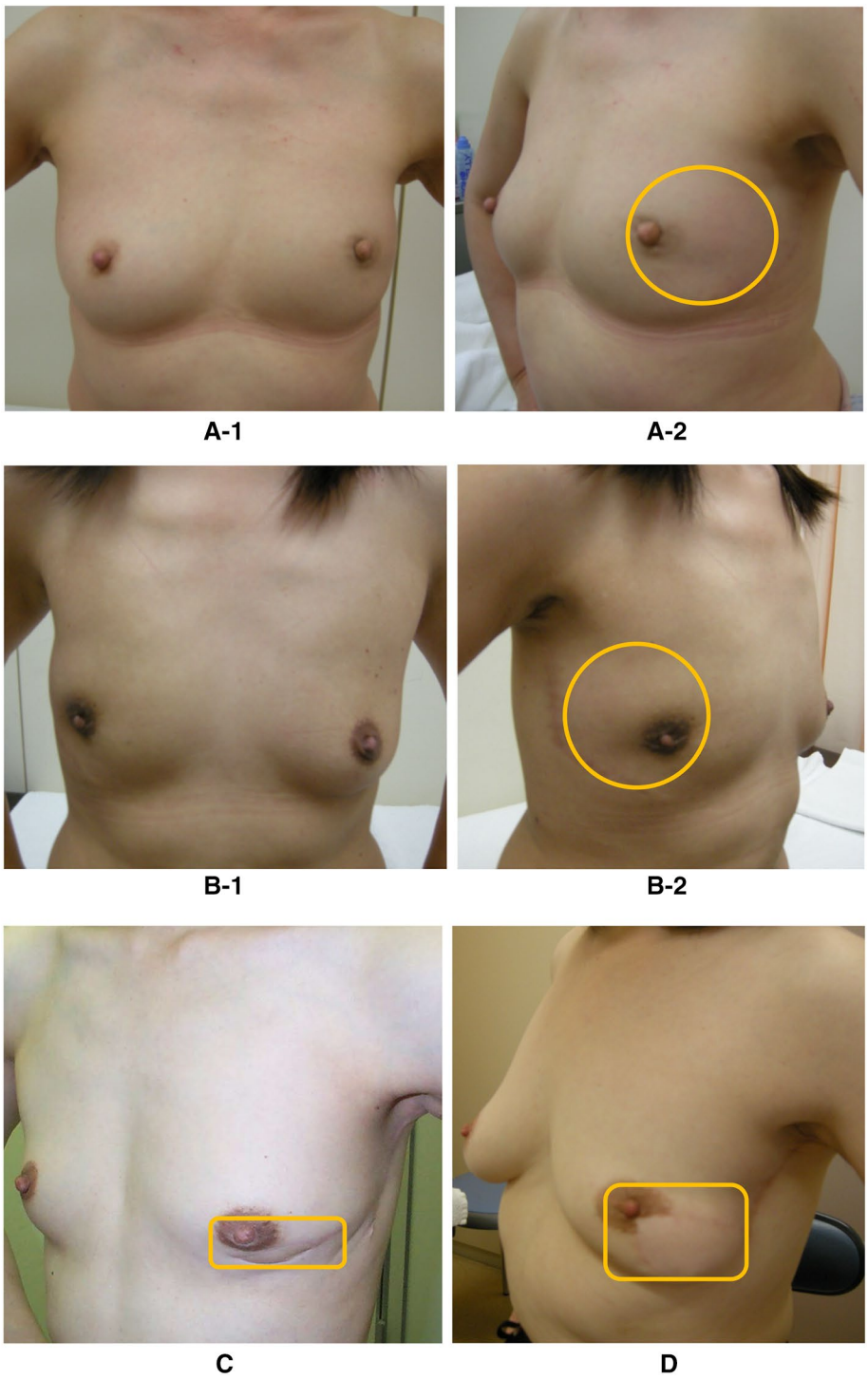

Fig. 2 Cosmetic appearances of four cases after several years after the surgery. The shape of breast were preserved in spite of the wide resection indicated by circles (**A-2, B-2, c** and **d**). Surgical scars were not seen by front views (**A-1** and **B-1**). However, nipple areolar complex was deviated to lateral side in several cases (**B-1**). Furthermore, we could repair the skin defects using the LTDF with a skin island (**c, d**)

1147 (49%), respectively, and compared the clinical characteristics, and recurrence rate.

Statistical analysis

All statistical analyses were made by Student's t test and the Chi-square test as appropriate (StatMate by ATMS, Tokyo, Japan).

Results

The changes in the surgical procedures are indicated in Fig. 3. BCS was performed in a total of 70% of patients. The indication for LTDF increased to 40% in 2010, but they decreased to 20–30% in the most recent period. In addition, the frequency of breast reconstruction has also increased.

The clinical characteristics of patients who underwent BP + LTDF (LTDF group) are compared with those patients in the BP and BT groups in Table 1. The mean age of patients of LTDF group was 54 ± 11, significantly younger than BP group (58 ± 14) and BT group (62 ± 14). And the proportion of T2 cases was significantly higher in LTDF group than in the BP group, and the proportions of T3–4 cases were significantly higher in the BT group than in LTDF and BP groups. Accordingly, the proportion of stage II cases was higher in the LTDF group than in the BP group, and the proportion of T3–4 is high in BT group. The frequency of cases treated by neoadjuvant chemotherapy is significantly high in LTDF group comparing with BP or BT group.

Concerning the complications of LTDF, we experienced a few complications of Grade 3–4 requiring surgical management, namely one case of dislocation of the LTDF, three cases of bleeding, and five cases each of skin necrosis and fat necrosis. Although we did not show the exact number, G1–G2 complications of bleeding, skin necrosis, and delayed fat necrosis were less than 5% (Table 2).

The numbers of recurrent case are summarized in Table 3. We found no marked difference in the rate of local recurrence or distant metastases between LTDF and BP groups. However, the rate of distant metastasis was significantly higher in the BT group than in the BP or BP + LTDF group ($p < 0.01$).

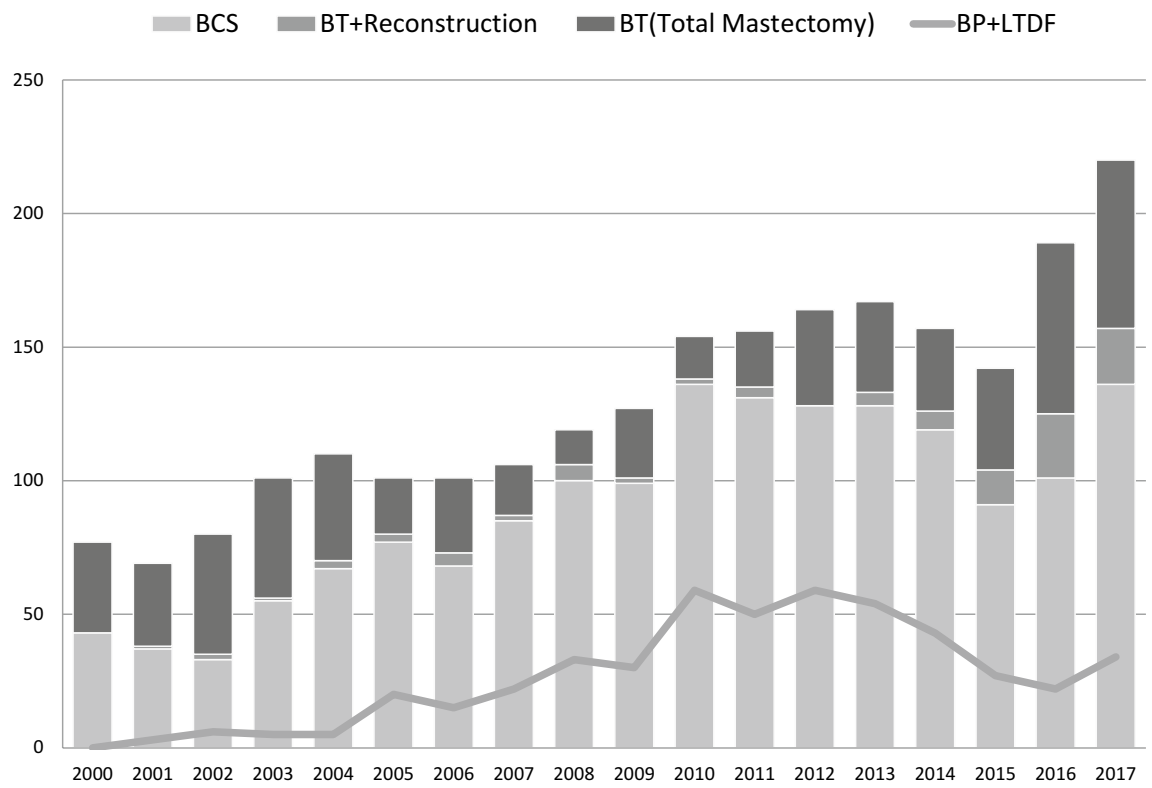

Fig. 3 The changes in indications of surgical procedures from 2000 to 2017. Breast conserving surgery (BCS) was performed in a total of 70% of patients. The indication for LTDF increased to 40% in 2010, but they decreased to 20–30% in the most recent period, in accordance with the frequency of breast reconstruction has also increased

Table 1 Clinical characteristics of patients in three groups LTDF, BP and BT

	LTDF	BP		BT	
	n	*n*	*p*(vs LTDF)	*n*	*p*(vs LTDF)
	487	1147		706	
Age	54 ± 11	58 ± 14	$p < 0.01$	62 ± 14	$p < 0.01$
Sex					
Female	487	1147	ns	706	ns
Male	0	0		6	
T					
Tis	88	169		125	
T1	179	650		191	
T2	202	313	$p < 0.01$*1	293	$p < 0.01$*2
T3	17	12		63	
T4	1	3		34	
N					
0	353	954		427	
1	93	153		129	
2	31	29	ns	95	ns
3	8	6		52	
Unknown	2	5		3	
M					
0	487	1143		689	
1	0	4		17	
Stage					
0	88	158		117	
I	153	570		173	
II	206	388	$p < 0.01$	277	$p < 0.01$
III	39	27		119	
IV	1	4		20	
Histology	0	0	ns	0	ns
DCIS and LCIS	86	162		117	
IDC	341	836		479	
ILC	21	25		35	
Mucinous	11	28		31	
Apocrine	4	16		8	
Others	24	80		36	
ER					
Positive	389	991	ns	521	ns
Negative	91	136		174	
Unknown	7	20		11	
PR					
Positive	349	911	ns	477	ns
Negative	131	216		210	
Unknown	7	20		19	
Her2					
Positive	95	248	ns	80	ns
Negative	383	837		555	
Unknown	9	62		71	
NAC					
Yes	105	51	$p < 0.01$*3	61	$p < 0.01$*3
No	382	1096		645	

NAC Neoadjuvant chemotherapy

*1; The proportion of T2 is higher in LTDF

Table 1 (continued)

*2; The proportion of T3, T4 is higher in BT

*3; The proportion of NAC is higher in LTDF than BP or BT

Table 2 Complications after LTDF ($n = 487$)

	G1–G2	G3–G4
Dislocation of LTDF	na	1
Bleeding	< 5%	3
Skin necrosis	< 5%	5
Fat necrosis (early)	na	5
Fat necrosis (delayed)	< 5%	1

G3–G4 complications required any surgical managements

na not applicable

Discussion

A number of post-BCS oncoplastic techniques have been reported, including the moving window technique [14], lateral tissue flap [15], and infra-mammary adipo-fascial flap [16]. Some of these procedures allow for extensive resection in BCS with satisfying cosmetic results.

We developed the LTDF in 1999, as an oncoplastic technique to fill the defects left by breast partial resection with surrounding tissues. We initially applied this technique to patients who had undergone quadrantectomy of the latero-inferior part. If we did not utilize LTDF in this case, then a large deformity with a disappointing nipple shape would be anticipated. Following its introduction, we applied this technique for defects of one-quarter–one-third of the lateral part of the breast.

The surgical technique of LTDF is relatively uncomplicated, and requires only a 30 min. of additional surgical time compared with BP. All breast surgeons are capable of performing this technique, provided they understand the skin design of the LTDF.

We previously reported the occurrence early and unexpected late complications by fat necrosis [17]. Most patients after primary chemotherapy require post-operative radiation therapy, which can cause poor cosmetic results for BCS.

The cosmetic results in the LTDF group were quite good despite rather extensive resection, although we have now objective data to share. Furthermore, the rate of complications after the LTDF technique is low, and we noted a low rate of fat necrosis after radiation therapy in the long term [17].

Recently, the frequency of BCT has decreased, while the indication of total mastectomy with immediate breast reconstruction has shown a rapid increase. This paradigm

Table 3 The rate of recurrence in LTDF, BP and BT groups

		LTDF	Bp	*p* (vs LTDF)	BT	*p* (vs LTDF)
Total cases	2338	487	1147		706	
Breast and skin of resected beast		9 (1.8%)	20 (1.7%)	ns	2 (0.3%)	ns
Local LN		2 (0.4%)	1 (0.1%)	ns	6 (0.8%)	ns
Distant metastasis		28 (5.7%)	56 (4.8%)	ns	90 (13%)	$p < 0.01$
Total recurrence		39 (8%)	77 (6.7%)	ns	98 (13.9%)	$p < 0.01$

shift has been attributed to the rate of complications associated with BCT such as fat necrosis, and other recent advances in the techniques of breast reconstructions. In addition, concerns about hereditary breast cancer have been risen among many physicians, asserting the need for mastectomy and preventive surgery [2, 18].

Irradiation for advanced breast cancer is also a factor associated with an increased risk of complications after reconstructive surgery.

On the contrary, irradiation itself might improve the prognosis for advanced breast cancer, as well as reduce the risk of local recurrence [19]. In this respect, the oncoplastic BCS that is tolerable to radiation therapy may be beneficial for cases of advanced breast cancer. We would like to recommend, neo-adjuvant chemotherapy and BCS using LTDF improves both the cosmetic results and prognosis.

Although, the long-term results of oncoplastic procedures for BCS are not always satisfying, we could report satisfying long-term outcomes of 487 cases treated by LTDF. LTDF is a suitable oncoplastic technique for BCS.

Acknowledgements This study was approved by the institutional review board at Yamanashi Central Hospital.

Compliance with ethical standards

Conflict of interest The authors have declared no conflicts of interest.

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