Journal of Surgical Oncology 2016;113:865–874

Autologous Flap Breast Reconstruction: Surgical Algorithm and Patient Selection

MAURICE Y. NAHABEDIAN, MD[1]* AND KETAN PATEL, MD[2]

[1]Department of Plastic Surgery, Georgetown University Hospital, Washington, District of Columbia
[2]Department of Plastic Surgery, University of Southern California, Los Angeles, California

Whole breast reconstruction using autologous tissue is the gold standard in many regions of the world. Reasons include breast replacement with native skin and fat, ability to shape and mold the tissue into a breast, no foreign materials are necessary, and it lasts forever when successful. There are now many options for autologous breast reconstruction and the decision making process regarding which flap to choose will depend on ones experience and comfort, ability to perform microvascular surgery, and the milieu in which one operates. This chapter will review many of the options for autologous breast reconstruction and provide an algorithmic approach for flap and patient selection.
J. Surg. Oncol. 2016;113:865–874. © 2016 Wiley Periodicals, Inc.

KEY WORDS: autologous; breast reconstruction; deep inferior epigastric perforator; TRAM flap; SGAP flap

INTRODUCTION

The use of autologous tissue for breast reconstruction following mastectomy is considered by many plastic surgeons to represent the gold standard. This is because autologous breast reconstruction will last forever and often improve over time. A variety of flaps from various donor sites have been described that have provided women with excellent outcomes and a high quality of life [1–14]. There are a variety of donor sites for autologous reconstruction; however, the most commonly utilized are from the abdomen and include the Transverse Rectus Abdominis Musculocutaneous (TRAM), Deep Inferior Epigastric Perforator (DIEP), and Superficial inferior epigastric artery flaps (SIEA). Other flaps include the latissimus dorsi musculocutaneous and thoracodorsal artery perforator flaps (TDAP), Inferior and Superior gluteal artery perforator flaps (IGAP, SGAP) and the Transverse Upper Gracillis (TUG), and Profunda Artery Perforator flaps (PAP).

The traditional methods of autologous breast reconstruction are the pedicled flaps that include the latissimus dorsi musculocutaneous flap and the TRAM flap [1,2]. These flaps include skin, fat, and muscle that are transferred on a vascularized pedicle. The purpose of the muscle is that of a conduit for the artery and vein to provide the blood supply to the adipocutaneous portion of the flap and to compliment flap volume. With the evolution of free tissue transfer, flaps could be designed from remote areas to the breast and be tailored to match volume requirements. The ability to successfully perform microvascular surgery opened the door to the era of perforator flaps that preserve the donor site musculature and minimize donor site morbidity.

This manuscript will review the current options and concepts associated with breast reconstruction using autologous tissue. The review will include focus on the pedicle as well as the free tissue transfer methods. Emphasis will focus on patient selection, flap selection, and tips and traps related to operative techniques.

Patient Selection

As ones surgical experience increases, it becomes well appreciated that proper patient selection and successful surgical outcomes are intimately related [15–17]. Although many women interested in breast reconstruction following mastectomy may be candidates for autologous reconstruction, not all may be. Candidacy may be precluded for reasons such as medical co-morbidities, extremes of body habitus, prior operative procedures at the donor site, or a desire for a quick and simple procedure.

When evaluating women for autologous breast reconstruction, several factors should be considered that are related to specific characteristics of the patient and breast. These include breast volume and contour, body habitus, donor site considerations, medical co-morbidities, tumor characteristics, patient preference, and the potential for adjuvant therapies. The abdomen has been the donor site of choice for most women and remains the most commonly preferred. Prerequisite physical findings for using the abdomen is that the patient have a sufficient quantity of fat in order to create a desired breast and that there be no scars in the critical areas about the perforators and the source vessels [18]. Although a woman may be slender with a paucity of fat, she may still be a candidate for autologous reconstruction if the breast volume requirements are low. In women who are overweight or obese, a flap can still be performed; however, the flap should be tailored to sustain its perfusion requirement and to minimize the incidence of localized fat necrosis as well as partial flap necrosis. Prior operations at a particular donor site may preclude the use of that flap because of the risk of damage to the angiosomes, perforators, or source vessels.

Patients should also be evaluated for co-morbidities prior to proceeding with autologous reconstruction. These operations can be several hours in length and patients must be physically able to tolerate the length of the operation and the recovery period following these procedure. Specific co-morbidities or factors that may preclude immediate autologous

*Correspondence to: Maurice Nahabedian, MD, Department of Plastic Surgery, Georgetown University Hospital, 3800 Reservoir Rd NW, Washington, DC 20007. Fax: +1-202-444-7180.
E-mail: drnahabedian@aol.com

Received 7 February 2016; Accepted 9 February 2016

DOI 10.1002/jso.24208

Published online 26 February 2016 in Wiley Online Library (wileyonlinelibrary.com).

reconstruction include active tobacco use, poorly controlled diabetes mellitus, morbid obesity, cardiac disease, and hypercoaguable states [19–22]. Patients are advised to stop using tobacco products for 4 weeks prior to surgery and for 2 weeks postoperatively. Diabetic patients should maintain strict glucose control and maintain a hemoglobin A1c level less than 7 to avoid problems with healing. Hypercoaguable states should be recognized preoperatively to avoid thrombotic events that can result in microvascular failures. Morbidly obese patients are advised to lose weight to minimize the incidence of adverse events. Performing breast reconstruction in obese patients is not a contra-indication; however, patients must be aware that the complication such as delayed healing, infection, and flap failure may be slightly increased.

The topic of complications is discussed and reviewed with all women. Common complications to all flaps include total flap failure, partial flap failure, and fat necrosis [23–28]. Total flap failure rates are generally less than 2%. Fat necrosis may occur in 0–10% of cases. The incidence of infection and hematoma are generally low and range from 0% to 3%. Other morbidities are more specific to the donor site. Abdominal flaps may be prone to weakness depending on the degree of muscle trauma or sacrifice. A bulge or hernia can also occur and ranges from 0% to 10%. Latissimus dorsi flaps are prone to seroma formation that occurs in 5–25% of patients. Gluteal flaps may be prone to seroma formation, contour irregularities, and pain. Thigh based flaps may be complicated by complex scars or lymphedema.

FLAP SELECTION

Flap selection is ultimately based on the volume requirements of the new breast and donor site availability. The abdomen is the most commonly used donor site with its many varieties that include the pedicle TRAM, free TRAM, DIEP, and the SIEA flap. When the abdomen is not suitable the secondary donor sites are typically considered that include the posterior thorax, gluteal, and thigh regions. The various flaps will be reviewed.

Abdominal Flaps

Inherent to the understanding of abdominal flaps is an appreciation to the amount of muscle that is elevated with the flap. Flap classification is based on the amount of rectus abdominis preserved on the abdominal wall (Table I) [27]. The rectus abdominis muscle can be separated into three longitudinal segments: medial, lateral, and central. The MS-0 (Muscle Sparing-none) includes the full width of the muscle (Fig. 1); MS-1 includes preservation of the medial or lateral segment of the muscle (Fig. 2); MS-2 includes the medial and lateral segment of the muscle (Fig. 3); and the MS-3 included preservation of all three segments (Fig. 4). The MS-0 flap results in a total loss of muscle continuity and completely disrupts muscle function.

TRAM Flap

The pedicle TRAM flap remains a commonly performed operation and can be performed unilaterally or bilaterally in both the immediate and delayed settings [1]. Of the four abdominal flaps, the pedicle TRAM is the only flap that does not require microvascular techniques. In general, the pedicle TRAM is performed in patients with mild to moderate lipodystrophy of the abdominal wall; although it can be considered in obese patients. In women with a body mass index greater than 30 or in women with a history of tobacco use, a surgical delay procedure is sometimes considered to optimize flap perfusion and minimize the incidence of fat necrosis, partial flap loss, and delayed healing.

The anatomy of the pedicle TRAM differs when compared to the other abdominal flaps. The primary vascularity is derived from the superior epigastric artery and vein. The primary purpose of the rectus abdominis muscle is that of a carrier for these vessels. It is not a significant source of breast volume except in women who are thin with small volume requirements. The degree of rectus abdominis muscle sacrifice is variable but requires the full length and a variable width. Many surgeons use the entire (MS-0) width because of its simplicity (Fig. 1). When muscle sparing is performed, the lateral (MS-1, Fig. 2) and sometimes lateral and medial (MS-2) segments of the rectus

TABLE I. The Muscle Sparing Classification for TRAM and DIEP Flaps

Muscle sparing technique	Definition (rectus abdominis)
MS-0	Full width, partial length
MS-1	Preservation of lateral segment
MS-2	Preservation of lateral and medial segment
MS-3 (DIEP)	Preservation of entire muscle

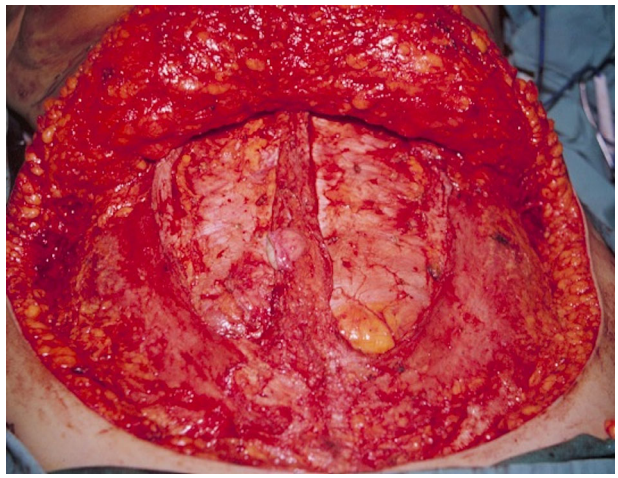

Fig. 1. The abdominal donor site following a MS-0 pedicle TRAM is illustrated.

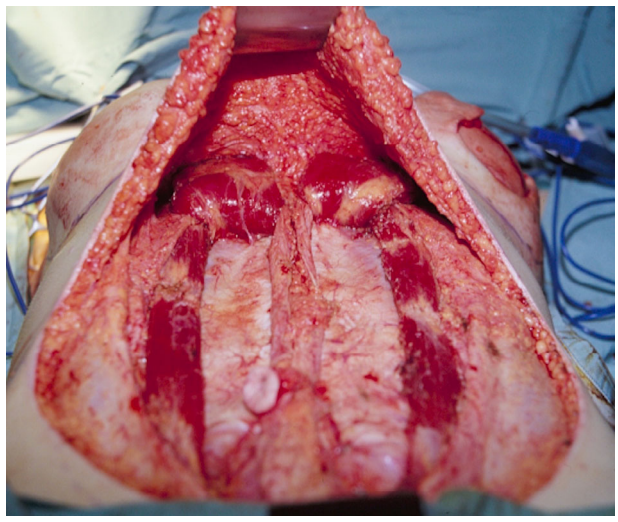

Fig. 2. The abdominal donor site following a MS-1 pedicle TRAM is illustrated.

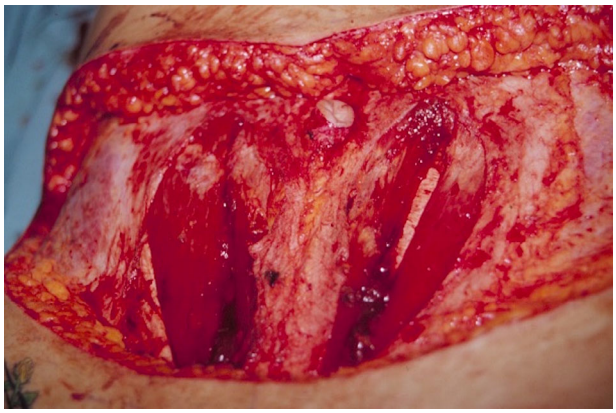

Fig. 3. The abdominal donor site following a MS-2 free TRAM is illustrated.

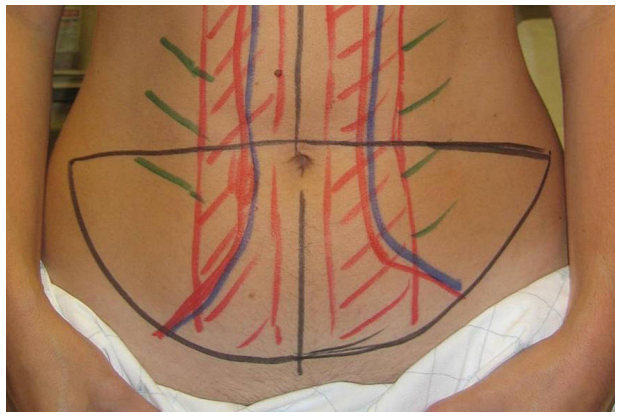

Fig. 5. The typical abdominal marking for the TRAM and DIEP flap is illustrated.

abdominis and its laterally based innervation is preserved. The advantages of the pedicle TRAM are that it is technically easier to perform, it can be performed without an assistant, and it does not require the use of an operating microscope or high power loupes. The operation typically requires 2–4 hr to complete and includes flap elevation, insetting, and closure. Disadvantages of the pedicle TRAM are several fold and related to perfusion capacity because the superior epigastric artery and vein are usually less robust the the inferior epigastric artery and vein, abdominal weakness due to greater muscle sacrifice and contour abnormalities due to loss of musculofacial support.

The unilateral reconstruction is usually performed with the ipsilateral or contralateral TRAM flap whereas the bilateral reconstruction is usually performed with ipsilateral flaps. Preoperative markings include the anterior superior iliac spine bilaterally followed by the flap outline (Fig. 5). Doppler ultrasound can be used to identify the location of the perforators. The thoracoepigastric tunnel is created between the abdomen and the mastectomy. Harvesting of the pedicle TRAM proceeds to a point where a fascial island containing a suitable number of perforators is localized. The decision to perform a full width or partial width is facilitated by using a doppler to determine the course of the superior epigastric artery along the rectus abdominis muscle and manual palpation. When the main source vessel travels under the fascial island and the quantity of lateral muscle is adequate, the medial two-thirds of the muscle can be harvested with preservation of the lateral segment. Following flap elevation, the TRAM is tunneled into the mastectomy space and inset (Fig. 2). Abdominal closure sometimes requires the use of a prosthetic mesh for additional support and to minimize the risk of a bulge or hernia (Fig. 6).

Abdominally based free tissue transfer. There are three abdominal free flaps that include the free TRAM, DIEP, and SIEA. These flaps all have unique characteristics that distinguish them from one another. All are useful in certain situations and all are capable of producing excellent aesthetic outcomes. A basic algorithm for use is provided in Table II.

Free TRAM

The free TRAM flap is similar to the pedicle TRAM flap in that it utilizes the same cutaneous territory of the abdomen [5,15]. It differs from the pedicle TRAM because it is based on the inferior epigastric artery and vein and it requires less sacrifice of the rectus abdominis muscle. Free TRAM flaps are classified as MS-0, MS-1, or MS-2 Figure 7 illustrates a typical MS-2 free TRAM that includes the central segment of the rectus abdominis muscle. The preserved muscle on the abdominal wall remains in continuity and is innervated and has the

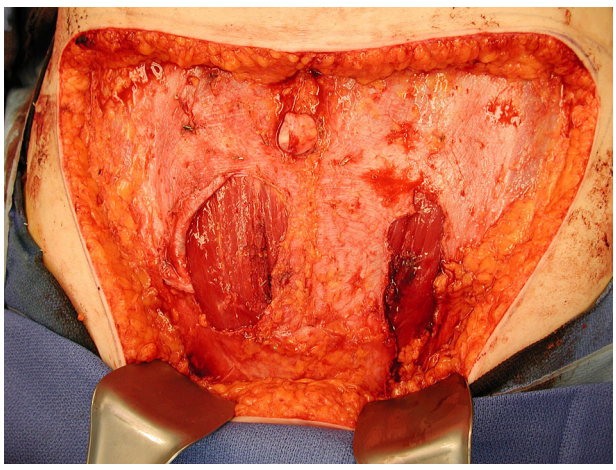

Fig. 4. The abdominal donor site following a MS-3 DIEP flap is illustrated.

Fig. 6. A synthetic mesh is placed over the anterior rectus sheath for additional reinforcement following a TRAM or DIEP flap.

TABLE II. Personal Algorithm for Selecting Free TRAM, DIEP, and SIEA Flaps Based on Body Habitus, Perforators, and Volume Requirements

Factor	Free TRAM	DIEP	SIEA
Breast volume requirements			
<800 g	+	+ +	+
>800 g	+ +	+	No
Abdominal fat			
Mild to moderate	+	+ +	+
Severe	+ +	+	No
Perforators >1.5 mm			
0	+	No	
>1	+	+ +	
Bilateral	+	+ +	+

potential to result in better muscle function. The free TRAM requires microvascular anastomosis to either the internal mammary or thoracodorsal artery and vein. The advantage of a free TRAM over a DIEP flap is that multiple perforators are included that may minimize the incidence of fat necrosis and venous congestion.

The free TRAM flap is considered when the SIEA and SIEV are not usable, the quality of perforators is poor (<1.5 mm in diameter), or in the event that the flap volume requirements require several perforators to optimize perfusion. When the principal perforators are small and localized in a segment of the rectus abdominis muscle or if the volume requirements are high, a small segment of the muscle is harvested with the flap. The advantage of including muscle is that multiple perforators can be included in the flap that may minimize the incidence of fat necrosis and venous congestion.

Technically, the free TRAM is more difficult to perform compared to the pedicle TRAM. The preoperative markings include delineation of the anterior superior iliac spine (ASIS) as well as the proposed upper and lower transverse incisions (Fig. 5). Following the initial incisions, the right and left flaps are elevated from a lateral to medial direction. Once a network of perforators is visualized; the anterior rectus sheath is outlined to encompass the perforators. The fascia is incised creating an island of perforators. The muscle is then undermined and the location of the inferior epigastric artery is visualized and palpated. When the perforators are centrally located an MS-2 free TRAM is performed. When the perforators are medial or lateral, an MS-1 free TRAM is performed. It is important to preserve the lateral intercostal motor innervation to maintain function of the rectus abdominis muscle.

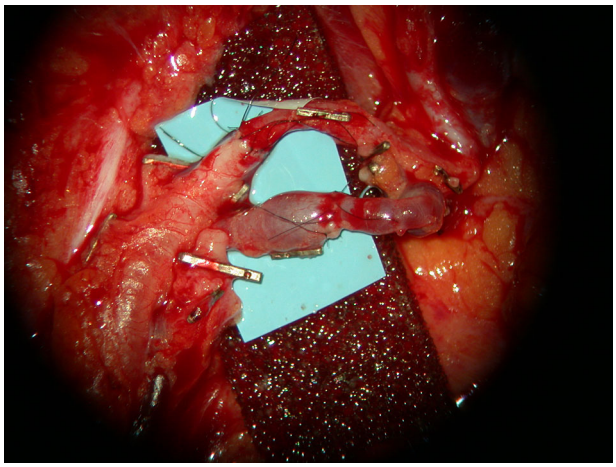

Fig. 8. The arterial and venous anastomosis following any of the microvascular flaps is illustrated.

The recipient vessels for the free TRAM include the internal mammary or the thoracodorsal artery and vein. Many surgeons prefer the internal mammary vessels because they are large caliber, have high flow, and permit optimal insetting and shaping of the flap. Following flap harvest, the flap is positioned on the chest wall, the donor, and recipient vessels are aligned, and then anastomosed to each other using 8-0 or 9-0 sutures or a coupling device (Fig. 8). Once the anastomosis is complete the flap is inset and shaped to create a new breast mound. The abdominal closure includes reapproximation of the medial and lateral segments of the rectus abdominis muscle and the anterior rectus sheath. Mesh support is sometimes considered followed by placement of closed suction drains and layered skin closure.

DIEP Flap

The DIEP flap is a true perforator flap based on the deep inferior epigastric artery and vein that is dissected from the rectus abdominis muscle through a myotomy without removal of the muscle [5,15,19,23]. The decision regarding whether to perform an MS-2 free TRAM or DIEP flap is ultimately based on the presence and quality of the

Fig. 7. A muscle sparing free TRAM flap is illustrated.

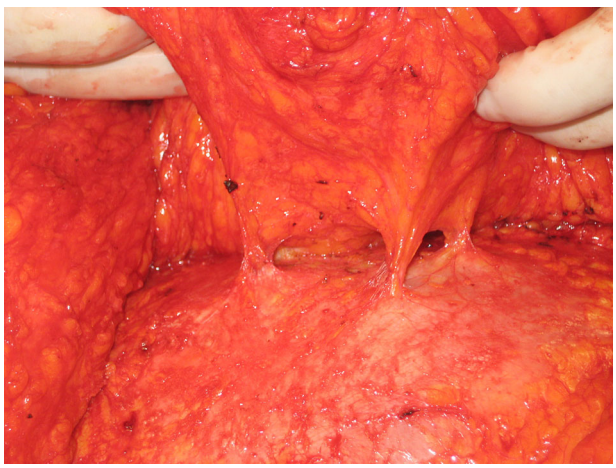

Fig. 9. A column of perforators is typically isolated when performing a free TRAM or DIEP flap.

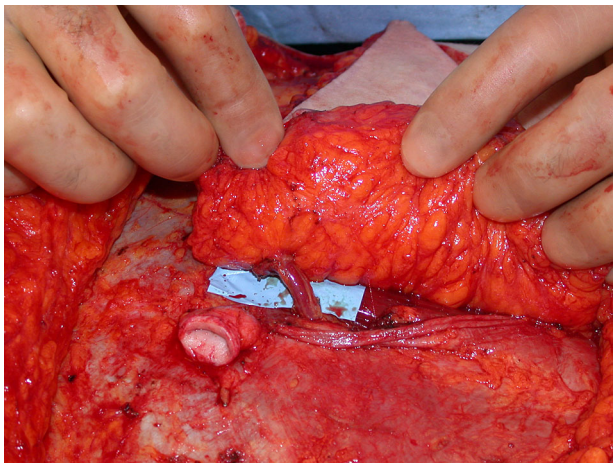

Fig. 10. A single perforator DIEP flap is being harvested.

abdominal wall perforatoring vessels (Table II). Knowledge of these perforators can be assessed either pre or intraoperatively. Preoperative assessment is best achieved using computed angiography (CT) or magnetic resonance (MR) angiography [29]. With these techniques the location and caliber of the perforating vessels can be adequately determined. Intraoperative assessment is also effective in identifying the abdominal wall perforatoring vessels. Most perforating vessels are located in the periumbilical region (Fig. 9). If a dominant perforator arising from the deep system is not identified, it may be because the superficial inferior epigastric system is the more dominant. In this situation, one can consider performing an SIEA.

The technical details related to the DIEP flap differ from the other abdominal flaps. The preoperative outline of the flap is the same as the free TRAM (Fig. 5). The selected perforator should be located near the center of the flap in order to obtain equidistant perfusion. A minimal perforator diameter of 1.5 mm is recommended. When several perforators are available, sequential occlusion can be performed to assist with the selection process to determine the best perforator. Harvesting a flap with more than one perforator can be considered when they are aligned in series or in close proximity. Medial row perforators are preferred when the flap will include tissue on the contralateral side

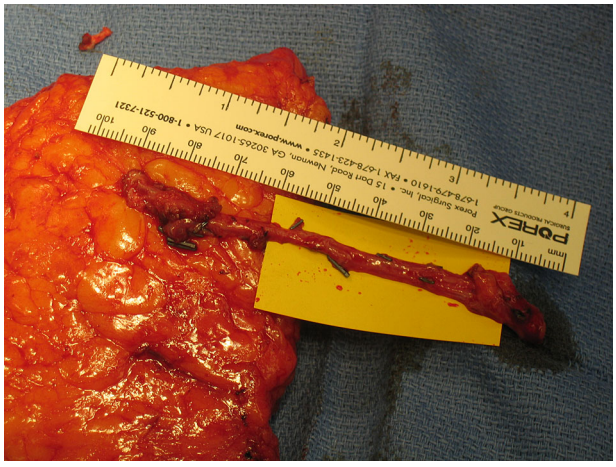

Fig. 11. A single perforator DIEP flap is harvested with a pedicle length of 9 cm.

Fig. 12. Preoperative photograph of a woman with left breast cancer following prosthetic reconstruction and radiation therapy.

(zones 3 or 4). During the dissection it is imperative to preserve the lateral intercostal nerves as they pierce the rectus abdominis muscle at the junction of the lateral and central longitudinal segments. Once the dominant perforator is selected, the intramuscular dissection proceeds

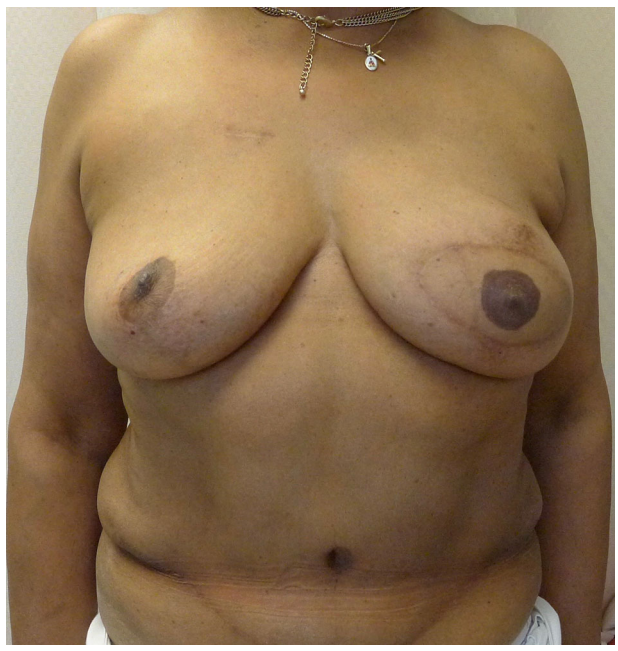

Fig. 13. Postoperative photography following removal of the implant and replacement with a left DIEP flap.

Fig. 14. Preoperative photography of a woman following right mastectomy and radiation therapy.

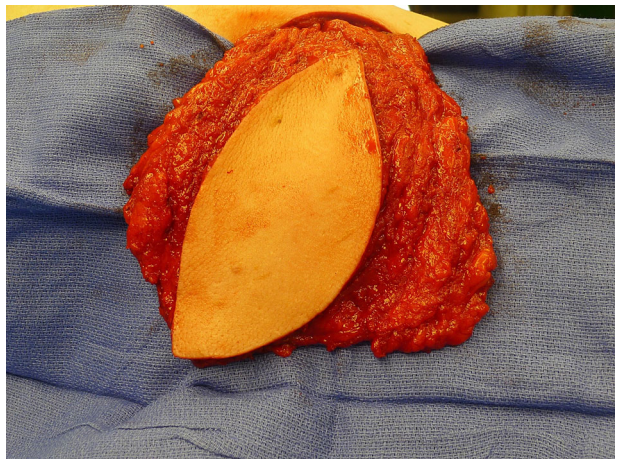

Fig. 16. Intraoperative photograph of the right latissimus dorsi musculocutaneous flap.

to the point that the perforator or inferior epigastric vessel becomes submuscular (Fig. 10). At that point there are two options. Some surgeon will harvest a short segment of the vessels and stop here whereas other surgeons may continue the dissection to the lateral edge of the muscle towards the iliac vessels. Further dissection usually results in larger caliber vessels. Once the desired pedicle length and caliber has been achieved (Fig. 11), the flap is harvested and the microvascular anastomosis to the recipient vessels is completed. The flap is inset and the abdomen is closed as previously described. Abdominal closure typically includes the scarpas layer, dermis, and skin. The need for supplemental mesh is usually not necessary with DIEP flaps unless there is fascial laxity or fragility. Figures 12 and 13 illustrate a patient following DIEP flap reconstruction.

SIEA Flap

The SIEA flap is an alternative option that is suitable in some women [13,30]. The SIEA flap is based on the superficial inferior epigastric artery and vein. The advantage of this flap over the other abdominal free flaps is that it does not require a fasciotomy or myotomy, thus the integrity of the abdominal wall is not disrupted. The superficial inferior epigastric vessels have been demonstrated to be "usable" in 30% of cases. The SIEA flap is technically easier to harvest that either the DIEP or muscle sparing free TRAM flap because it is essentially an adipocutaneous flap that is perfused by a direct perforator. Direct perforators do not course through a muscle. A limitation of the SIEA flap is that the angiosome is usually confined to the ipsilateral flap; therefore, inclusion of zone 3 may result in inadequate perfusion and ultimately fat or partial flap necrosis. Thus, the SIEA flap is ideal for women having unilateral or bilateral breast reconstruction in which only a hemi flap is used.

The superficial inferior epigastric artery and vein cross the inguinal ligament about 1/3 the distance from the pubic bone to the ASIS. Following visualization of the vessels, it is prudent to dissect out the deep system perforators as well to ensure that the perfusion from the

Fig. 15. Preoperative marking for a unilateral latissimus dorsi musculocutaneous flap.

Fig. 17. Postoperative photograph demonstrating excellent controur and acceptable symmetry.

Fig. 18. Postoperative photograph of the donor site scar.

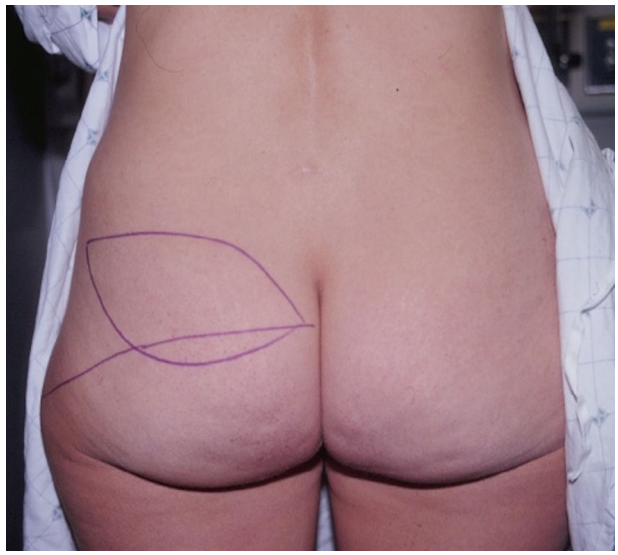

Fig. 20. Preoperative markings of the left SGAP flap.

superficial system is adequate. Following perforator isolation, they should be sequentially occluded to ensure that the perfusion from the superficial artery and vein is adequate. Insetting the SIEA flap requires special attention compared to the other abdominal free flaps because the pedicle enters the flap at the edge rather than the undersurface. De-epitheliazation of the inferior edge of the flap along the pedicle will facilitate insetting without compromising flow [30].

Latissimus dorsi reconstruction. The latissimus dorsi flap was the first flap utilized for autologous breast reconstruction and remains a valuable and reliable option for partial or total breast reconstruction [2]. This flap is usually raised as a pedicle flap and does not require microvascular surgery. The thoracodorsal artery and vein constitute the primary blood supply for this flap. This flap tends to provide a mild to moderate amount of volume and therefore requires the use of an implantable prosthetic device, either a tissue expander or implant. Autologous fat grafting is sometimes considered as an alternative to prosthetic devices.

Latissimus dorsi flaps are useful for immediate or delayed breast reconstruction. When used for immediate reconstruction, a tissue expander or implant can be placed simultaneously. It is also useful for delayed reconstruction following prior implant removal or abdominal flap failure especially in the setting of prior radiation or infection. In these situations, a three stage approach is usually considered consisting of the flap followed by insertion of a tissue expander, followed by a permanent implant. The latissimus dorsi flap is a reliable and sturdy flap with a high likelihood of success Disadvantages of the LD flap include donor site scarring and breast asymmetry in unilateral cases. The latissimus dorsi muscle can atrophy over time, especially if the latissimus muscle has been denervated. This may result in a future volume deficiency with visibility or palpability of the implant. Autologous fat grafting can be used to camouflage or add thickness to the soft tissues. The most common complication is seroma formation that occurs in approximately 15–25% of patients at the site of muscle harvest. Other complications include hematoma, infection, fat necrosis, and partial or total flap loss.

Fig. 19. Preoperative photograph in a patient with bilateral breast cancer scheduled for staged mastectomy and SGAP flap reconstruction.

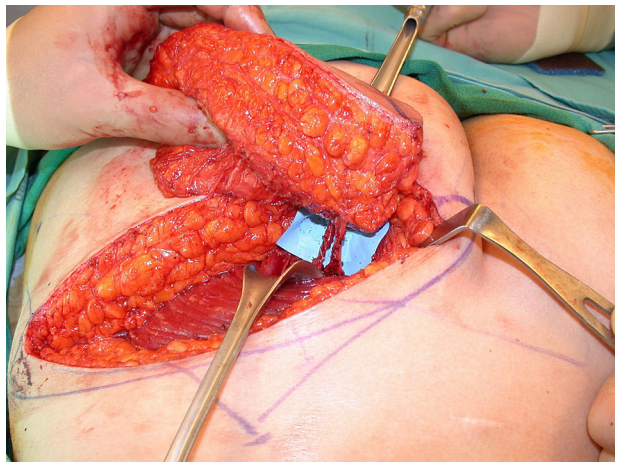

Fig. 21. Intraoperative photograph of the perforator and the SGAP flap.

Fig. 22. Late postoperative outcome following bilateral SGAP flaps.

The technical aspects related to elevation of a latissimus dorsi flap are relatively straightforward. Patients are marked in the standing position with the skin territory drawn according to the resting skin tension lines. In the operating room, patients are typically placed in the lateral decubitus position. The flap can be harvested using the entire latissimus dorsi muscle or a portion of it. The thoracodorsal artery and vein has a descending and a transverse branch that can be used to perfuse the flap. The insertion of the latissimus dorsi muscle is the acromion process and is sometimes detached when additional rotation of advancement of the flap is necessary. The thoracodorsal nerve is usually preserved to minimize muscle atrophy; however, preservation of the nerve may cause animation. The raised flap is tunneled through a high axillary tunnel into the breast pocket and inset. A prosthetic device can be placed under the flap or under the pectoralis major muscle. The insetting should be performed with the patient sitting at a 30° angle for optimal shaping. A single closed suction drain is placed along the flap and two drains are placed at the donor site. The flap and donor sites are closed in a layered fashion. Figures 14–18 illustrate a patient following latissimus dorsi flap breast reconstruction.

Fig. 23. Late postoperative outcome of the bilateral gluteal donor sites following bilateral SGAP flaps.

Thoracodorsal Artery Perforator Flap

The thoracodorsal artery perforator flap (TDAP) is another option for breast reconstruction but is more often used for partial breast reconstruction following oncoplastic surgery [8,12]. It is usually a low volume flap that is performed as a pedicle flap for laterally based breast defects. Including adjacent adipose tissue to augment flap volume can extend or increase the volume of the flap. Although TDAP flaps can be used for total breast reconstruction in petite women with small breasts, additional procedures to obtain adequate volume would likely be necessary.

Gluteal Flaps

The gluteal flaps are arguably amongst the more complex flaps in the armamentarium of the microsurgeon [4,6,11]. In general, gluteal free flaps are considered when the abdomen is not a suitable donor site and the patient is not interested in prosthetic reconstruction. Gluteal flaps can be raised with or without the gluteus maximus muscle. There are two perforator flaps that are derived from this region that include the superior (SGAP) and inferior (IGAP) gluteal artery perforator flaps. The specific locations for each flap include the upper buttock (above the piriformis muscle) for the SGAP and the gluteal crease region (below the piriformis muscle) for the IGAP. The gluteal flaps are ideally suited for women that are of moderate body habitus. They are usually not recommended for morbidly obese women.

SGAP Flap

The technical aspects of harvesting an SGAP flap require special attention. An appreciation of the anatomic landmarks is essential [4,11]. These include the greater trochanter laterally, the posterior superior iliac crest superiorly, and the coccyx inferiorly. The location of the perforators is best determined using a hand-held doppler probe with the patient in the prone position on the operating table. In contrast to the DIEP flap where a centrally based perforator is preferred, with the SGAP, a peripheral located perforator is sometimes preferred to facilitate the microsurgical anastomosis and flap insetting. In contrast to DIEP flap the length of the myotomy is minimized; whereas with the SGAP, the length of the myotomy is maximized. The dissection continues deep to the gluteus maximus and medius muscle before penetrating the deep fibrous fascia. Once beyond this point, there are multiple vascular branches that must be carefully dissected and divided before choosing the end-point of the perforator. Once complete, the flap is harvested. The recipient vessels typically include the internal mammary perforators at the level of the pectoralis major muscle or perforators emanating from the IM vessels. The typical intercostal interspace is number 4 or 5 because the diameter of the internal mammary vessels at this level more closely approximates that of the superior gluteal artery and vein. Following completion of the anastomosis, the flap is inset and the donor site is closed over a closed suction drain. Figures 19–23 illustrate a patient having SGAP flap breast reconstruction.

IGAP Flap

The IGAP flap is raised with the same landmarks as the SGAP flap. The skin territory for this flap can be positioned along the inferior

gluteal crease [6]. In general, the adipocutaneous component of this flap is slightly less than that of the SGAP. Other considerations are that the sciatic nerve is often exposed during this dissection and may result in postoperative discomfort. Because the incision is located in the ischial region, sitting may be restricted for several days following the operation and dehiscence of the incision may be observed more often.

Thigh Flaps

The medial and posterior thigh regions have become an excellent alternative donor site for autologous breast reconstruction. Flaps such as the transverse upper gracilis (TUG), diagonal upper gracillis (DUG), transverse musculocutaneous gracilis (TMG), and the profunda artery perforator (PAP) have been utilized [7,10,14].

TUG and TMG Flaps

The medially based thigh flaps include the TMG, DUG, and TUG flaps [10,14]. The The skin territories can be oriented transversely or diagonally. Diagonally based flaps may result in less lymphatic disruption and minimize the risk of lymphedema. Candidates for a these flap include women that are generally not candidates for abdominal flaps due to lack of tissue or prior surgery that has disrupted the abdominal vascularity. Candidates for medial thigh flaps must have enough skin and fat to adequately create a breast of desired volume.

Preparation for these flaps requires special attention. Patients are evaluated in the standing position by pinching the medial thigh region to determine the optimal height of the flap. The anterior and posterior limits of the flap are based on the dimensions of the mastectomy defect. The skin paddle can be delineated transversely or in a Fleur-de-lis pattern. Patients are placed in the lithotomy position. The skin territory is incised and the dissection proceeds to the level of the muscle fascia. Superficial nerves within the flap are usually transected. The saphenous vein is included into the flap for additional venous drainage. The gracilis artery is usually associated with a venae commitans. The gracilis muscle is visualized and divided at its origin and at its distal musculotendinous insertion. The flap is transferred to the chest wall for the microvascular anastomosis. Ideally recipient vessels are selected that will provide an optimal size match. The internal mammary vessels or their perforating branches are typically used.

PAP Flap

The PAP flap is becoming the preferred second option for many surgeons [7]. This flap is based off the profunda femoris artery and vein that has several associated perforators within the posterior compartment of the thigh. This flap is often considered as an alternative to the abdomen and ideally suited for small to moderate size breasts with lipodystrophy in the posterior thigh territory. The weight of this flap ranges from 250 to 700 g. The advantages of this flap over gluteal flaps and medial thigh flaps are that lymphedema risk is minimal, pedicle length is increased, and gluteal contour is not affected

CONCLUSIONS

As plastic and reconstructive surgeons continue to expand upon the armamentarium of autologous tissue options for breast reconstruction, outcomes will continue to improve. Autologous tissue offers many advantages that prosthetic devices cannot including longevity, ability to be predictable and successful in complex cases such as prior radiation or device infection, and provide the added benefit of aesthetic recontouring at the donor sites. The goal of reconstructive breast surgery is no longer to create just a breast mound but to create a breast with natural shape, volume, contour, and symmetry. Patient expectations following mastectomy and reconstruction have increased and reconstructive plastic surgeons should continue to strive for excellence.

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