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edited by J. Peter Rubin and Alan Matarasso

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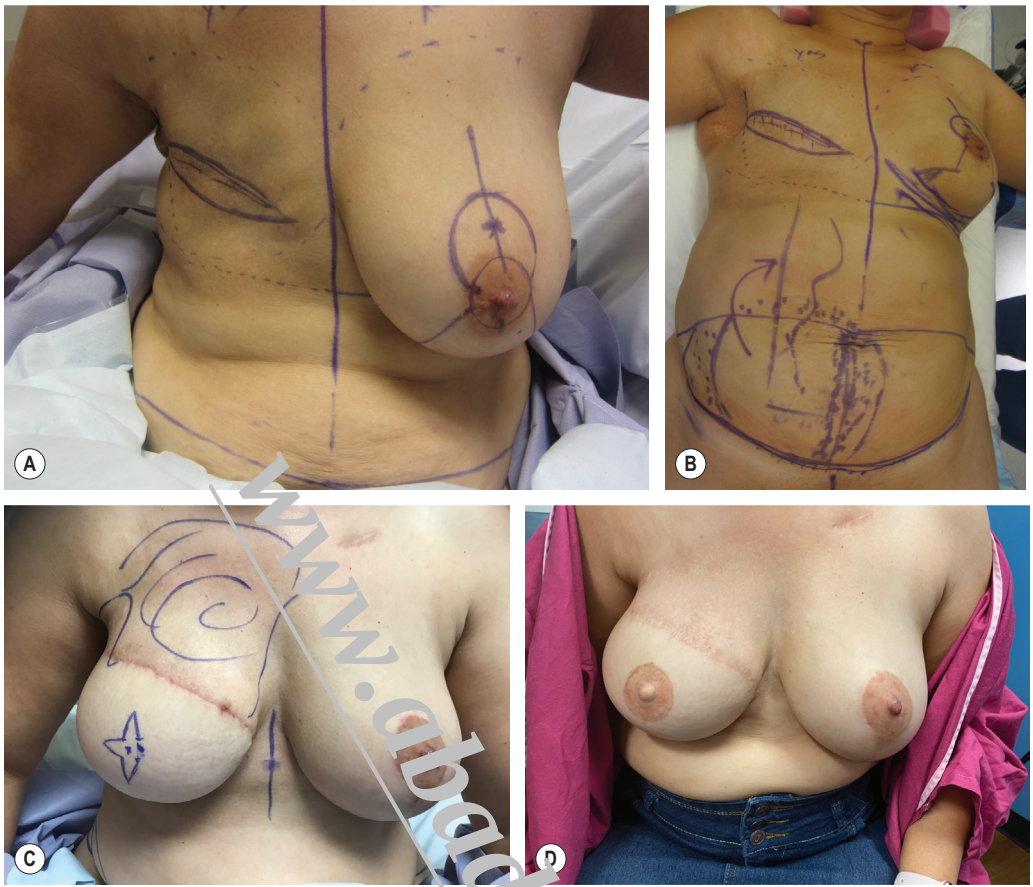

Figure 28.10 Case example of a patient who received a right TRAM flap in the setting of preoperative radiation therapy with contralateral reduction and subsequent nipple–areolar reconstruction. **(A)** Preoperative defect with planned contralateral reduction. **(B)** Intraoperative markings. **(C)** Patient at 4 months' postoperative from initial surgery showing planned nipple reconstruction and fat grafting for improved contour. **(D)** Final reconstructive outcome 11 months' postoperative.

Hints and tips

1. Preoperatively, carefully select patients who will benefit from this procedure and who understand both the benefits and risks involved.
2. As the goal is to obtain a symmetrical reconstruction, the contralateral breast must be addressed and may involve a breast reduction that can be safely done at the same time. The benefit is that less tissue is transferred with the TRAM flap, thus reducing the risks of fat necrosis. If the contralateral breast needs only a mastopexy, this is typically done secondarily.
3. Carefully assess the mastectomy site in the patients undergoing an immediate reconstruction. First, the vascularity of the mastectomy flaps is assessed, and any compromised flaps are excised and adjustments made with a larger TRAM flap skin island. Second, the mastectomy pocket generally needs to be adjusted due to wide resection at the site of the IMF and laterally.
4. In patients undergoing delayed reconstruction, the mastectomy scar is excised and the skin flaps are elevated off the pectoralis major muscle to recreate the mastectomy pocket. The skin below the mastectomy scar is usually excised down to the IMF, as it is generally too tight to accommodate the flap. Consequently, a TRAM flap with a larger skin island is required in delayed reconstruction. The "Bikini Inset" may also be considered as an option for delayed TRAM flap inset in the previously irradiated breast.
5. The pedicled TRAM flap is elevated as described above and a medial subcutaneous tunnel is made connecting the mastectomy site with the abdominal dissection, which minimally encroaches into the IMF of the side being reconstructed. Generally, the tunnel is big enough to allow a hand to traverse, and thus the pedicled flap can be introduced into the cavity with minimal trauma. For safe passage through the tunnel, the TRAM flap should be pushed rather than pulled.
6. Zone 3 of the TRAM is brought superiorly and can be affixed to the chest wall with an absorbable suture.
7. It is helpful to make the TRAM flap slightly bigger than the opposite side, to allow for muscle atrophy. If it is still too large at the time of nipple–areolar reconstruction, liposuction can be performed to obtain better symmetry.
8. A final assessment is made of the mastectomy flap vascularity, excising any tissue with questionable vascularity. The final de-epithelialization of the flap is performed and the inset completed. SPY technology (Novadaq Corp., Bonita Springs, FL), if available, may be helpful to evaluate compromised skin.

(Continued)

Hints and tips—cont'd

9. The suturing of a thicker mastectomy flap to the edge of a de-epithelialized TRAM flap may lead to an uneven repair with an overriding of the mastectomy flap and relative depression of the TRAM flap. To avoid this uneven repair, the use of a suturing technique that starts deep and takes a vertical mattress bite of the de-epithelialized side of the flap and a more superficial horizontal mattress of the surrounding mastectomy flap, results in a more even repair and better result.
10. Great care needs to be taken in repairing the abdominal wall using mesh as described above. The mesh is inlaid into the defect created by muscle harvest and attached to the conjoint tendon laterally and linea alba medially. The rectus fascia is then advanced with a running polypropylene suture, thereby covering up a significant part of the mesh and providing a strong repair and restoring the normal muscle tension of the remaining abdominal wall muscles. Even if the fascial defect can be closed primarily, mesh is still used as it provides a stronger repair, a reduced likelihood of hernia, and minimal displacement of the umbilicus. Care should be taken to ensure that the polypropylene mesh is inset with the direction of stretch in a vertical orientation and that the repair is not "too tight", as this can cause considerable discomfort postoperatively that is difficult to treat.
11. Drains are inserted at both the mastectomy site (usually one drain) and at the abdominal donor site (usually two drains – one on each lower abdomen).
12. The use of long-lasting local anesthesia agents delivered by an On-Q pump (I-Flow Corporation, Irvine, CA) can help with postoperative pain.
13. Overall satisfaction: in the authors' experience, patients undergoing pedicled TRAM flap surgery (both unilateral and bilateral) tend to relate minimal interference with daily activities and report a satisfaction score of 8.3 out of 10, with most stating that they would have the surgery again.[19,30] Others, including Moscona *et al*., report that a total of 75% of women were satisfied with the operation, 73% declared high satisfaction, and only 12% were dissatisfied with the results.[31] Also, Veiga *et al*. similarly found a generic increase in health-related quality of life after TRAM breast reconstruction.[32]

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Breast reconstruction with the latissimus dorsi flap

Dennis C. Hammond

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Introduction

Breast reconstruction has undergone a transformation over the past 40 years. Techniques in soft tissue management and improvements in tissue expander and implant design have advanced to the point where the subtle and artistic forms that define the female breast can be preserved and even improved upon after mastectomy. Central to the development of these techniques, and in particular, the management of soft tissue, has been the description and subsequent refinement of the latissimus dorsi musculocutaneous flap (LDMF). This chapter will outline the basics of latissimus dorsi flap breast reconstruction and describe in detail how the flap can be used to obtain outstanding results in both immediate and delayed breast reconstruction after mastectomy.

Operative strategy

To understand the important role the latissimus flap has played in helping define the current results and expectations associated with modern breast reconstruction, it is helpful to organize the goals inherent in achieving an aesthetic result.

- Volume – One of the most powerful visual criteria that defines breast beauty is volume. The creation of proportional and symmetric breast volume is paramount when performing breast reconstruction. Volumes that either fall short of aesthetic or conversely exceed the desired amount can adversely affect the quality of the result, particularly when any degree of asymmetry is created.
- Skin envelope – To accommodate a desired volume, it is imperative that a proportional skin envelope be either preserved or reconstructed. Failure to create a skin envelope of either adequate surface area or shape will adversely affect the final result as the volume of the reconstructed breast will fall short of ideal.
- Contour – An aesthetic breast presents smooth and even contours across the medial, superior and lateral borders that flow away from the chest wall. Any element of sudden contour change or sharp step-off appears artificial and can be a hallmark of an unsatisfactory breast reconstruction.
- NAC – The nipple–areola complex (NAC) presents as a defining element of an aesthetic breast. When absent, a breast mound can be perfectly reconstructed; however, the missing NAC is immediately noticed. The addition of a symmetrically placed NAC of the proper size and shape that preserves symmetry enhances the quality of the aesthetic result in a very significant manner.
- Symmetry – Central to any successful breast reconstruction is the creation of symmetry in every aspect of breast appearance. This includes the position of the breast footprint, volume, shape, inframammary fold location, breast base diameter, projection and position of the NAC. Each of these aesthetic elements can be properly reconstructed; however, if symmetry with the opposite breast is lacking, the quality of the result is adversely affected.

The great advantage afforded by the addition of the LDMF is that each of these elements of an aesthetic breast can be reconstructed using the skin, fat and muscle of the flap to add missing volume, replace missing skin, soften peripheral contours, create a reconstructed breast that can accommodate the addition of a significant amount of volume, and provide appropriate symmetry. Additionally, secondary to the thickness of the dermis on the back, using the skin island of the flap to reconstruct the NAC results in the most reliable and long-lasting projection of the reconstructed nipple of any technique currently described. Such results are often lacking when using traditional techniques based on thin mastectomy skin flaps. While the technical versatility of the LDMF is of great advantage, perhaps even more important is the reliability of the vascular supply to the flap. Due to the robust thoracodorsal pedicle that supplies the flap, it is very unusual to experience any degree of ischemia in either the muscle, skin or fat of the flap, even in patients with complex medical conditions such as diabetes, connective tissue disease or even in patients who smoke. The dissection of the flap is straightforward and the anatomy is constant, which facilitates easy elevation and rotation of the flap into the mastectomy defect. Taken together, all of these factors combine to make the LDMF an excellent option for patients seeking either immediate or delayed breast reconstruction.

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Anatomy

The latissimus is one of several muscles that cover the upper portion of the back[5] (Fig. 29.1). Of these muscles, it is the largest and takes origin from the medial thoracolumbar fascia, posterior iliac crest, and lateral fibers of the external oblique before inserting via a thick tendon into the intertubercular groove of the humerus. The anterior border of the muscle defines the posterior border of the axilla. The superior border of the muscle takes origin from under lower medial origin of the trapezius before coursing over the tip of the scapula. As the muscle passes into the axilla, there is a variable fusion of muscle fibers with those of the teres major that must be correctly identified and released to allow proper access to the axilla.

The dominant vascular pedicle to the LDMF is the thoracodorsal artery, which is a branch of the subscapular artery, which comes off the axillary artery[6,7] (Fig. 29.2). The thoracodorsal artery gives off an important serratus branch approximately 10 cm below the tendinous insertion of the muscle. This branch can maintain vascular viability of the flap via reversal of flow when the thoracodorsal pedicle has been previously ligated.[8] A secondary blood supply is provided by perforators off the posterior intercostal arteries laterally and the lumbar arteries medially. These perforators enter the under surface of the muscle directly from the chest wall in the mid-substance of the muscle and must be directly controlled during flap elevation. Within the substance of the muscle, the thoracodorsal artery then bifurcates into a transverse and a lateral branch that then extensively arborizes within the muscle, passing multiple perforators to the overlying skin and fat. The venous return parallels the artery as two evenly spaced comitantes before emptying into the axillary vein.

The innervation to the latissimus muscle comes from the C6 to C8 ventral nerve roots that coalesce into a well-defined thoracodorsal nerve. The nerve enters the muscle separately from the vascular pedicle and can be positively identified by pinching the substance of the nerve and observing the intense contraction that results in the muscle. Once the nerve enters the muscle, several different portions of the muscle are innervated independently, which has led some surgeons to adopt a partial muscle harvest strategy when using the LDMF and yet still leave behind functional muscle mass.[9]

Patient marking

The marking sequence in LDMF breast reconstruction is important as it identifies the specific landmarks that guide the surgical procedure (Videos 29.1 ▶ & 29.2 ▶). This marking procedure is performed preoperatively with the patient standing comfortably with the arms at the sides. Initially the midline is marked along with the palpable tip of the scapula. A line is drawn from the posterior border of the axilla curving medially across the tip of the scapula. This represents the upper border of the latissimus muscle. The estimated inferior margin of the trapezius is drawn as it covers the superomedial corner of the latissimus muscle. With the arm raised up over the head, the anterior border of the muscle is marked by identifying the edge of the muscle in the axilla and drawing this landmark inferiorly toward the iliac crest. The origin of the muscle from the thoracolumbar fascia is drawn estimating this to be 2–3 cm off the midline and this muscle origin is followed as it curves inferolaterally along the iliac crest. In this fashion, the surface area of the latissimus muscle is outlined in such a way that the skin island can now be centered