Anterolateral Thigh Flap for Postmastectomy Breast Reconstruction

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Most postmastectomy defects are reconstructed by use of lower abdominal-wall tissue either as a pedicled or free flap. However, there are some contraindications for using lower abdominal flaps in breast reconstruction, such as inadequate soft-tissue volume, previous abdominoplasty, lower paramedian or multiple abdominal scars, and plans for future pregnancy. In such situations, a gluteal flap has often been the second choice. However, the quality of the adipose tissue of gluteal flaps is inferior to that of lower abdominal flaps, the pedicle is short, and a two-team approach is not possible because creation of the gluteal flap requires that the patient's position be changed during the operation.

In 2000, five cases of breast reconstructions were performed with anterolateral thigh flaps in the authors' institution. Two of them were secondary and three were immediate unilateral breast reconstructions. The mean weight of the specimen removed was 350 g in the three patients who underwent immediate reconstruction, and the mean weight of the entire anterolateral thigh flap was 410 g. Skin islands ranged in size from 4 × 8 cm to 7 × 22 cm, with the underlying fat pad ranging in size from 10 × 12 cm to 14 × 22 cm. The mean pedicle length was 11 cm (range, 7 to 15 cm). All flaps were completely successful, except for one that involved some fat necrosis.

The quality of the skin and underlying fat and the pliability of the anterolateral thigh flap are much superior to those of gluteal flaps and are similar to those of lower abdominal flaps. In thin patients, more subcutaneous fat can be harvested by extending the flap under the skin. Use of a thigh flap allows a two-team approach with the patient in a supine position, and no change of patient position is required during the operation. However, the position of the scar may not be acceptable to some patients.

Therefore, when an abdominal flap is unavailable or contraindicated, the creation of an anterolateral thigh flap for primary and secondary breast reconstruction is an alternative to the use of lower abdominal and gluteal tissues. (*Plast. Reconstr. Surg.* 110: 82, 2002.)

Advances in reconstructive microsurgery began with its earliest applications for traumatic replantation and lower-extremity reconstruction.[1–5] In the 1980s significant developments continued in all areas of reconstruction, leading to great improvements for lower extremity, head and neck defect, and breast reconstruction.[6–11]

The first free-flap reconstruction of the breast was reported by Holmstrom[12]; however, Grotting et al.[13] made it popular in 1989 with the use of the free transverse rectus abdominis musculocutaneous (TRAM) flap. After that, free autogenous tissue transfer became the primary method of breast-mound reconstruction in many centers. Free-tissue transfers surpassed pedicled reconstruction because of the improved blood supply, easier inset, and high free-flap success rates they offer.[14–17]

The TRAM flap is the most common technique for autogenous breast reconstruction.[18–23] Its adipose tissue and skin quality closely mimic breast skin and fat, making it superior to other choices. The skin island is within the area typically excised in abdominoplasty. The blood supply comes from the perforating vessels of the rectus abdominis muscle, which has a dual blood supply. The pedicled flap receives its blood supply from the minor superior epigastric vasculature; however, the free TRAM flap is nourished by the major inferior epigastric system, which provides better blood supply to the skin island. The free TRAM flap is also preferred over the pedicled flap because of its easier insertion and more natural contour.[16] Criticism of this flap has primarily centered on its donor-site morbidity. Recent studies of the perforator flap have led to the development of the deep inferior epigastric

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artery perforator flap[24–28], which uses the same skin island as the TRAM flap but preserves the rectus abdominis muscle and anterior rectus fascia, for less donor-site morbidity.[29,30] Other flaps from the same lower abdominal area, but based on the superficial inferior epigastric artery (superficial inferior epigastric artery flap)[27,31] or skin vessels above the abdominal fascia (paraumbilical perforator flap),[32] have also been developed but have not gained popularity because of the anatomical variations and supramicrosurgery technique involved, respectively. Major contraindications of these lower abdominal flaps include inadequate soft-tissue volume (especially in Asian women), previous abdominoplasty, lower paramedian scars, or multiple abdominal scars.[18,33] Many reconstructive surgeons also consider the TRAM flap to be contraindicated for patients planning for future pregnancy,[34] although Chen et al.[34] and Grotting et al.[13] have reported successful normal pregnancies and delivery after TRAM flap surgery.

The free superior gluteal myocutaneous flap is based on the gluteus maximus muscle, and blood to the flap is supplied by the superior gluteal vasculature. The major disadvantage of the superior gluteal myocutaneous flap is its short pedicle (3 to 5 cm), which often leads to the use of vein grafts.[35,36] Its perforator counterpart, the superior gluteal perforator flap, can provide a longer pedicle of 6 cm or more and has become the second choice of breast reconstruction in selected patients who have contraindications for lower abdominal flaps, described above.[18,37–41] A significant disadvantage of the gluteal flaps is the quality of the their adipose tissue, which is more septated and less pliable than that of the TRAM or deep inferior epigastric perforator flaps, making the insertion of the gluteal flaps challenging and providing a less optimal result.[18] Yet another disadvantage of the gluteal flaps is the need to change the patient's position during such flap operations.

Recently, the anterolateral thigh flap has become the standard flap for soft-tissue reconstruction in head and neck reconstruction and reconstruction of the upper and lower extremities. It has many advantages in free-flap surgery, including a long pedicle with a suitable vessel diameter, the availability of different tissues with a large amount of skin, and its applicability as a sensate or a flow-through flap if needed.[42–51] In this article, we present the application of the anterolateral thigh flap for postmastectomy-defect reconstruction.

Materials and Methods

In 2000, five cases of breast reconstruction were performed with anterolateral thigh flaps at our institution. Two were performed as secondary reconstructions and three as immediate unilateral breast reconstructions. One patient received a deep inferior epigastric perforator flap for secondary breast reconstruction but developed partial necrosis, necessitating another reconstructive operation with an anterolateral thigh flap 1 month later. Indications for the anterolateral thigh flap in the other four patients were thin lower abdomens and plans for future pregnancy (Table I).

The mean weight of the specimen removed was 350 g in the three patients who underwent immediate reconstruction, and the mean weight of the entire anterolateral thigh flap was 410 g. Skin islands ranged in size from 4 × 8 cm to 7 × 22 cm, with the underlying fat pad ranging in size from 10 × 12 cm to 14 × 22 cm. The mean pedicle length was 11 cm (range, 7 to 15 cm). The thoracodorsal system was chosen for provision of recipient vessels in all patients. All donor areas were closed primarily (Table I).

Operative Technique

The dissection of the anterolateral thigh flap has been previously described in detail.[49–51] The cutaneous vessels are mapped by a portable handheld pencil Doppler probe centered over the midpoint between the anterior superior iliac spine and superolateral corner of the patella. The majority of skin vessels are located in the inferolateral quadrant of a circle, 3 cm in radius, drawn centered at this midpoint. The flap is centered over the location of these vessels, with the long axis of the flap parallel to that of the thigh. The operation is carried out by two teams, with the patient in the supine position. The maximum width of the flap is planned to be 8 cm to ensure the primary closure of the donor area; however, the length can be more liberal.

The flap is incised at the medial site, and a large area in the subdermal level is undermined to obtain a large fat pad under the skin. The deep fascia of the thigh is then incised at the medial site, and fascia fat extension and skin is gently dissected off the rectus femoris and vastus lateralis muscles until the vessels to

TABLE I
Patient Data

Age (years)	Timing of Reconstruction	Indication for Anterolateral Thigh Flap	Specimen Weight (g)	Flap Weight (g)	Flap Skin-Paddle Size (cm)	Flap Fat-Pad Size (cm)	Pedicle Length (cm)	Complications and Management	Outcome
51	Secondary	Failure of deep inferior epigastric perforator flap	—	585	9 × 16	14 × 16	15	None	Good
31	Secondary	Inadequate abdominal soft tissue	—	300	5 × 12	10 × 13	7	Venous occlusion; redid venous anastomosis	Some fat necrosis
27	Primary	Future plans for pregnancy; inadequate abdominal soft tissue	280	300	4 × 8	10 × 12	10	None	Good
37	Primary	Inadequate abdominal soft tissue	225	275	6 × 13	13 × 15	12	None	Good
32	Primary	Future plans for pregnancy; inadequate abdominal soft tissue	545	590	7 × 22	14 × 22	11	None	Good

the skin can be seen. Once the skin vessel is seen, whether it is a musculocutaneous perforator or a septocutaneous vessel,[48] it is dissected to the main pedicle. After the main pedicle is divided, the donor area is primarily closed.

Results

There were no complications with four of the flaps. We explored one flap that showed evidence of venous insufficiency and redid the anastomosis with a vein graft. This flap developed wound dehiscence and partial fat necrosis. After débridement and several dressings, the wound healed with an acceptable scar. One patient, with the widest skin paddle and primary closure of the donor area, experienced wound dehiscence but healed by secondary intention.

Case Report

A 32-year-old woman (case 5) had infiltrating ductal carcinoma of the left breast (Fig. 1, *above, left*) and desired immediate autogenous breast reconstruction after cancer treatment. We planned a modified radical mastectomy and immediate reconstruction with an anterolateral thigh flap because she had "saddle bags" on the lateral thigh that matched the size of the opposite normal breast (Fig. 1, *above, right*). In addition, the patient had a relatively thin abdomen and concerns about a surgical procedure of the lower abdomen because she was planning to marry and become pregnant in the future. While the general surgeons performed the mastectomy and axillary node dissection, the plastic surgery team harvested an anterolateral thigh flap with a skin paddle of 7 × 22 cm and underlying fat pad of 14 × 22 cm based on a single septocutaneous vessel (Fig. 1, *center, left*). The weight of the specimen was 545 g, and the weight of the flap was 590 g. After we measured the size of the skin defect, we deepithelialized and molded the remaining part of the skin paddle. After we inserted the flap, we performed microsurgical anastomosis between the thoracodorsal system and the descending branch of the lateral circumflex femoral system. There was no intraoperative or postoperative complication. The patient received adjuvant chemotherapy. Fifteen months later, the nipple of the reconstructed breast was reconstructed (Fig. 1, *center, right,* and *below, left*). The donor-site scar of the flap was acceptable, and there was no contour deformity (Fig. 1, *below, right*).

Discussion

The most common techniques for breast reconstruction share a common donor site, the lower abdomen, and thus share the same indications and contraindications. For the lower abdomen to be used as a donor site in breast reconstruction, the patient should ideally have an abdominal fat pad large enough to be molded into a breast. Multiple abdominal scars from previous operations, especially lower paramedian scars[33] and scars from previous abdominoplasty, present a contraindication for the use of lower abdomen as a donor site. Although successful pregnancies have been reported after the harvest of pedicled and free TRAM flaps,[13,34] the possibility of abdominal-wall complications during future pregnancies still remains a concern for both the patient and the surgeon. Breast reconstruction with lower

FIG. 1. (*Above, left*) Preoperative view of the patient. A deep inferior epigastric perforator flap was not performed because of the patient's concern for future pregnancy and because of her relatively thin abdomen. (*Above, right*) Planning for the anterolateral thigh flap. (*Center, left*) Dissection of the flap. Notice the large amount of undermining performed to obtain additional fatty tissue. (*Center, right*) Anterior view 6 months after surgery. (*Below, left*) Oblique view 16 months after nipple reconstruction. (*Below, right*) The scar at the donor site.

abdominal flaps in very thin patients poses a challenge.[18] A pedicled latissimus dorsi flap augmented by a small prosthesis can be an option. However, the use of a prosthesis in postmastectomy reconstruction usually results in a poor aesthetic outcome because of capsular contracture and leakage as a result of degradation of the silicone bladder over time. Particularly for young patients who undergo implant reconstructions, one or more implant exchanges may be required over the course of a lifetime.[18] Other options include the superior gluteal artery perforator flap, Rubens flap, scapular flap, lateral thigh flap,[18] and anterolateral thigh flap. For very thin patients or for patients with contraindications for a lower ab-

dominal flap, the surgeon has to choose one of these secondary options for autogenous soft-tissue transfer, preferably one with less donor-site morbidity, enough skin and a large enough fat pad, and good quality of the skin and pad.

The anterolateral thigh flap described by Song et al.[52] subsequently achieved popularity, especially in Asian countries. The anterolateral thigh flap fulfills most of the requirements of postmastectomy breast reconstruction. The flap is usually bulky in women, which has been considered a relative disadvantage when a thin flap is needed. In a thin patient, more subcutaneous fat can be harvested by undermining the skin flap. The quality of the skin and underlying fat and the pliability of the flap are much superior to those in gluteal flaps and are similar to those in lower abdominal flaps. The thigh flap also allows a two-team approach. The patient is placed in the supine position, and no change in patient position is required during the operation. Simultaneous harvest of bilateral flaps is also possible. This is a unique feature that is only possible with the anterolateral thigh flap. Although the flap can be harvested with a greater amount of subcutaneous fat by undermining the skin flap (Fig. 2), it must be stressed that the volume of the flap would be insufficient for an adequate breast reconstruction in Western and African populations. On the other hand, its volume is not less than that of any other second-choice flap for breast reconstruction. In those situations, this flap can still be augmented with a prosthesis, although we have no such experience with such augmentation. The only disadvantage of the anterolateral thigh flap seems to be the scar and slight contour defect at the donor site (Figs. 3 and 4). However, a flap less than 9 cm in width can be closed primarily. In immediate breast reconstruction, the skin island needed is usually small, allowing placement of the scar in the upper third of the thigh, which is quite acceptable to many patients. Besides, a scar on the leg is usually more acceptable to Asian women than a scar on the back (such as the scar of the latissimus dorsi flap, which is also a good option for the reconstruction of a small breast).

In conclusion, when an abdominal flap is unavailable or contraindicated for autogenous tissue breast reconstruction, the anterolateral thigh flap is an excellent option in selected patients with small breasts.

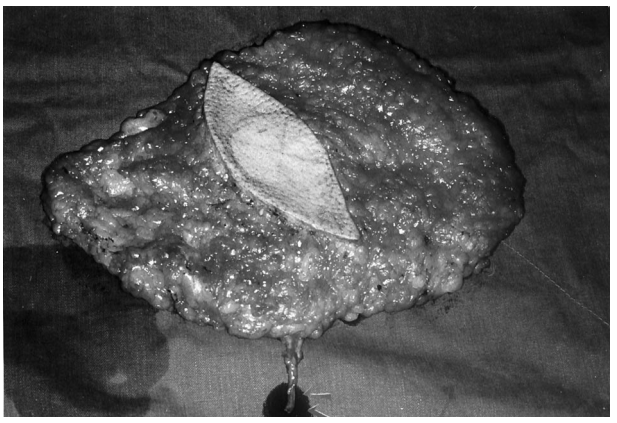

FIG. 2. The large amount of additional fat tissue obtained.

FIG. 3. (*Above*) Postoperative anterior view of case 3. (*Below*) The donor-site scar in case 3.

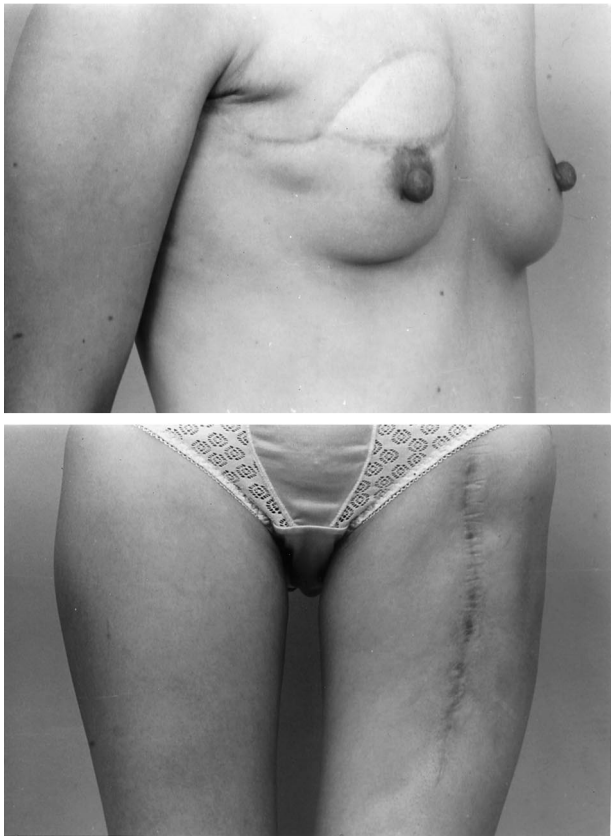

FIG. 4. (*Above*) Postoperative oblique view of case 4. (*Below*) The donor-site scar in case 4.

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