

Why Change a Good Thing? Revisiting the Fleur-de-Lis Reconstruction of the Breast

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Although the latissimus flap is known for its simplicity and reliability, use of the fleur-de-lis pattern was plagued by undesirable T-shaped donor sites and small breast volumes in thin patients. We report a modified technique for optimal shaping of the standard latissimus with the successful application of a modified fleur-de-lis pattern. Because a "wet" tumescent infiltration was utilized and large amounts of subcutaneous fat were harvested, these changes permitted application to a wide variety of patients, with generous breast volumes reducing the size of the implant placed and resulting in excellent donor-site scars.

This is a retrospective cohort study of 53 delayed or immediate reconstructions performed consecutively by the principal author (M.E.A.) on 48 patients at a university-based, urban hospital. Each case was analyzed between April of 1995 and February of 1999, with a follow-up from 2.5 to 44 months. All patients underwent injection of tumescent solution into the subcutaneous plane and harvest of large amounts of subcutaneous fat with the neurologically intact latissimus muscle. The last 25 reconstructions utilized the modified fleur-de-lis skin pattern, an inferiorly based vertical limb and replacement of skin deficiency in both axes.

Of 11 perioperatively irradiated patients, none required skin grafting, whereas 6 percent of all native mastectomy flaps were grafted. There was one instance of minor distal tip flap necrosis in a nonirradiated patient. No implants became infected or were extruded. Donor sites were without wound complications and unveiled a 16 percent overall seroma rate.

Through selective addition of harvested tissue, this modified technique, particularly the fleur-de-lis pattern, permits improved volume and projection in the inferior pole. The T-shaped donor-site closure is not only acceptable, but is also desirable, with reduced wound tension and minimization of dog-ear formation. With a relative paucity of complications, this conceptually ideal modification is technically simple and aesthetically comparable to our transverse rectus abdominis muscle flap results. (*Plast. Reconstr. Surg.* 109: 525, 2002.)

Historically, the standard latissimus flap has been known for its advantages including reliability, easy patient recovery, good aesthetic results, and maintenance of volume over time (Fig. 1).¹⁻⁶ For certain patient populations not suitable for alternative reconstructive procedures, it is known to be an effective and favorable option.⁷⁻⁹ Disadvantages of the flap, including the need for an implant, the high rate of seroma formation, and some limitations to the aesthetic result when compared with the transverse rectus abdominis muscle (TRAM) flap, have made it second choice for many plastic surgeons.^{10,11} In 1991, McCraw and Papp introduced an important concept by changing the crescent shape to a three-cornered skin paddle for improved distribution of volume.¹² They also incorporated large amounts of subcutaneous fat, which precluded the need for an implant and created the fully autogenous fleur-de-lis latissimus flap.⁹ This modification made the latissimus flap available to a population of patients with small to moderately sized breasts desiring autogenous reconstruction, but was not universally accepted because of undesirable T-shaped donor-site scars and the difficulty in achieving adequate volumes for symmetry.

We propose to revisit the fleur-de-lis pattern using a modified tumescent technique of local infiltration allowing rapid elevation of flaps and including large amounts of subcutaneous fat. This modification has enabled us, through the distribution of greater amounts of tissue to the inferior pole of the breast, to optimize

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FIG. 1. Fifteen-year postoperative view of right latissimus dorsi flap speaks to the durability of the flap. (*Above*) Anterolateral view of right latissimus flap demonstrates the preserved volume of the breast. (*Below*) Anterior view demonstrates failure of the old method to completely cover the implant resulting in dimpling of the surface of the breast.

breast contour and ptosis and minimize implant size. The flap design evolved from an oblique positioned elliptical flap into a modification of the fleur-de-lis pattern borrowed from McCraw and Papp, to optimize not only breast contour but also the donor-site scar (Fig. 2). Careful closure of this T-shaped donor site eliminates excess tissue often found laterally, and the scar is easily hidden in the bra line. Despite the addition of the tumescent solution, the seroma rate is minimal, with a complete absence of donor-site wound or serious flap complications. In either immediate or delayed reconstructions, our method has converted a technically challenging breast reconstruction to a type of breast augmentation procedure, with results equally as impressive as our TRAM results (Fig. 3). The purpose of this study was to present and evaluate retrospectively the results of 53 modified myocutaneous latissimus

dorsi breast reconstructions (25 using the fleur-de-lis pattern), operated on by the senior author (M.E.A.), and to draw conclusions on the basis of this experience about the usefulness of this procedure.

PATIENTS AND METHODS

The office records of patients with the preoperative diagnosis of absence of breast, undergoing either immediate or delayed latissimus dorsi flap reconstruction, with or without implants, were reviewed. There were 53 consecutive reconstructions performed on 48 patients between April of 1995 and December of 1998. Only the last 25 cases utilized the fleur-de-lis pattern of flap. The follow-up period ranged from 2.5 to 44 months. Results were defined by evaluations of each patient's condition by the operating surgeon at every office visit as recorded in the chart.

Patient Selection

The patients ranged in age from 30 to 67 years (mean, 47.0 years). The majority of the

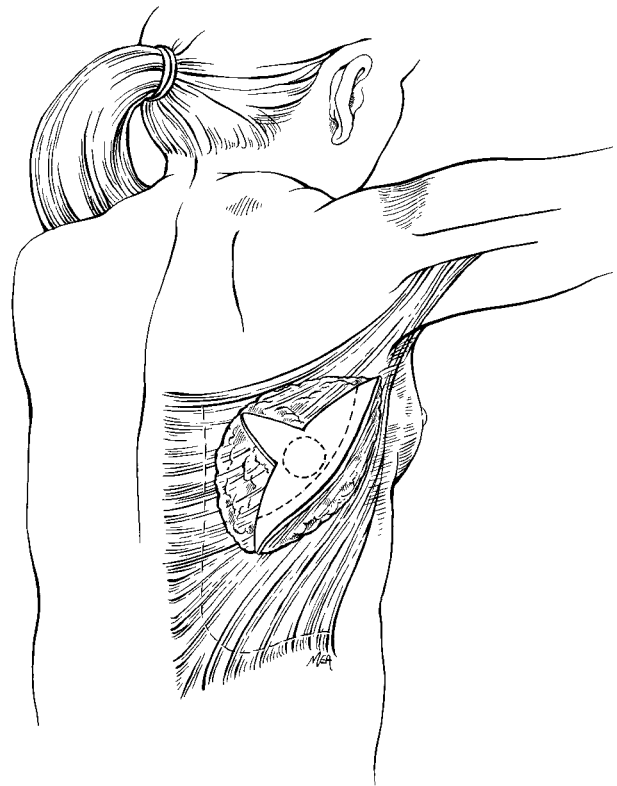


FIG. 2. Donor site of latissimus dorsi flap with the fleur-de-lis pattern, extensive subcutaneous tissue to be included in the harvest, and alternative skin paddles to be individualized to each patient. (Original illustration by Marguerite E. Aitken, M.D.)

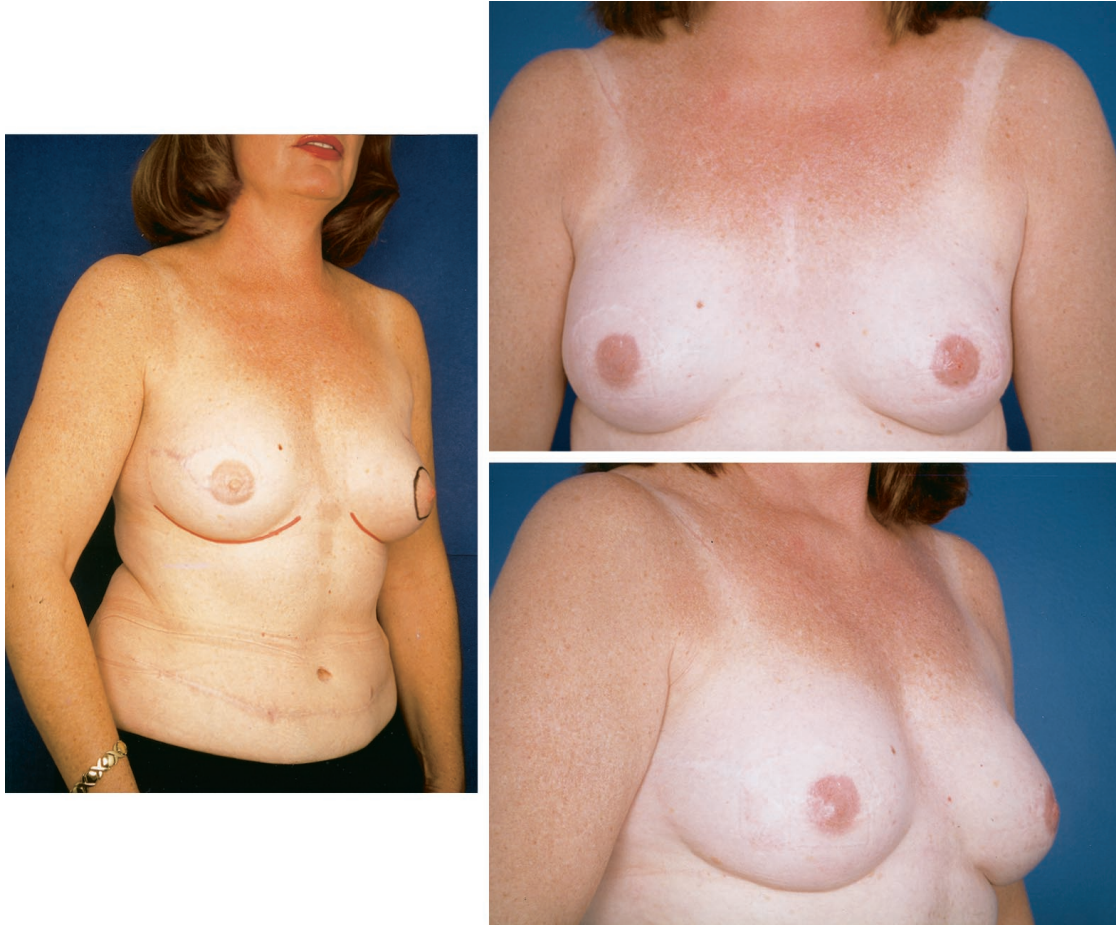


FIG. 3. (Left) Preoperative view of patient for left mastectomy and modified latissimus dorsi reconstruction, after right TRAM reconstruction. (Above, right) Anterolateral view at 12 months postoperatively from latissimus reconstruction illustrates preserved breast contour and ptosis. (Below, right) Oblique view compares right TRAM with left latissimus dorsi flaps, suggesting either method can be successful in the preservation of normal breast contour and ptosis.

patients had modified radical mastectomies, whereas the causes of their deformities varied: breast carcinoma, severe breast irregularities resulting from prior silicone injections, prior leaking of silicone from silicone gel implants, and prior lost TRAM flap.

Operative Technique

The patient is initially prepared in the lateral position on a bean bag. After the back is draped out, the patient is placed supine and the chest draped for the mastectomy. No further draping is needed during the procedure. At the completion of the modified radical mastectomy, the patient is placed in the lateral position with inflation of the bean bag, having been previously prepared sterile. Between 300 and 1000 cc of a 1:1,000,000 solution of epinephrine is injected into the subcutaneous plane. A knife dissection is carried out just

above Scarpa's fascia, leaving native flaps approximately 1 cm in thickness (Fig. 3). The region that will form the inferior tendinous insertion of the muscle is totally divided, but the muscle is left innervated to maximize bulk. A modified fleur-de-lis pattern is used regardless of whether the planned reconstruction is delayed or immediate.

Closure of the T-shaped donor site in two axes pulls excess tissues from the lateral chest wall, minimizing bulk and eliminating dog ears. A monofilament subcutaneous pullout suture is left in place for 2 months or longer to prevent scar widening. After the back closure is completed and the patient turned, the pectoralis muscle is elevated, allowing the latissimus muscle to form the lateral portion of the implant pocket. Even in a thin patient, 150 to 200 cc of volume from the latissimus muscle can be achieved. In a larger patient, two to three times

that volume is obtained, allowing for a very modest sized implant (< 300 cc in all but the largest of breasts). The inset is performed as shown in Figure 4. In the case of delayed reconstruction, the wound contraction that is part of the natural healing process leaves a deficiency in the transverse and the vertical axes, centered around the location of the original nipple-areola complex. As the fleur-de-lis flap is inset, the skin volume is expanded in two directions, optimizing contour and symmetry. In the immediate reconstruction, using a skin-sparing mastectomy,¹³⁻¹⁵ the vertical limb is deepithelialized which, particularly in the thin patient, allows more volume to be placed at the inferior pole, particularly emphasizing the ptotic shape of the breast (Fig. 5).

All saline implants were anterior valve, textured, and round, as contoured implants tend to overproject. The textured surface aids in preventing implant displacement postoperatively, which has not been a problem in this series.

RESULTS

In this study, 48 patients underwent 53 latissimus dorsi myocutaneous reconstructions, 34 immediate and 17 delayed, 28 conventional and 25 modified, as described above, using the fleur-de-lis pattern. One patient with bilateral

reconstruction received silicone implants and one latissimus flap was placed beneath a previous TRAM flap and therefore no implant was used. Of the remaining reconstructions, one patient did not opt for implants and the rest utilized either saline-filled textured implants or expanders (Table I).

Skin Necrosis

A recent European study of 111 patients undergoing latissimus dorsi reconstructions found a 6 percent rate of necrosis of one-tenth of the total latissimus flap area,¹⁶ whereas other studies cite a range of 4 to 7 percent.¹⁶⁻¹⁸ One large study quoted complete loss of the latissimus flap in 1 of 125 patients.⁹ Our threshold for placing a split-thickness skin graft was reasonable at 3 cm in diameter, constituting a major component of the flap. Whereas three patients (6 percent) had native mastectomy flaps that required grafting, only one latissimus flap showed signs of distal tip necrosis and did not warrant a split-thickness skin graft (Table II). No patient experienced complete latissimus flap loss or loss of the implant after necrosis of the native mastectomy skin flaps (Figs. 6 and 7).

As more women are diagnosed early with breast cancer and opt for breast conservation therapy with adjuvant radiation, more partial

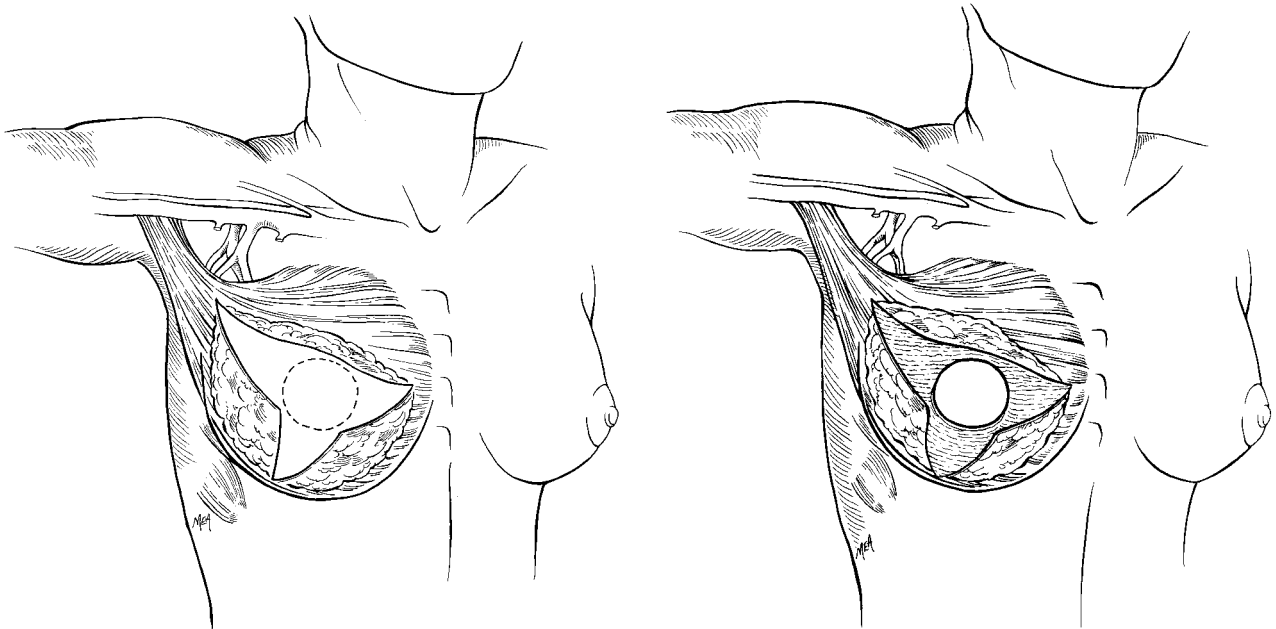


FIG. 4. Inset of latissimus flap to mastectomy defect with excess subcutaneous tissue. (Left) Repair of the conventional defect (delayed mastectomy) with fleur-de-lis skin paddle replacing the lost tissue in both the transverse and vertical axes. (Right) Repair of the skin-sparing mastectomy defect allows the vertical limb in particular to be deepithelialized for greater volume in the inferior pole. (Original illustrations by Marguerite E. Aitken, M.D.)



FIG. 5. Two-month postoperative photograph after left skin-sparing mastectomy and reconstruction with the modified fleur-de-lis reconstruction. (Above) Anterior view of key-hole-type skin-sparing mastectomy incision. (Below) Donor site with obliquely positioned T-scar.

and complete breast reconstructions on irradiated tissue will occur. Despite reports of postirradiation fibrosis, soft-tissue necrosis, edema, and contractures, studies show that the risk of

flap loss is not increased in patients undergoing perioperative adjuvant irradiation.¹⁹⁻²¹ Of the 53 reconstructions performed, 11 experienced either preoperative or postoperative irradiation therapy (21 percent). Of these, none required a split-thickness skin graft to either the latissimus flap or the native mastectomy flaps (Table II).

Seroma Rate

Seroma is understood to be caused by the shearing force of the moving scapular girdle through the latissimus donor site and the failure of the overlying skin to adhere to the musculature below.^{10,11} The literature reports a wide variation in rate of seroma, ranging between 9 and 19 percent²²⁻²⁴ and, in some studies using extended harvests, as high as 79 percent.²⁵ Slavin has reported seroma formation is not improved by the use of prophylactic large suction drains,²⁶ whereas others have attempted alternative techniques such as quilting stitches.^{27,28} One recent study reports a significant decrease in seroma rate with the use of knife dissection versus electrocautery dissection.²⁹ In our study, the most common complication was a minor seroma, defined by aspiration one to two times from a nonpainful swollen fluid collection or any aspiration of a fluid swelling severe enough to cause the patient concern. We found, using the tumescent technique and knife dissection, four patients to have developed a minor seroma (8 percent), some observed to be associated with early exercise.³⁰ A minor seroma responded to one to two aspirations of less than 75 ml of total fluid. A major seroma was one requiring more than

TABLE I
Patient Profile and Complications

	Age Groups				Total (%)
	30-39	40-49	50-59	60-67	
Number of patients	10	22	16	5	53
Reconstructive timing					
Immediate	5	12	11	5	33
Delayed	5	10	5	0	20
Irradiation					
Preoperative	2	5	1	0	8 (15)
Postoperative	0	2	1	0	3 (6)
Complications					
Wound coverage with split-thickness skin graft					
Native mastectomy flap	0	1	2	0	3
Latissimus flap	0	0	0	0	0
Seroma					
Major	1	2	1	0	4 (8)
Minor	0	2	1	1	4 (8)
Deflation	1	1	1	0	3 (6)

TABLE II
Breakdown of Patients According to
Perioperative Irradiation

Complication	Preoperative Irradiation (n = 8)	Postoperative Irradiation (n = 3)	No Perioperative Irradiation (n = 42)
Flap necrosis			
Mastectomy flap (%)	0	0	3 (6)
Latissimus flap (%)	0	0	1 (2)
Infection	0	0	0

two aspirations or surgical intervention. Four patients experienced a major seroma complication (8 percent), none of which caused implant extrusion or required surgical correction or any other measures such as sclerosing agents. No evidence of infection was found secondary to a seroma.

Implant Deflation

A recently published study of 171 implant patients reports a 4 percent rate of expander

deflation over a 7-year period, with a breast irradiation rate of only 13 percent,³¹ and another large study (450 patients) reports a rupture rate of 3.5 percent.¹⁹ Our study found deflation rates of expanders to be 6 percent, with a rate of chest wall irradiation of 21 percent and evidence of at least one faulty valve in the expander (Fig. 8).

DISCUSSION

The latissimus flap was the predominant method of breast reconstruction in the 1970s because of its reliability and relative simplicity. With the advent of tissue expansion and the TRAM flap, the latissimus flap lost favor because of the perception that it combines disadvantages of both alternatives (i.e., donor-site scars with their attendant morbidity and the need for an implant). However, there are many limitations of tissue expansion: difficulties in achieving and maintaining a natural teardrop shape over time, the rippling and distortion seen with capsular contracture, and the increasing evidence of poor outcomes in the face of irradiated tissues. It has been suggested that flaps do not offer a protective role against irradiation³²; however, our absence of complications suggests either the ratio of flap to implant volume was beneficial or the incidence too low and therefore study size too small to show a difference. Some patients, particularly in older age groups, do not want to endure the postoperative recovery and potential morbidity of a TRAM flap, and others have risk factors that make them suboptimal candidates for a TRAM flap.

In recent years, other authors have discussed methods to optimize the latissimus flap. Slavin et al. describe utilizing the latissimus for reconstruction of difficult partial defect contour abnormalities to produce excellent aesthetic results closely mimicking the opposite breast's teardrop shape.^{14,15,20} We have used a tumescent infiltration, extended the amount of subcutaneous tissue harvested, and routinely used the modified fleur-de-lis pattern with a small implant. This combination has produced outstanding contour with increased volume and fullness in the inferior pole of even the very thin patient. This is particularly evident in the delayed reconstruction, where natural wound contraction often leaves a significant skin deficiency in both the transverse and vertical axes, addressed by the flexibility of the fleur-de-lis shape in a one-stage procedure.

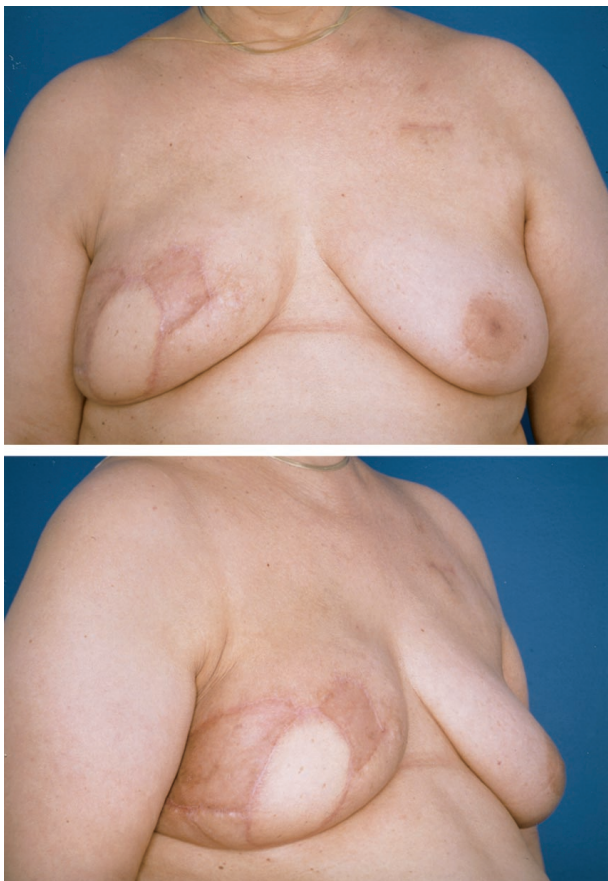


FIG. 6. (Left) Anterior and (right) anterolateral views of partial loss of native mastectomy flaps after right mastectomy and immediate modified reconstruction, resulting in a split-thickness skin graft, in a 64-year-old patient.

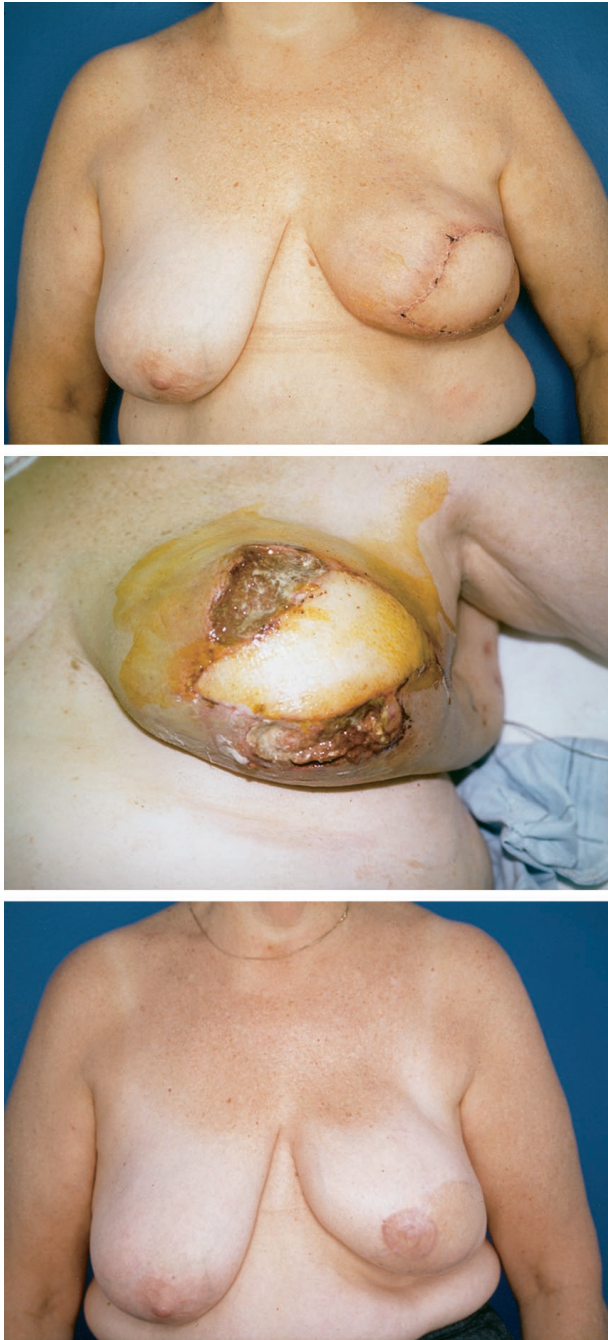


FIG. 7. Postoperative views after left mastectomy and immediate reconstruction with the modified latissimus dorsi myocutaneous flap. (*Above*) View at 2 weeks postoperatively. (*Center*) Necrosis of native mastectomy flaps with no involvement of the adjacent latissimus flap. (*Below*) One year later, after approximation of native skin to repair defect of lost tissue and after nipple reconstruction and tattooing.

While improving the final shape of the inset, the flap donor site is also optimized. Although the T-scar might seem a disadvantage on the back, we have had no donor-site breakdown and have minimized the tendency for dog-ears

through closure of the wound in the two axes, eliminating tension on the wound and again reducing the need for further surgical procedures. In addition, infiltrating with a modified superwet technique, dissection can be performed rapidly with a scalpel, avoiding the use of electrocautery, except for control of perforators, subsequently minimizing the zone of necrosis produced by surgical dissection. Despite this extensive dissection, there is no increase in seroma rate with this technique.

CONCLUSIONS

The latissimus dorsi myocutaneous flap remains a simple, reliable reconstructive option for patients seeking optimal results with minimal recovery time. For most patients, the modified fleur-de-lis pattern provides a symmetric, more natural appearing reconstruction with easily hidden scars and fewer subsequent operative procedures. This modified flap is no longer limited to



FIG. 8. (*Above*) Two weeks after right mastectomy and immediate latissimus dorsi myocutaneous reconstruction. (*Below*) Three weeks postoperatively, implant deflation is noted by the loss of volume in the upper outer quadrant and the maintained fullness in the lower pole of the breast.

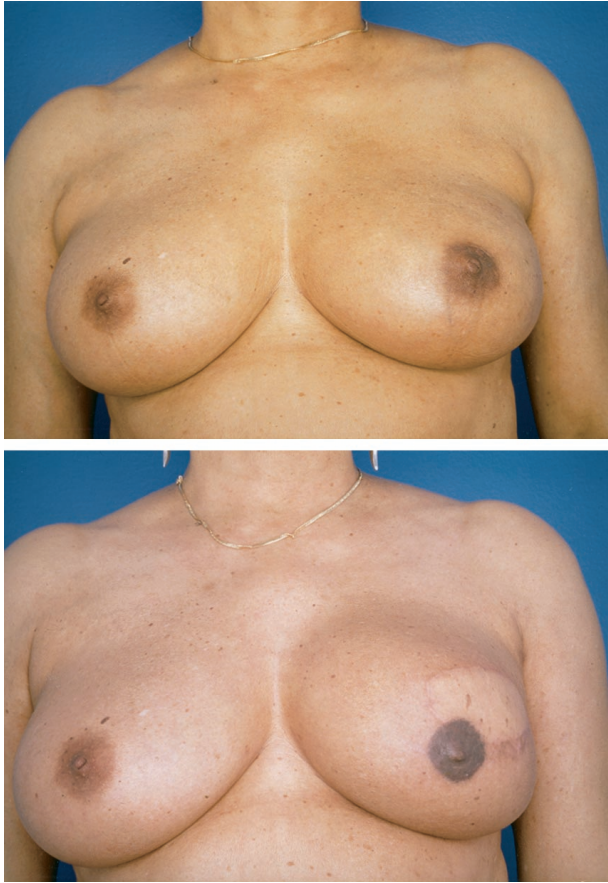


FIG. 9. (Above) Preoperative and (below) postoperative views after left mastectomy and immediate modified myocutaneous latissimus dorsi reconstruction.

a population of women with small to moderately sized breasts. For either immediate or delayed reconstruction, the transfer of greater amounts of subcutaneous tissues from the back and the use of a small implant improves the ease with which the appropriate shape can be achieved (Figs. 9 and 10). These modifications also demonstrate the utility of the latissimus flap and its ability to virtually eliminate implant exposure, even in the instance of significant mastectomy skin flap necrosis or in the face of irradiated tissues.

Few surgeons would utilize only one option from their armamentarium for breast reconstruction. This reproducible technique has been shown to have the same or fewer complications than the standard latissimus flap, specifically regarding the minimal seroma rate and the complete absence of donor-site wound or serious flap complications. We conclude that the latissimus with the fleur-de-lis modification should be considered a first-line option for all women considering breast reconstruction, regardless of their



FIG. 10. Postoperative views after right mastopexy and left mastectomy with the delayed modified myocutaneous fleur-de-lis latissimus dorsi reconstruction. (Above) Ten days postoperatively. (Below) Six months after nipple reconstruction with tattooing.

bra size, especially those reluctant to undergo a TRAM flap reconstruction. In our experience, the aesthetic results were far superior to our results with tissue expansion, and in most cases approached the results achieved with the TRAM flap. We now use this latissimus in about 75 percent of those patients undergoing implant reconstruction and, if anything, our enthusiasm for the flap is increasing.

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