Fig. 6. Venous thrombosis detected during the reoperation.

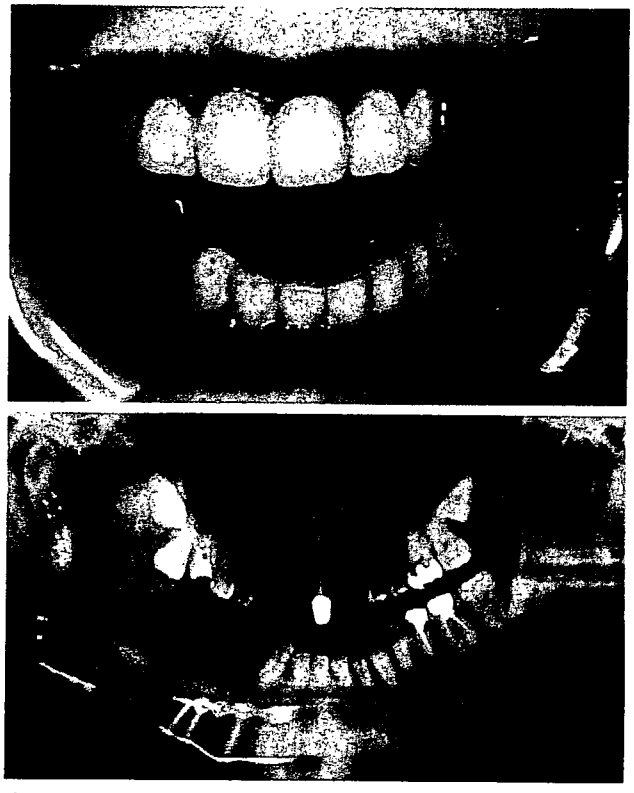

Fig. 7. Six months after reoperation. The transferred tissue survived completely.

The ability to detect problems intraoperatively is considered to decrease the incidence of reexploration after free tissue transfer.[9] Intraoperative monitoring of venous pressure rapidly detected venous insufficiency found in two of our present 52 cases, and also in other cases where we have noticed transiently elevated venous pressure as the wound was closed or a dressing was applied, which was then corrected immediately. In addition, this monitoring modality helped to facilitate postoperative care by avoiding critical elevations in venous pressure because of posturing and movement by the patient. Because the blood flow is derived from the pressure gradient between the arterial and venous sides, keeping the venous pressure at a lower level is important to ensure good perfusion in the transferred tissue. Despite the high-risk group indicated for venous pressure monitoring in our patient series, postoperative venous thrombosis occurred in only one of the 52 patients. The ability to detect critical venous pressure elevation during the intraoperative and/or postoperative period might lead to a lower incidence of venous thrombosis.

Reproducibility on an individual basis may be affected by potential artifacts, such as an unfavorable location of the catheter, motion, posturing, and obstruction of the line connected to the transducer. However, provided that one has a clear understanding of the technical background of this method, intraparenchymatous venous pressure monitoring can provide reproducible results in the assessment of venous compromise. This technique is not advocated for all cases of free-flap surgery because of potential complications in association with the pulling out of the catheter. Because we experienced only one case of postoperative venous thrombosis, further investigations were obviously required to discuss cost-effectiveness analysis of this technique. It would seem to be particularly indicated for high-risk patients, such as those demonstrated to have an abnormality in the venous anatomy, those undergoing reconstruction after lower leg trauma, and those requiring a vein graft.

CONCLUSIONS

Venous outflow abnormalities in instances of free composite tissue graft transfer can lead to devastating sequelae. Although various methods for monitoring the interstitial blood flow have been advocated, no single approach has been found to provide reliable information about incompetence of venous outflow. Monitoring the changes in the venous pressure is a method that is simple to implement, and the findings are, generally speaking, reliable and useful in helping the surgeon to decide when to reexplore the operative site. Although the venous pressure is in the range of 0 to 35 mmHg during the first 3 days after surgery, a subsequent trend to venous hypertension reaching a level of 50 mmHg clearly indicates venous outflow obstruction. Reexploration of the

wound is indicated if the "ailing" flap is to be rescued.

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DISCLOSURE

None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this article.

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Original Article

Options for Immediate Breast Reconstruction Following Skin-Sparing Mastectomy

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Background: Skin-sparing mastectomy (SSM) is a type of breast cancer surgery presupposed as breast reconstruction surgery. Cosmetically, it is an extremely effective breast cancer operation because the greater part of the breast's native skin and infra-mammary fold are conserved. All cases of SSM and immediate breast reconstruction performed by the senior author during the last five years were reviewed.

Methods: There are three implant options for breast reconstruction, namely, deep inferior epigastric perforator (DIEP) flap, latissimus dorsi myocutaneous (LDM) flap, and breast implant, and one of these was used for reconstruction after comprehensive evaluation.

Results: From 2001 to 2005, immediate reconstructions following SSM were performed on 124 cases (128 breasts) by the same surgeon. Partial necrosis of the breast skin occurred in 4 cases of SSM. The mean follow-up was 33.6 months. During the follow-up, there was local recurrence following surgery in 3 cases. The overall aesthetic results of immediate breast reconstruction after SSM are better than those after non-SSM.

Conclusion: SSM preserves the native breast skin and infra-mammary fold, and is an extremely useful breast cancer surgery for breast reconstruction. SSM is an excellent breast cancer surgical technique. We think this procedure should be considered in more facilities conducting breast reconstruction in Japan.

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Key words: Skin-sparing mastectomy, Immediate breast reconstruction, Deep inferior epigastric perforator (DIEP) flap, Latissimus dorsi myocutaneous (LDM) flap, Breast implant

Introduction

Reconstructive surgery following cancer resection is an important procedure for plastic surgeons, and breast reconstruction is a surgery in which aesthetics are of utmost importance. Cooperation of the breast surgeon is essential in the pursuit of good appearance, and surgical procedures that allow easy reconstruction of good breast form without affecting the completeness of cure are desirable.

Skin-sparing mastectomy (SSM) is mastectomy with minimum necessary skin removal only the areola, nipple, and skin directly over the tumor or skin at the biopsy site is removed as necessary[1]. Cosmetically, it is an extremely effective breast cancer operation because the greater part of the breast's native skin and inframammary fold are conserved. That is, an implant that corresponds in size to the amount of removed tissue is simply placed into the subcutaneous pocket formed after tumor excision. Regarding the implant, we have three options, namely, deep inferior epigastric perforator (DIEP) flap, latissimus dorsi myocutaneous (LDM) flap, and breast implant, and one is selected for the reconstruction after comprehensive evaluation.

We examined the cases that underwent breast-reconstructive surgery following SSM at our institution during the last five years, and report the details.

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Table 1. Mean Operation Time and Blood Loss for Each Reconstructive Techniques and SSM

	LDM flaps (n: 66)	free DIEP flaps (n: 45)	Tissue Expander (n: 10)	TRAM flap (n: 6)	VRAM flap (n: 1)
Operation time, (h)	4.68 ± 1.38	8.73 ± 2.83	2.65 ± 1.30	7.85 ± 1.89	7
Blood loss, (ml)	304 ± 179	541 ± 276	218 ± 179	595 ± 295	340

Patients and Methods

Indications

The indications for SSM are determined after a comprehensive evaluation including the breast surgeon's examination, cytodiagnosis, biopsy, and diagnostic imaging. Fundamentally, it is limited to cases having extensible breast skin with low probability of infiltration, regardless of the extent of intraductal progression. Even if breast preservation is possible, discussion with the patient often leads to SSM being selected due to its excellent local control.

Operative Procedure

SSM: Essentially, the entire mammary gland is removed through a lateral breast incision, but the thickness of the fat attached to the skin flap depends on the surgeon's judgement. The skin directly above the tumor is also excised according to its proximity to the tumor, but even when it is not excised, the fat that is preserved should be 5 mm or less in thickness, and it is necessary to take care not to damage the vascular network beneath the dermis. In particular, care must be exercised because the risk of necrosis increases if the electric scalpel is excessively used for hemostasis on the underside of the skin. Whether to excise the areola and nipple is determined by a quick perioperative pathological examination of the tissue under the nipple. If biopsy was performed before surgery, fusiform resection including the skin of the biopsy site is conducted.

We have three options for reconstruction, a DIEP flap, LDM flap, or breast implant. Fundamentally, the DIEP flap is chosen if the breast volume is at least moderate and the abdominal fat is sufficient[2]. The LDM flap is chosen for a small breast. Reconstruction using a breast implant is performed for moderate or larger breasts when the subcutaneous abdominal fat is insufficient, or when the patient does not desire reconstruction with autologous tissue.

1) DIEP flap: The perforators in the navel area are found by preoperative color Doppler flowmetry, and the largest perforator is selected. Usually one perforator is used to elevate a flap, but sometimes we use two if they are relatively narrow. The skin flap is selected from the side contralateral to the lesion, centered on zones I and III, and the inclusion of zone II is determined by whether the perforator is a lateral division or a medial one. The perforator is traced to the bifurcation of the external iliac vessels, and a long vascular pedicle is taken and anastomosed to the thoracodorsal vessels. However, if it is judged during the procedure that the perforator is very narrow and that a perforator flap cannot be used, a pedicled transverse rectus abdominis myocutaneous (TRAM) flap is used instead.

2) LDM flap: Usually a transverse, fusiform incision is designed so that the scar will be hidden in the bra line on the back. The LDM flap has adipose tissue beneath the superficial fascia attached to it. The insertion of the latissimus dorsi muscle is severed with an electric scalpel, sparing the entry site of the thoracodorsal vessels so that the flap is an island myocutaneous flap with thoracodorsal vessels as a pedicle. The myocutaneous flap is subcutaneously tunneled through the axillary region to the precordial region to create a breast mound. It is made slightly bigger than the unaffected side in consideration of postoperative atrophy.

3) Breast implant: The skin and subcutaneous tissue detached in SSM are thin and there is risk of capsular contracture or exposure of artificial materials if the breast implant is simply placed in the subcutaneous pocket, and therefore it is inserted under the pectoralis major muscle. The pectoralis major muscle is cut at its origin, a sufficiently large pocket is created, and a tissue expander (TE) is inserted. The TE is gradually enlarged and the breast volume is determined by comparison with the contralateral breast. Then, the TE is injected with physiological saline to 20% more than the volume of the breast implant. The

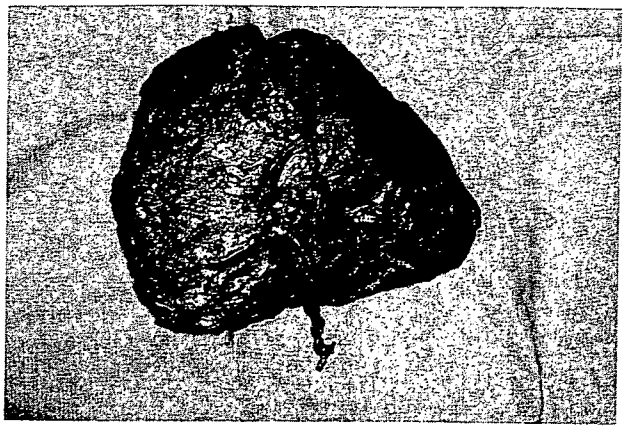

Fig 1. Case 1: A 13 × 30 cm DIEP flap was elevated with two perforators.

TE is removed, and the breast implant is inserted 3 to 6 months after surgery.

Results

From 2001 to 2005, immediate reconstructions following SSM were performed by the same surgeon on 124 cases (128 breasts). The SSM group consisted of 68 cases with excision of the nipple and 56 cases with preservation of the nipple. The SSM reconstruction techniques were 66 LDM flaps, 45 free DIEP flaps, 10 TE + bag, 6 TRAM flaps, and one VRAM flap. The time for the operation was 4.68 ± 1.38 hours in the LDM flap group, 8.73 ± 2.83 hours in the free DIEP flap group, and 2.65 ± 1.30 hours in the TE + bag group (Table 1). The volume of blood loss was 304 ± 179 ml in the LDM flap group, 541 ± 276 ml in the free DIEP flap group, and 218 ± 179 ml in the TE + bag group. Reconstruction of the areola and nipple was done in 32 cases. Partial necrosis of the breast skin occurred in 4 cases of SSM. In two cases, it healed with scar formation by conservative treatment, one case was reconstructed with an LDM flap because of extensive necrosis in all layers, and the other case was excised and sutured because the area was small. The mean follow-up period was 33.6 months. During the follow-up, postoperative local recurrence occurred in three cases; in two cases mastectomy including the reconstructed tissue was done, and in one case partial mastectomy including the skin at the site of local recurrence was done.

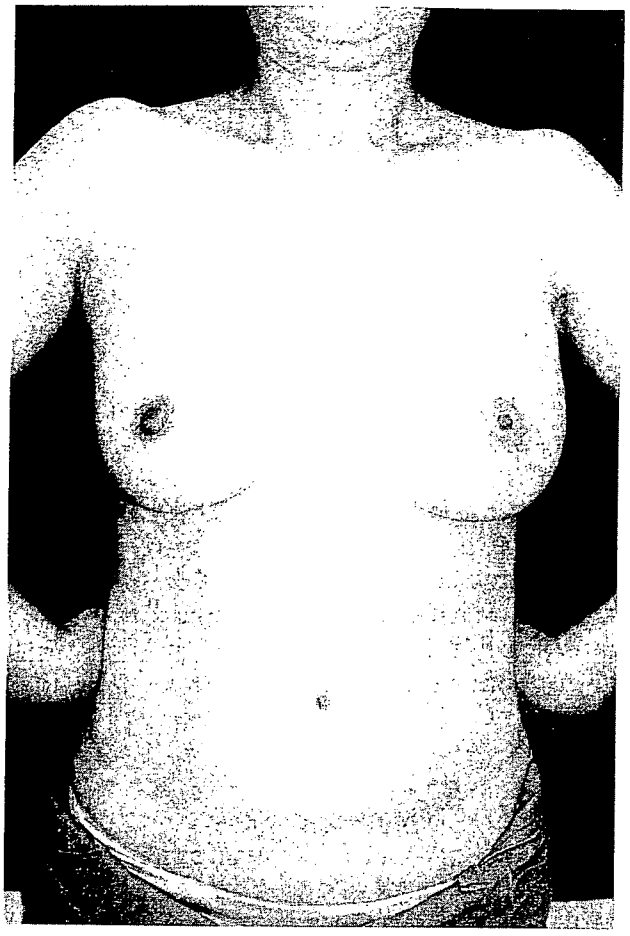

Fig 2. Case 1: The breasts have left/right symmetry, and the patient is satisfied 3 years after surgery. The rectus abdominis muscle function was preserved, there is no abdominal bulge, and the scars are not prominent.

Case Reports

Case 1: DIEP Flap

The patient was 55-year-old woman. SSM was performed for breast cancer in the left C region (T1). From the lateral breast incision, SSM with nipple-areola complex resection was performed. Axillary lymph node dissection was not performed because biopsy of the sentinel lymph node was negative. A 13 × 30 cm DIEP flap was elevated with two perforators and anastomosed end-to-end to the thoracodorsal vessels (Fig 1). Since the perforator was a medial division, zones I and II were used to form the breast mound. The nipple-areola complex was later reconstructed. The patient's postoperative progress was favorable, and so far (3 year after surgery), neither local recurrence nor distant metastasis has occurred. The breasts have left/right symmetry, and the patient is satis-

Fig 3. Case 2: SSM was conducted for breast cancer with involvement of the nipple-areola complex.

Fig 4. Case 3: The insertion of the latissimus dorsi muscle was severed and transferred to the precordial region as an island skin flap to form the breast mound.

fied. The rectus abdominis muscle function was preserved, there is no abdominal bulge, and the scars are not prominent (Fig 2).

Case 2: LDM Flap

The patient was 59-year-old woman. SSM was conducted for breast cancer in the left CE region (T1). The entire mammary gland with nipple-areola complex was removed via a lateral breast incision, and biopsy of the sentinel lymph node was negative (Fig 3). The skin island was designed to be hidden on the back by a bra. The insertion of the latissimus dorsi muscle was severed and transferred to the precordial region as an island musclocutaneous flap to form the breast mound (Fig 4). The LDM flap underwent deepithelialization except for the nipple-areolar region, and was placed under the mastectomy flap. The nipple-areola complex was later reconstructed. The patient's postoperative progress was favorable, and so far (2 years after surgery) neither local recurrence nor distant metastasis has occurred. The breasts have left/right symmetry, and the patient is satisfied (Fig 5). The scars on the back are not prominent.

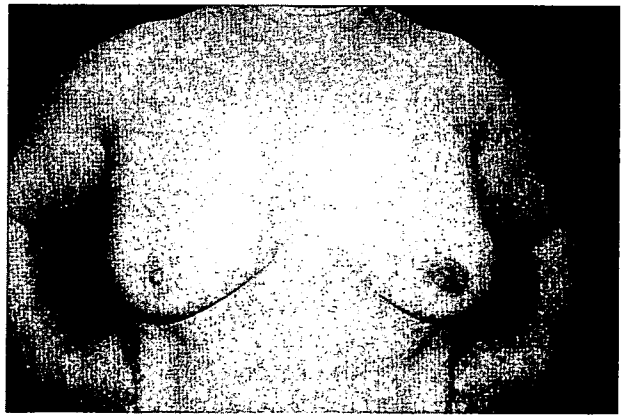

Fig 5. Case 3: The nipple-areola complex was later reconstructed. The patient's postoperative progress was favorable. The breasts have left/right symmetry, and the patient was satisfied 2 years after surgery. The scar on the back is not prominent.

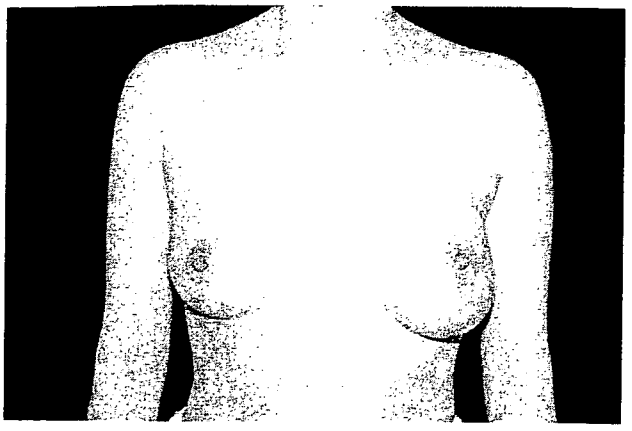

Fig 6. Case 3: The entire left mammary gland was removed via a lateral breast incision. The TE was filled with 300 cc of physiological saline.

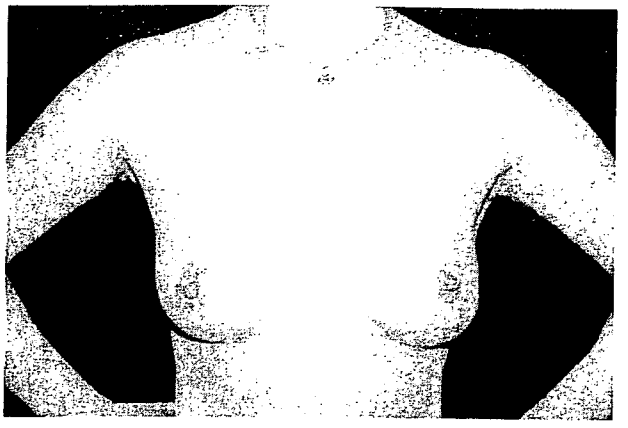

Fig 7. Case 3: After 4 months, a 220-cc cohesive silicone bag was implanted. The breasts have left/right symmetry, and the patient is satisfied 3 years after surgery.

Case 3: Breast Implant

The patient was 42-year-old woman. SSM was performed for breast cancer in the left C region (T1). The entire mammary gland was removed via a lateral breast incision. Biopsy of the sentinel lymph node was negative. The pectoralis major muscle was separated at its origin, and a 12.5 × 12.5 cm 600-cc TE was inserted in the pocket underneath the pectoralis major muscle. The TE was filled with 300 cc of physiological saline (Fig 6), and after 4 months a 220-cc cohesive silicone bag was implanted. The patient's postoperative progress was favorable, and so far (three years after surgery) neither local recurrence nor distant metastasis has occurred. The breasts have left/right symmetry, and the patient is satisfied (Fig 7). Capsular contracture was not recognized 3 years postoperatively.

Discussion

Surgery is still the main treatment for breast cancer, but the changes in the operative procedures have been dramatic. In the 1960s, mastectomy with excision of the pectoral muscles and extended surgery was predominant. In the 1980s, pectoral-preserving mastectomies gradually increased. Then in the 1990s, breast-preserving treatments appeared with a trend toward further scaling down. In a national survey conducted by the Japanese Breast Cancer Society in 2000, scaling down was prominently seen with pectoral-preserving mastectomies (52%), breast-preserving treatment (41%), and extended radical mastectomy with excision of the pectoral muscles (1%). In addition, cases of breast reconstruction are increasing, as awareness of the patient QOL increases. However, the breast skin is extensively removed in the pectoral-preserving surgery or excision of the pectoral muscles in the standard breast cancer surgery. Moreover, if reconstruction is done with an LDM flap or TRAM flap, a patchwork appearance is unavoidable because skin with different color and texture is exposed on the surface of the breast. In breast-preserving surgery, the partial tissue loss was sufficiently filled with the LDM flap, but considering the use of postoperative irradiation and the high rate of local recurrence in comparison with the other operations, it was not a reconstruction-oriented technique.

In contrast, the SSM reported by Toth & Lappert in 1991 is a breast cancer surgical technique in which the entire mammary gland is removed but the breast's native skin is preserved as far as possible on the assumption of reconstruction[1]. Because the native breast skin and the submammary sulcus are preserved by this method, it is extremely advantageous for breast reconstruction.

The indications for SSM were reportedly stage T1/T2, multiple tumors, DCIS and preventive mastectomy[3], but recently the range of operative indication has broadened to include stage T3 and T4[4-7]. The indications at our institution are not strictly related to the tumor diameter or stage, but are for cases in which breast-preserving treatment is not possible and in which no tumor invasion to the breast skin surface is observed. In the clinical practice, the indications include cases having

Table 2. Recurrence Rate Following SSM and Non-SSM

	Year	SSM (n)	Non-SSM (n)	LR (%) SSM	LR (%) NSSM	Follow-up period (M)
Yano *et al.*	2007	124	NE	2.4	NE	33.6
Margulies *et al.*[12]	2005	50	NE	0.0	NE	7.9
Greenway *et al.*[13]	2005	225	1022	1.7	1.5	49
Downes *et al.*[14]	2005	38	NE	2.6	NE	52.9
Fersis *et al.*[15]	2004	60	NE	6.6	NE	52
Gerber *et al.*[16]	2003	112	134	5.4	8.2	59
Carlson *et al.*[6]	2003	565	NE	5.5	NE	65.4
Medina-Franco *et al.*[7]	2002	176	NE	4.5	NE	73
Foster *et al.*[5]	2002	67	NE	4.0	NE	49.2
Carlson *et al.*[4]	2001	118	NE	2.7	NE	42.7
Rivadeneira *et al.*[17]	2000	71	127	5.6	3.9	49
Kroll *et al.*[18]	1999	114	40	7.0	7.5	66
Toth *et al.*[19]	1999	50	NE	0.0	NE	57
Simmons *et al.*[20]	1999	77	154	3.9	3.25	20.2
Newman *et al.*[21]	1998	372	NE	6.2	NE	50
Slavin *et al.*[8]	1998	51	NE	2.0	NE	44.8
Kroll *et al.*[22]	1997	104	27	6.7	7.4	67.2

SSM, skin-sparing mastectomy; LR, local recurrence; NE, not evaluated

extensive calcification, cases of multiple tumors and intraductal progression. Whether to perform SSM is determined by clinical pathology factors.

The line of incision is very commonly circumareolar in European and American reports. Slavin et al. divided them into four types: 1) periareolar incision, 2) periareolar incision with lateral extension, 3) elliptical incision centered on the areola, and 4) periareolar incision with medial and lateral extensions[8]. Other methods based on breast reduction surgery have also been reported[9]. For an areola-preserving mastectomy, in which only the nipple is excised, four types of incision lines have been reported: 1) transverse incision across the areola with extra-areolar extension, 2) S-shaped intra-areolar incision, 3) inverted T-shaped incision consisting of a downward incision from the nipple and incision of the infra-mammary crease, and 4) incision of the infra-mammary crease[9]. SSM that preserves both the areola and nipple has been reported, in which the entire mammary gland is excised via a lateral breast incision or incision of the infra-mammary crease, but this procedure is rare in the UK[10].

In principle, we use a lateral breast incision to preserve the areola and nipple as far as possible, avoid scarring of the surface of the breast if possible, and choose a line of incision that is useful for reconstruction. Whether to excise the areola and nipple or not is determined by a quick perioperative pathological examination, and the amount of skin to be excised from the biopsy site and directly above the tumor is judged by the surgeon.

Esthetically, SSM is an excellent breast cancer surgical technique, but there are two problems. One is the problem of necrosis of the preserved breast skin due to poor circulation, and the other is local recurrence of breast cancer.

We encountered partial necrosis of the breast skin in 4 of 124 cases of SSM during the last 5 years. In 2 cases, it healed with scar formation by conservative treatment, 1 case was reconstructed with a LDM flap because of extensive necrosis in all layers, and the other case required surgical excision and suturing because the area was small. Thinning and poor blood circulation in the skin flap directly above the tumor is sometimes unavoidable, but if care is taken not to damage the subdermal vascular network with the electric scalpel, this is usually not a problem.

Many recent reports have stated that the recurrence rate is not high following SSM compared with non-SSM techniques (Table 2). During a mean follow-up period of 7.9-73 months, the recurrence rate after SSM was 0-6.7% and that after non-SSM was 1.50-8.2%, without significant difference. Simple comparison is not possible because the disease period and tissue types of SSM in the patients differ and the duration of postoperative follow-up observation is not uniform, but

the theory that SSM will result in an increase rate of recurrence seems to be refuted. We have encountered 3 cases of recurrence (2.4%, 3/124), and in 2 cases mastectomy, including the reconstructed tissue, had to be performed, while in the other case only the breast skin including the site of recurrence was excised. We plan to continue careful follow-up.

Regarding the method of reconstruction, the point is to implant an amount of soft filler that corresponds to the amount lost into the subcutaneous pocket formed by excision of the mammary gland. As filler, we have three options, namely, a DIEP flap, a LDM flap, or a breast implant. We decide the method of reconstruction after consultation with the patient.

The DIEP flap, originally developed by Koshima & Soeda[11], is a skin flap including fat fed by blood vessels without the muscle itself from the rectus abdominis muscle. Before using this skin flap, we also mainly used an ordinary pedicled TRAM flap, but taking the muscle and fascia requires strict postoperative bed rest. Nevertheless, a mild bulge in the lower abdomen formed postoperatively in many cases due to opening of the rectus sheath. With the DIEP flap, the rectus abdominis muscle function is preserved because the intercostal nerves are carefully preserved, and no lower abdominal bulge develops because the sheath is also completely preserved. The subcutaneous fat in the lower abdomen does not ordinarily present a quantitative problem, and is sufficient for reconstruction even in cases of macromastia. However, if a perforator from the lateral row is used, the blood circulation in zone II can be unstable and reconstruction must be done using only zones I and III. For the vascular pedicle, about 12 cm can be collected by tracing the perforator to the bifurcation of the external iliac vessels, which is long enough to reach the thoracodorsal vessels. In immediate reconstruction, the thoracodorsal vessels are already exposed and the vascular anastomosis is advantageous. In reconstruction using the DIEP flap, there was no atrophy of the transplanted tissue, it retained its very soft condition, and it was the best reconstruction method compared to the other two methods.

With the LDM flap, we cannot deny the possibility that the reconstructed breast will shrink because of reduced muscle due to postoperative disuse atrophy. However, it is effective for patients with moderate or smaller breasts because it is a comparatively simple procedure which places only a small burden on the patient.

Breast implants are used for patients with moderate or larger breasts whose lower abdominal subcutaneous fat is exceptionally thin, or for young patients who wish to bear children. Because the breast skin flap is very thin in SSM, it is necessary to place the breast implant beneath the pectoralis major muscle. If various breast implants are prepared, it may be possible to directly place the breast implant immediately, but at present a TE is temporarily implanted and replaced with the breast implant when the size is determined. This necessitates a second operation, but the size is more accurately determined and positioning can be corrected at replacement, and it seems to be useful.

Conclusion

SSM preserves the native breast skin and submammary sulcus, and is an extremely useful breast cancer surgery when conducting breast reconstruction. It is already widespread in Europe and America, and it is reportedly not much different from the other operative procedures with regard to local recurrence. We believe strongly that skin-sparing mastectomy with immediate reconstruction is a significant advance in the treatment of breast cancer: it provides patients with an improved cosmetic outcome with less emotional trauma and morbidity. We think it is a procedure which should be performed at more facilities conducting breast reconstruction.

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Postoperative Seroma Formation in Breast Reconstruction With Latissimus Dorsi Flaps

A Retrospective Study of 174 Consecutive Cases

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Abstract: The latissimus dorsi flap has been widely used in breast reconstruction surgery. Despite its potential advantages such as low donor morbidity and vascular reliability, the complication of donor-site seroma formation frequently occurs. Consecutive 174 patients who underwent breast reconstruction with the latissimus dorsi flap from 2001 to 2006 were retrospectively reviewed. The age, body mass index (BMI), smoking history, timing of reconstruction, type of breast surgery and nodal dissection, and several other intraoperative data were analyzed. The overall incidence of postoperative seroma was 21%. Increased age (>50 years) and obesity (BMI >23 kg/m^2) were significant risk factors for seroma formation (P = 0.02 and 0.004, respectively). The patients who underwent skin-sparing mastectomy or modified radical mastectomy had higher incidence of seroma formation (28% and 33%, respectively) as compared with those who had breast-conservative surgery (11%). A significant correlation was found between the type of breast surgery and the incidence of seroma (P = 0.04). The type of nodal dissection did not affect the incidence of postoperative seroma (P = 0.66). We concluded that increased age, obesity, and invasive breast surgery are risk factors for donor-site seroma formation after breast reconstruction with the latissimus dorsi flap. Close attention should be paid to prevent development of postoperative seroma when operating on such high-risk patients.

Key Words: donor-site seroma, latissimus dorsi flap, breast reconstruction, risk factor

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Autologous latissimus dorsi flap has become a standard procedure for breast reconstruction since its first description in the late 1970s.[1,2] At our institution, it has become the most frequently used flap for its advantages, including low donor-site morbidity, reliable vascularity, and no need for microvascular procedures. The rate of major flap and donor-site complications is relatively low as compared with the other autologous flaps, such as partial necrosis of the transverse rectus abdominis musculocutaneous flap. On the other hand, as many previous reports mentioned, postoperative seroma develops as a minor donor-site complication at a high rate, ranging from 11.8% to 79%.[3–8] Despite such a high incidence, little information is available regarding the risk factors for donor-site seroma formation. The purpose of this study was to investigate the relation between various factors and the incidence of donor-site seroma, which possibly contributes to predicting and even preventing postoperative seroma formation. A series of 174 consecutive patients operated upon by a single surgeon was retrospectively examined.

PATIENTS AND METHODS

In this study, 174 patients who underwent breast reconstruction with latissimus dorsi flap from January 2001 through August 2006 at Osaka University Hospital were retrospectively reviewed. Data regarding age at the time of operation, body mass index (BMI, normal/underweight, <23; overweight/obese, >23), smoking history, flap harvest side, timing of reconstruction, type of breast surgery (skin-sparing mastectomy, modified radical mastectomy, radical mastectomy, or breast-conservative surgery), type of nodal dissection (axillary or sentinel node dissection), design of skin paddle (transverse, oblique, or vertical), total operation time, and total blood loss were collected for each patient. All reconstruction procedures were performed by the senior author (K.Y.) using identical dissection technique, except the skin paddle design. All the latissimus dorsi flaps were harvested by judicious use of electrocautery, and a vacuum drainage tube was placed at the donor site at the end of the operation. No quilting stitches were performed at the donor site. The drains were removed when drainage was less than 20 mL/24 hours; otherwise, they were removed at 2 weeks postoperatively. After removal of the drains, interventional drainage was performed once a week when there was liquid fluctuation at the donor site. In this study, seroma formation was defined as the persistence of seroma more than 4 weeks postoperatively.

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Statistical analysis was performed using a statistical software (Statcel version 2). The data were analyzed using the χ^2 test. A value of $P < 0.05$ was considered significant.

RESULTS

The overall data of the incidence of donor-site seroma are summarized in Table 1. Among the 174 patients, 37 (21%) developed a postoperative seroma. The patients younger than 50 years of age had a significantly lower incidence of postoperative seroma (22 of 129 patients; 17%), as compared with those older than 50 years of age (15 of 45 patients; 33%) ($P = 0.02$). Of the 134 patients with BMI <23, 22 (16%) developed a seroma, as compared with 15 of 40 patients (38%) with BMI >23 ($P = 0.004$). Although the National Institutes of Health defines the subjects with BMI >25 as overweight, we defined those with BMI >23 as overweight or obese, considering the Asian woman's constitution.

TABLE 1. Comparison of the Incidence of Donor-Site Seroma

Variables	No. Cases	No. Seroma (%)	P
Overall	174	37 (21)	
Age			0.02
<50	129	22 (17)	
>50	45	15 (33)	
Body mass index			0.004
<23 kg/m^2	134	22 (16)	
>23 kg/m^2	40	15 (38)	
Smoking history			0.99
No	141	30 (21)	
Yes	33	7 (21)	
Flap harvest side			0.23
Left	93	23 (25)	
Right	81	14 (17)	
Timing of reconstruction			0.92
Immediate	156	33 (21)	
Delayed	18	4 (22)	
Type of breast surgery			0.04
Skin-sparing mastectomy	83	23 (28)	
Modified radical mastectomy	18	6 (33)	
Radical mastectomy	3	0	
Breast-conservative surgery	70	8 (11)	
Nodal dissection			0.66
Axillary node dissection	70	15 (21)	
Sentinel node dissection	91	18 (20)	
No nodal dissection	13	4 (31)	
Design of skin paddle			0.21
Transverse	109	19 (17)	
Oblique	44	11 (25)	
Vertical	21	7 (33)	
Total operation time			0.35
<270 min	87	16 (18)	
>270 min	87	21 (24)	
Total blood loss			0.22
<210 mL	86	15 (17)	
>210 mL	88	22 (25)	

The patients who underwent skin-sparing mastectomy and modified radical mastectomy demonstrated a higher incidence of postoperative seroma (28% and 33%, respectively) than those who underwent breast-conservative surgery (11%). There was a significant correlation between the type of breast surgery and the incidence of seroma ($P = 0.04$). The other variables, such as smoking history, timing of reconstruction, or type of nodal dissection, did not affect the incidence of seroma formation.

All the patients who developed a seroma were successfully treated without surgical intervention, except for 1 patient who showed a persistent seroma formation for 4 years. After unsuccessful conservative treatments, including repeated punctures and sclerotherapy, complete capsulectomy of the seroma cavity and quilting stitches did eventually achieve healing.

DISCUSSION

Following the use of the latissimus dorsi musculocutaneous flap for breast reconstruction, donor-site seroma formation became the most common complication. In addition to destruction of many small blood and lymphatic vessels during flap harvest, insufficient immobilization of the donor site, which is essential for proper wound healing, makes its treatment difficult. Although some attempts were made to reduce the incidence of donor-site seroma such as use of quilting sutures,[7,9] scalpel dissection instead of electrocautery dissection,[7] or fibrin glue,[3,10] with some positive results, these procedures result in prolonged operation time and increased hospital fees. Therefore, it is rational to perform such procedures in selected cases if we can pre- or intraoperatively identify the patients at high risk of postoperative seroma formation. Thus, to determine the predictors for seroma formation is clearly warranted.

Recently, several authors have attempted to analyze the potential risk factors for donor-site seroma formation.[4,5] However, the detailed data about the patients' profiles and operative procedures are still insufficient. In our large series of 174 consecutive patients with latissimus dorsi flap breast reconstructions, the overall incidence of donor-site seroma was 21%. We attributed this relatively low incidence (as compared with the previous reports[3-8]) not only to the differences in the technique of flap harvest and the definition of seroma formation but also to the small number of obese patients in our study population. Obesity has been regarded as a potential risk factor for seroma formation,[5,8,11-13] as well as advanced age.[4,14,15] Indeed, in our study, obese patients had a significantly higher incidence of donor-site seroma as compared with the nonobese patients. Similarly, the patients older than 50 years of age had a risk of seroma formation greater than those younger than 50 years of age.

We also paid attention to the type of breast surgery since recent treatments of breast cancer have shown a trend toward less invasive surgery, such as the breast-conservative surgery.[11] In fact, about 90% of the patients in our study underwent either breast-conservative surgery or skin-sparing mastectomy. The current data clearly revealed a decreasing tendency of seroma formation in less invasive breast surgery.

The possible reason for this finding is easy to understand as follows. Reconstruction of a large defect demands a large flap, which consequently results in a wide dissection and a large dead space at the donor site. The same explanation might be applied to obese patients, whose breast volumes are generally larger than those of the nonobese patients.

An unexpected finding in our study was that the nodal dissection did not affect the incidence of donor-site seroma formation, irrespective of the type of nodal dissection. An axillary seroma reportedly develops in 15% to 50% of the patients after axillary node dissection and in 0% to 7% after sentinel node dissection.[15-18] Regarding the donor-site seroma, Randolph et al[4] reported that the patients who underwent prior or concurrent nodal dissection had a higher incidence of seroma formation (52%) as compared with those who underwent no nodal dissection (25%), but the difference was not significant. Although we have currently no suitable explanation for the discrepancy between our study results and those of a previous study, additional data such as the total number of axillary lymph node removed might be helpful to assess the significance of this variable.

To the best of our knowledge, this is the largest-scale study concerning the donor-site seroma formation after breast reconstruction with the latissimus dorsi flap. The significant risk factors for seroma formation included increased age, obesity, and invasive breast surgery. We believe that of the best countermeasure for donor-site seroma formation will be prevention. Besides a careful flap dissection and postoperative compressive garments, additional intraoperative procedures such as quilting stitches, scalpel dissection, or use of fibrin glue should be considered, especially in the "high-risk" patients.

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Cosmetic outcome and patient satisfaction after skin-sparing mastectomy for breast cancer with immediate reconstruction of the breast

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Purpose. *We conducted a retrospective study to assess the safety, cosmetic outcome, and patients' satisfaction after skin-sparing (SSM) and nipple-sparing mastectomy (NSM) for breast cancer with immediate reconstruction of the breast (SMIBR).*

Methods. *The subjects were patients, who underwent SMIBR, breast-conserving surgery (BCS), and total mastectomy (MST) between 2000 and 2004 at Osaka University Hospital. Cosmetic outcome was estimated by 4 reviewers by scoring postoperative photographs of the patients. Patient satisfaction was evaluated with a questionnaire for assessment of quality of life for Japanese breast cancer patients.*

Results. *Of the 74 patients who had undergone SMIBR, 4 developed local recurrences (5%). The local recurrence rate for SMIBR patients was greater than that for BCS (4/178) and MST (3/178, P = .10). The distant recurrence rate was similar for all three types of patients (5% for SMIBR, 5% for BCS, and 9% for MST). The median averaged score by 4 reviewers for the estimated cosmetic outcomes was 7.8 for the SMIBR and 7.5 for the BCS group (P = .20), and for age-adjusted patients, the corresponding scores were 8.2 and 8.0 (P = .70). There was no difference in cosmetic outcome between the SSM and NSM subgroups (P = .09). Average scores for patient satisfaction (social activity, physical aspects, and general condition) were the same for the 3 groups. For body image, the BCS and SMIBR groups had higher scores than the MST group ($p < 0.05$). Average scores for questions relating to bodily pain and sexual aspects were higher for the BCS than the MST group, but were not different between SMIBR and BCS groups. Similar trends for the 3 groups were observed when patients were divided into subgroups by tumor size or axillary dissection.*

Conclusions. *SMIBR is safe with a comparatively low local recurrence rate and the same distant recurrence rate as for BCS and MST. Moreover, it results in objective cosmetic outcome and patient satisfaction as good as those for BCS, and greater patient satisfaction with body image than that for MST. (Surgery 2008;143:414-25.)*

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BREAST SURGERY has changed drastically in the last two decades. Currently, breast-conserving surgery has become a standard procedure for early breast cancer and improves quality of life (QOL).[1,2] For patients with large tumors, multiple tumors, or wide-spread ductal carcinoma in situ (DCIS), breast-conserving surgery is considered to be contra-indicated. To improve QOL of such patients, preoperative chemotherapy has been used for patients with large invasive cancers and has led to an increase in the ratio of breast-conserving surgery for such patients.[3-5] The cosmetic outcome depends on the size of the residual tumor, and often the results are poor for patients with small breasts. In contrast, for patients with multiple tumors, wide-spread DCIS, and multicentric residual tumors after preoperative chemotherapy, mastectomy is inevitable, and breast reconstruction is the only way to preserve the shape of the breast. Consequently, skin-sparing mastectomy (SSM) and nipple-sparing mastectomy (NSM), combined with

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immediate breast reconstruction (SMIBR), have been performed for increasing numbers of patients, resulting in better physical and psychological satisfaction.[6] This procedure is a good choice for Japanese women, many of whom have small breasts, because of severe deformity of the breast often observed after breast-conserving surgery.

We report our experience with SMIBR for Japanese women with breast cancer, which confirmed the safety and good cosmetic outcome of SMIBR as well as high patient satisfaction in comparison with breast-conserving surgery and total mastectomy.

PATIENTS AND METHODS

Patients. The study subjects were patients who underwent operation for primary breast cancer at Osaka University Hospital between 2000 and 2004. Patients older than 70 years and those who received primary systemic chemotherapy were excluded from this study, because these factors might affect the prognosis.

After consent for the operation had been obtained, skin-sparing mastectomy or nipple-sparing mastectomy with immediate breast reconstruction (SMIBR) was performed for patients with DCIS, invasive ductal carcinoma with extensive intraductal components, or multiple tumors. SMIBR was performed for 74 women (SSM = 41, NSM = 33) during the 2-year period. SSM and NSM were performed by surgeons, and IBR by a plastic surgeon (K.Y.). The nipple and the areola were preserved when both of the following 2 conditions were met. One was that the tumor had been diagnosed by means of pre-operative image analysis as DCIS or as a small invasive cancer without tumor extension to the nipple. The other was confirmation of the absence of tumor components at the cut-end of the subareolar tissue by means of immediate intra-operative pathologic examination of frozen sections. Sentinel lymph node biopsy (SLNB) was performed for patients with T1-2 (<3 cm) N0 tumors who had expressed their desire for this procedure and given their consent. Axillary dissection was omitted for subjects without metastasis in the sentinel nodes examined by frozen sections. Other patients, who did not desire SLNB and with metastasis in the sentinel nodes underwent axillary completion. SSM was performed through a skin incision around the tumor and the nipple as described previously,[7] and sentinel lymph node biopsy and axillary dissection were performed through another incision in the axilla. NSM was carried out through a hemi-circular incision around the areola and a 10-cm incision from the axilla to the lateral edge of the breast. The areola was preserved as a thin flap dividing the ductal tissue. Material for reconstruction, such as the latissimus dorsi myocutaneous (LDMC) flap, the deep inferior epigastric perforator (DIEP) flap, the transverse rectus abdominis myocutaneous flap, and prosthetic materials, were selected before surgery by the plastic surgeon according to the size and shape of the breast and taking the patient's request and condition into consideration. In some, skin defects were patched with the skin of the flaps, and some patients underwent reconstruction of the nipple and areola immediately or several months after the initial operation. Two patients whose tumor showed extensive lymphatic vessel invasion or who had 4 or more metastatic axillary lymph nodes received 50 Gr of post-operative adjuvant radiation therapy to the reconstructed breast and the chest wall including the axilla and supraclavicular area. Chemical and/or hormonal adjuvant treatment was administered to patients with invasive cancers depending on the estimated risk factors. All patients were followed every 3 mo by both a breast surgeon and a plastic surgeon using physical and laboratory examinations, and reconstructed breasts were also examined by means of mammography or ultrasonography if deemed necessary.

Breast-conserving surgery (BCS) was performed for 178 patients with breast cancers smaller than 3 cm who did not desire immediate reconstruction. The tumors were removed through a hemicircular incision around the areola with/without 1 to 2 cm lateral extension of the wound. Sentinel node biopsy and axillary dissection were performed through a separate incision in the axilla. All except 5 of these patients received 50 Gr of postoperative adjuvant radiation therapy to the conserved breast, and those with positive or close margins received an additional boost of 10 Gr to the tumor bed. Four of the 5 patients refused radiation therapy, and for one, who had scleroderma, radiation therapy was contra-indicated. Another 178 patients who did not desire either BCS or SMIBR underwent conventional total mastectomy (MST). Eight of these patients with 4 or more metastatic axillary lymph nodes received 50 Gr of post-operative adjuvant radiation therapy to the chest wall in the same manner as described above. The patients with BCS and MST were also given adjuvant treatment and were followed by breast surgeons every 3 to 6 months using physical and laboratory examinations. Patient characteristics are summarized in Table I.

Table I. Characteristics of the patients for the study

*Type of surgery**		*SMIBR (%)*			*BCS (%)*	*MST (%)*
		SSM	*NSM*	*SSM + NSM*		
Number of patients	Total	41	33	74	178	178
Tumor stage	Tis	2 (5)	5 (15)	7 (9)	9 (5)	13 (7)
	T1	20 (49)	12 (36)	32 (43)	123 (69)	58 (33)
	T2	18 (44)	15 (45)	33 (45)	46 (26)	103 (58)
	T3	1 (2)	1 (3)	2 (3)	0 (0)	4 (2)
Nodal status	N0	40 (98)	31 (94)	71 (96)	169 (95)	152 (85)
	N1	1 (2)	1 (3)	2 (3)	8 (4)	22 (12)
	N2	0 (0)	1 (1)	1 (1)	1 (1)	4 (2)
Reconstruction#	LDMC	21 (51)	24 (73)	45 (61)	-	-
	DIEP	16 (39)	8 (24)	24 (32)	-	-
	TRAM	4 (10)	0 (0)	4 (5)	-	-
	Implant	0 (0)	1 (3)	1 (1)	-	-
Axillary dissection$	SLNB	31 (76)	25 (76)	56 (76)	142 (80)	98 (55)
	ALND	10 (24)	8 (24)	18 (24)	36 (20)	80 (45)
Adjuvant therapy&	CT	8 (20)	8 (24)	16 (22)	32 (18)	60 (34)
	ET	22 (54)	21 (64)	43 (58)	128 (72)	120 (67)
	RT	1 (2)	1 (3)	2 (3)	173 (97)	8 (4)
Age (years)	Mean	47	44	45.7	52	55
Follow-up (months)	Mean	47	53	50	56	54

*SMIBR; skin-sparing and nipple-sparing mastectomy with immediate reconstruction, BCS; breast-conserving surgery, MST; total mastectomy, SSM; skin-sparing mastectomy, NSM; nipple-sparing mastectomy.
#LDMC; latissimus dorsi myocutaneous flap, DIEP; deep inferior epigastric perforator flap, TRAM; transverse rectus abdominis myocutaneous flap.
$SLNB; sentinel lymph node biopsy without axillary dissection, ALND; completion of axillary lymph node dissection.
&CT; chemotherapy, ET; endocrine therapy, RT; radiation therapy.

Assessment of cosmetic outcome for patients with SMIBR. Cosmetic outcome for 74 patients with SMIBR was assessed and photographs of those who had given their consent were taken by the plastic surgeon during routine follow-up physical examination. Eighteen patients did not visit our hospital, because they had changed to another hospital or had ceased to visit for their physical examination. Eventually, 56 patients were eligible for assessment with photographs taken from the standard 3 directions, comprising 1 frontal and 2 oblique views. For control, 70 patients were selected randomly among the 178 patients who underwent BCS, and photographs were taken in the same manner as above by a breast surgeon; however, 23 patients did not appear on the scheduled day during the study period from June 2004 to May 2005, and we could not contact

year-old female breast surgeon (S.U.) and the other a 50-year-old male plastic surgeon (K.Y.), and by 2 female nurses, 22 and 28 years old, all from the department of breast surgery. Inconspicuousness of the scar and symmetry of volume and shape of the breast, in addition to size, color, and position of the nipple-areola complex, as well as symmetry of position of the inframammary line, were evaluated on the photographs, and scored on a scale established by the Japanese Breast Cancer Society (Table II). The score for each item was then totaled by each reviewer for a maximum of 10 points per patient, and an averaged total score was obtained from the 4 total scores. Visual assessments of patients were then categorized based on the average total score: "Excellent" (≥9 points), "Good" (7-8 points), "Fair" (5-6 points) and "Poor" (≤4 points)

Table II. Scoring criteria for cosmetic assessment

Score (points)	*2*	*1*	*0*
Breast			
Symmetry of volume	Symmetric	Slightly asymmetric	Asymmetric
Symmetry of shape	Symmetric	Slightly asymmetric	Asymmetric
Visibility of scar	Inconspicuous	Slightly conspicuous	Conspicuous
Nipple-areolar complex			
Symmetry of size	-	Symmetric	Asymmetric
Symmetry of position		Difference < 2 cm	Difference >= 2 cm
Equality of color	-	Almost equal	Different
Inframammary line			
Symmetry of position	-	Difference < 2 cm	Difference >= 2 cm

Cosmetic outcome of each patient was assessed with photographs using a scoring system shown above. The score for each item was then totaled for a maximum of 10 points in each patient by each reviewer, and an averaged total score was obtained for each case from the four total scores. Visual assessments of patients were then categorized based on the averaged total score: "Eexcellent" (>=9 points), "Good" (7-8points), "Fair" (5-6 points) and "Poor" (<=4 points).

item), bodily pain (6 items), body image (2 items), sexual aspects (1 item), and motherhood aspects (4 items) (Table III). Questions were answered by patients using a 5-grade system. A score of 1 represents the worst condition or dissatisfaction, while a score of 5 represents the best condition or complete satisfaction.

The questionnaire was mailed out at least 6 mo after completion of adjuvant chemotherapy and radiation therapy (median: 16 mo), with a request for the patients to fill it out anonymously and to post it in an enclosed envelope to our office. Some patients were excluded from the study for a variety of reasons and were not sent the questionnaire. Twelve patients with recurrence of breast cancer, two with other malignancies after operation and two with serious autoimmune diseases were excluded from the study because, for example, pain from bone metastases or discomfort caused by chemotherapy might affect the results. Three patients had changed to another hospital and could not be contacted. Patients with some mental and/or social problems (31 patients), for example, depression caused by the disease, excessive apprehensions about how the doctor behaved, and distress caused by financial or family trouble, were also excluded, because these problems might affect the results relating to body image and sexual aspects. The exclusion was based on the suggestion by the doctor in charge.

Statistical analysis. SPSS software (SPSS Japan for quality of life assessment by the Japanese Breast Cancer Society. Questions were answered by patients using a 5-grade system, from 1 to 5, and evaluated by scoring on the basis of 100 points. For example, when an answer (A) was 4, the score (B) was calculated by the formula, $B = (A-1) \times 25$, to equal 75 points. For some grouped questions, the total score obtained was converted to a score based on 100 points. For example, when the total score for questions 1 to 6 was 460 out of 600 points, the converted score based on the 100 point system was 76.7 points. Average scores for each item were compared among patient groups and analyzed with Student's *t* test.

RESULTS

Prognosis for patients with SMIBR. The mean follow-up period was 50 months for the SMIBR, 54 months for the MST, and 56 months for the BCS group. Four local recurrences (5%) and 4 distant recurrences (5%) were observed in the 74 patients with SMIBR, 3 local (2%) and 16 distant (9%) recurrences in the 178 with MST, and 4 local (2%) and 9 (5%) distant recurrences in the 178 with BCS. In-breast recurrence rate was not statistically different for the SMIBR than the BCS group ($P = .19$). There was no difference in the distant recurrence rate among these groups. Five-year distant disease-free survival rates for the 3 groups were similar (91% for SMIBR, 94% for BCS and 90% for MST; $P = .387$).

Table III. The questionnaire

Social activities

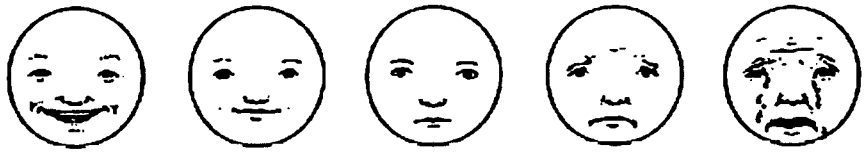
1. Can you do everything need for your daily life?
   5. Everything 4. Almost everything 3. Sufficient 2. Somewhat 1. Not at all
2. Can you go out without any assistance?
   5. Definitely 4. Easily 3. Rather easily 2. With difficulty 1. Not at all
3. Can you go for a walk for about 30 minutes?
   5. Definitely 4. Easily 3. Rather easily 2. With difficulty 1. Not at all
4. Is it difficult for you to walk a short distance?
   5. Not difficult at all 4. Not so difficult 3. A little difficult 2. Difficult 1. Very difficult
5. Can you use the stairs?
   5. Very easily 4. Easily 3. Rather easily 2. With difficulty 1. Not at all
6. Can you take a bath without any assistance?
   5. Very easily 4. Easily 3. Rather easily 2. With difficulty 1. Not at all

Physical aspects

7. How is your condition recently?
   5. Very good 4. Good 3. Rather good 2. Not bad 1. Bad
8. How is your appetite?
   5. Very good 4. Good 3. Rather good 2. Not bad 1. Bad
9. Do you enjoy your meals?
   5. Very much 4. A lot 3. Moderatey 2. A little 1. Not at all
10. Do you have to vomit?
    5. Never 4.Seldom 3. Occasionally 2. Sometimes 1. Often
11. Have you lost weight?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much

General

12. Please select a face best expresses your condition recently.



Bodily pain

13. Do you feel any pain and/or numbness in your breast, armpit and arm on the side of the operation?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much
14. Do you have any swelling in your arm on the side of the operation?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much
15. Can you raise your arm on the side of the operation?
    5. Very easily 4. Easily 3. Rather easily 2. A little 1. Not at all
16. Do you have any trouble with the skin of the breast on the side of the operation, for example, redness, swelling or itching?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much
17. Do you have any pain related to your disease or operation?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much
18. Are you satisfied with the result of the operation as far as the scar and shape of the breast are concerned?
    5. Very much 4. Very 3. Rather 2. A little 1. Not at all

Table III. (*Continued*)

Motherhood aspects

22. Do you worry about your family suffering the same disease as you?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much
23. Do you worry about not spending enough time with your child?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much
24. Do you worry about not taking enough care of your baby?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much
25. Do you worry about having a/another baby?
    5. Not at all 4. A little 3. Not so much 2. Much 1. Very much

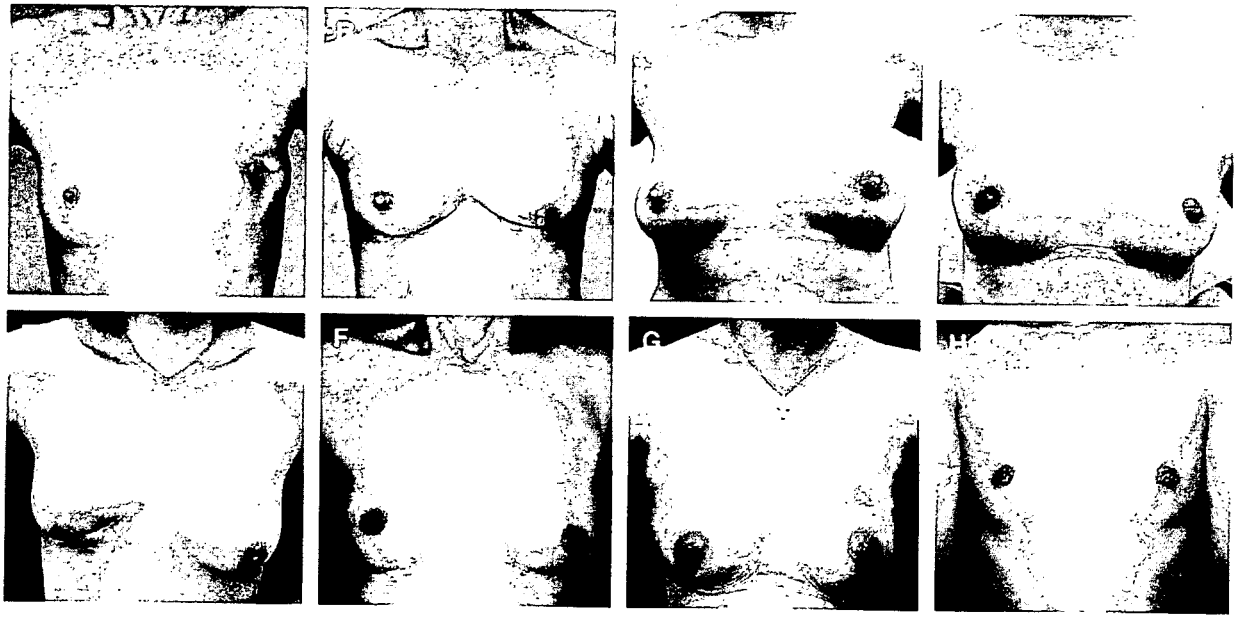


Figure. Assessment of cosmetic outcome. Cosmetic outcome was assessed with the aid of photographs for patients with BCS (**A to D**) and SMIBR (**E to H**) according to a scoring system by which patients with over all scores of 0 to 4 points were categorized as "Poor" (**A, E**), with 5 to 6 points as "Fair" (**B, F**), with 7 to 8 points as "Good" (**C, G**) and with 9 to 10 points as "Excellent" (**D, H**).

areola and was treated with mastectomy and axillary dissection. Pathologic examination after the second operation found an invasive tumor with intraductal components spreading beneath the areola. Another woman with DCIS which had spread widely in the upper quadrants of the left breast underwent NSM and IBR with DIEP flap; 38 months after the initial surgery, she developed a small lump near the sternum, treated with additional resection. Retrospective review of magnetic resonance imaging (MRI) and computed tomography (CT) results for these patients before the first operation revealed subtly enhanced lesions spreading to the subdermal tissue or to the inner edge of the mammary gland. Their relapses were considered to have been caused by incomplete resection of the gland.

The third patient underwent SMIBR with removal of the skin overlying the tumor followed by DIEP-flap reconstruction. Thirty-four months after the primary operation, a recurrent tumor was observed near the scar where the skin over the tumor was removed. Pathologic examination indicated that the tumor was located in the subdermal tissue and was surrounded by subcutaneous fat tissue. A photograph taken on the first day of the patient's visit to our hospital showed a faint scar of core-needle biopsy performed in a previous hospital at the same site as that of the recurrence. Since the scar was not noticed during the primary operation, it was not removed. This observation suggests that such recurrence may be caused by the implantation of tumor cells during core-needle

Table IV. Characteristics of patients for cosmetic assessment

*Type of surgery**		*SMIBR (%)*			*BCS (%)*
		SSM	*NSM*	*SSM + NSM*	
Number of patients	Total	28	28	56	47
Tumor stage	Tis	1 (4)	5 (18)	6 (11)	3 (6)
	T1	15 (54)	12 (43)	27 (48)	31 (66)
	T2	11 (39)	10 (36)	21 (38)	13 (28)
	T3	1 (4)	1 (4)	2 (4)	0 (0)
Reconstruction#	LDM	14 (50)	19 (68)	33 (59)	-
	DIEP	10 (36)	8 (29)	18 (32)	-
	TRAM	4 (14)	0 (0)	4 (7)	-
	Implant	0 (0)	1 (4)	1 (2)	-
Axillary dissection$	SLNB	22 (79)	25 (89)	47 (84)	44 (94)
	ALND	6 (21)	3 (11)	9 (16)	3 (6)
Postoperative radiation		1 (4)	0 (0)	1 (2)	46 (98)
Period after operation (months)	Median (range)	13 (5-36)	12.5 (4-26)	13 (4-36)	22 (6-54)

*SMIBR; skin-sparing and nipple-sparing mastectomy with immediate reconstruction, BCS; breast-conserving surgery, MST; total mastectomy, SSM; skin-sparing mastectomy, NSM; nipple-sparing mastectomy.
#LDMC; latissimus dorsi myocutaneous flap, DIEP; deep inferior epigastric perforator flap, TRAM; transverse rectus abdominis myocutaneous flap.
$SLNB; sentinel lymph node biopsy without axillary dissection, ALND; completion of axillary lymph node dissection.

biopsy. This patient, therefore, underwent additional local excision of the recurrent tumor and radiation therapy for the breast.

The last patient with local recurrence had undergone SMIBR with resection of both the nipple-areola complex and the skin overlying the tumor followed by DIEP-flap reconstruction. Pathologic examination found extensive lymphatic invasion of tumor cells in the specimen of the main tumor, although only one axillary lymph node showed metastasis. Six months after operation, while the patient was receiving postoperative adjuvant chemotherapy, she discovered a hard lump in the area near where the primary tumor had been located. This recurrence was considered to have been caused by remnant tumor cells in subcutaneous lymphatic vessels. The patient underwent total mastectomy and additional chemotherapy.

Assessment of cosmetic outcome. Cosmetic outcome was assessed on the basis of 56 photographs of the patients with SMIBR and 47 of those with BCS, which were scored according to the scale referred to above. Representative cases are shown in the Figure. Patient characteristics are summarized in Table IV, and the assessment results in Table V. There was no significant difference between SMIBR and BCS groups ($P = .2$), although the percentage patients assessed "Poor" was less in the SMIBR (9%) than in the BCS group (21%). Comparison of patients with SMIBR in the SSM and NSM group showed no difference in cosmetic outcome ($P = .2$). Statistical analysis of 30 pairs of age-adjusted patients from the BCS and SMIBR groups showed no significant difference in total score ($P = .8$), while age-adjusted patients in the SSM group showed no significant disadvantage in cosmetic outcome from those in the NSM group ($P = 1.0$).

Assessment of patient satisfaction. The questionnaire was sent to 71 patients with SMIBR, 158 with MST and 154 with BCS. The response rates were 70% for SMIBR (50 patients), 77% for MST (121) and 81% for BCS (125) (Table VI). The median of the age of the patients with SMIBR was less than that of the BCS and MST patients ($P < .05$). Axillary dissection was performed more often for patients with MST than for the other groups, while postoperative chemotherapy was also administered to more patients with MST than to the other groups ($P < .05$). The QOL-ACD responses indicated that these differences did not affect social activity, physical aspects, or general quality of life. According to the QOL-ACD-B response, the average score for patient satisfaction with body image was the same for the SMIBR group as for the BCS group and significantly greater than for MST group ($P < .05$). In particular, the average scores for Q19 ("Do you worry about choosing clothes that suit you?") and Q20 ("Are you reluctant to be seen naked in a public bath or spa?") were greater for both the SMIBR and BCS groups than for the MST group. The average score for response to the latter question by the BCS group was greater than that by the SMIBR group. The BCS group also showed significantly greater scores for questions about bodily pain and sexual aspects than did the MST group, while the SMIBR group did not.