Application and Refinement of the Superior Gluteal Artery Perforator Free Flap for Bilateral Simultaneous Breast Reconstruction

Frank J. DellaCroce, M.D., and Scott K. Sullivan, M.D.

New Orleans, La.

Background: The gluteal artery perforator free flap represents the state of the art in autogenous breast reconstruction for the patient with insufficient abdominal donor tissue. Preservation of the gluteal musculature limits morbidity and allows for rapid patient recovery. The need for intraoperative repositioning has historically limited gluteal artery perforator flap breast reconstruction to one breast per operation. This results from a desire to avoid marathon surgical times when the flaps are dissected out sequentially and/or having the patient lie on the first reconstructed breast as the second flap is harvested. Prior protocols have relied on staging the reconstructions weeks apart to address these concerns. This is a significant issue for patients requiring bilateral mastectomy and results in the patient being subjected to two major sequential operations and their associated recoveries.

Methods: The authors describe their experience and associated technical considerations with an initial 20 patients (40 flaps).

Results: The average operative time was 7 hours 47 minutes (excluding mastectomy). There were no vascular complications and no flap failures.

Conclusions: Bilateral simultaneous gluteal artery perforator flap breast reconstruction may be performed safely with reproducible success and a complication rate that is comparable to that of other commonly performed autogenous tissue techniques. This report represents the largest described experience to date and the first dedicated treatise on a protocol that provides significant advantages and an option that has heretofore been unavailable to this group of patients. (*Plast. Reconstr. Surg.* 116: 97, 2005.)

The abdomen remains a first choice for autogenous breast reconstruction. The incision placement is aesthetically favorable, and soft-tissue volume is often adequate. These factors, combined with avoidance of intraoperative repositioning, maintain the abdomen as the initial consideration in those who desire autogenous breast reconstruction. Our group relies solely on the deep inferior epigastric perforator and superficial inferior epigastric artery flaps in those who are candidates for abdominal harvest.[1] Patients with inadequate abdominal soft -tissue volume or prior abdominal surgeries that render the abdominal perforating vessels compromised are offered the superior gluteal artery perforator flap as an alternative. The superior gluteal artery perforator flap evolved as a refinement of the gluteal myocutaneous flap, which was first described in 1975 by Fujino et al. for reconstruction of the aplastic breast.[2] Koshima et al.'s work led to the

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original descriptions of the gluteal artery perforator flap for management of sacral pressure sores.[3] Numerous applications have evolved for this flap, including breast reconstruction.[4,5] The gluteal artery perforator flap allows for harvest of substantial amounts of fatty tissue even in very thin patients. The avoidance of gluteal muscle sacrifice provides for minimization of long-term morbidity as well as a shortened recovery period. The donor site is placed in an aesthetically acceptable location, with minimal resultant contour changes in the buttock. Despite these advantages, there has been a paucity of reports in the literature on this technique; the superior gluteal artery perforator flap has essentially been relegated to a distant second choice when options for breast reconstruction are considered. The failure of the gluteal artery perforator flap to assume a more prominent role in the plastic surgeon's armamentarium for breast reconstruction likely stems from many of the same issues that prevent the deep inferior epigastric perforator flap from replacing the transverse rectus abdominis musculocutaneous flap. The primary issues raised include technical difficulties associated with harvest of the flap, the need for intraoperative patient repositioning, vessel mismatch at anastomosis, donor-site scarring and morbidity, and inadequate available tissue volume for reconstruction of the larger breast. As a result, bilateral gluteal artery perforator flap reconstruction has historically been staged. This results from a desire to avoid marathon surgical times when the flaps are dissected out sequentially and/or having the patient lie on the first reconstructed breast as the second flap is harvested. Blondeel reported on four cases in his 1999 review with a mean operative time of 11 hours 6 minutes.[6] Resultant recommendations have been to perform one reconstruction at a time, 2 to 6 weeks apart. This is a significant issue for patients requiring bilateral mastectomy. The patient is subjected to two major operations, two general anesthetics, two recoveries, and two sets of hospital charges. Our group has recently developed a protocol to provide immediate, simultaneous, bilateral gluteal artery perforator flap reconstruction for our patients. Our experience addresses the associated technical issues and refinements that allow for application of the flap as a practical, reliable, and reproducible tool in the reconstructive microsurgeon's repertoire for bilateral breast reconstruction.

Patients and Methods

One criticism of the gluteal perforator flap is the technical difficulty associated with harvest and utilization of the flap for breast reconstruction. Many regard it as the most technically challenging of the mainstream flap options for breast reconstruction. The perforating vessels have a number of muscular/musculocutaneous branches as they pass through the gluteus maximus. Once the perforating vessels are followed down through the deep layer of the muscular fascia, the caliber of the vessels, especially the vein, increases rapidly. It is not uncommon to encounter a venous confluens with a diameter of 8 to 10 mm and five or six joining vessels. The number of branches of both the vein and artery also increases once the deep fascia is opened. This issue may be averted if the caliber of the artery and vein and the length of the perforator are adequate before entry into the deep subfascial fat pad. This is, however, rarely the case, and an adequate arterial size is usually only encountered as dissection continues in a controlled and meticulous fashion through the fascia deep to the gluteus musculature. A bloodless field is mandatory when working in a field that tapers rapidly. Harvest of larger, thicker flaps can accentuate these factors. The intramuscular course of the perforators is taken advantage of compared with gluteal myocutaneous flaps,[7] thereby producing a longer pedicle. This facilitates anastomosis to the recipient vessels, as the flap can be positioned out of the microsurgical field. A skin paddle design of approximately 8×22 cm is oriented along the panty line in an oblique fashion to produce a scar that is easy to conceal in bathing suits and undergarments. It is our preference to place the flap design much higher on the buttock than is traditionally described to allow for the ultimate scar line to rest at the junction of the aesthetic units of the lower back and upper buttock. This essentially results in only the medial half of the flap being centered over the gluteus maximus. To achieve this, careful Doppler examination is carried out preoperatively to ensure inclusion of perforating branches of the superior gluteal artery in the skin paddle design. The desired size of the base of the flap is marked around this perimeter, usually in the 11 to 14 cm range, to approximate the measured base of the breast before mastectomy (Fig. 1). The predicted site for emergence of the superior gluteal artery is

FIG. 1. Flap design with perforator signal points marked out.

marked, as previously described. A point one-third down a line drawn between the posterior superior iliac spine and the greater trochanter is marked. A handheld Doppler device is then used to localize the perforating vessels in this region, as noted. Ideally, one the perforator is inset into the breast pocket, it will fall close to the junction of the medial and middle thirds of the flap. This provides proximity to the recipient internal mammary vessels to facilitate anastomosis and to avoid tethering once the perforator is inset. A location in this range is also preferred because it places the feeding vessels near the center of the tissue composite to ensure adequate and as uniform a distribution of perfusion as possible. The other factors in planning the flap harvest are the flap shape and volume that one wishes to obtain during harvest. With bilateral reconstructions, we have found that the buttock opposite the breast to be reconstructed provides the most favorable set-up. Substantial volume may be added to the flap by simply beveling away from the skin to increase capture of the deeper fat.

Our protocol relies on a team of two microsurgeons working in tandem. The recipient internal mammary artery and vein are initially prepared on each side simultaneously. Use of the internal mammary vessels allows for medial positioning of the flap and avoids vein grafts. A 2-cm section of cartilage is removed from the fourth rib at its junction with the sternum. The underlying perichondrium is removed and the vessels are freed of their adventitial attachments. Wide exposure of the recipient vessels facilitates microvascular anastomosis (Fig. 2), as the pedicle on the superior gluteal artery perforator flap is typically in the range of 4 to 6 cm in our experience compared with that of other authors who have quoted pedicle lengths in the 7- to 8-cm range.[4,6] Once complete, the wound is dressed and the patient is placed in the prone position for flap harvest. The perimeter of the flap is defined with electrocautery, and incision through the superficial fascia of the gluteus maximus follows. Both surgeons work at a similar pace with an identical technique to allow for symmetrical harvest. The subfascial plane is entered thusly and serves as the plane for perforator identification (Fig. 3, *above*). Once the dominant perforator or perforators are identified, selection is made based on size and location of the feeding vessels. Perforators entering the central third of the flap are chosen preferentially to provide adequate vessel length and flap perfusion. Perforators entering the medial third of the flap typically have a very short course through the muscle, and their associated shorter length can provide for a more challenging anastomosis. The lateral third of the flap is usually undercut to minimize lateral donor-site deformity; therefore, it is usually devoid of perforating vessels. Once a selection has been made, the perforators are then followed down through the substance of the muscle by spreading and preserving the fibers. The connective tissue of the perimysia around the vessels serves as a layer that may be handled with relative impunity and speeds the dissection of the perforator. The dissection is then carried through the deep

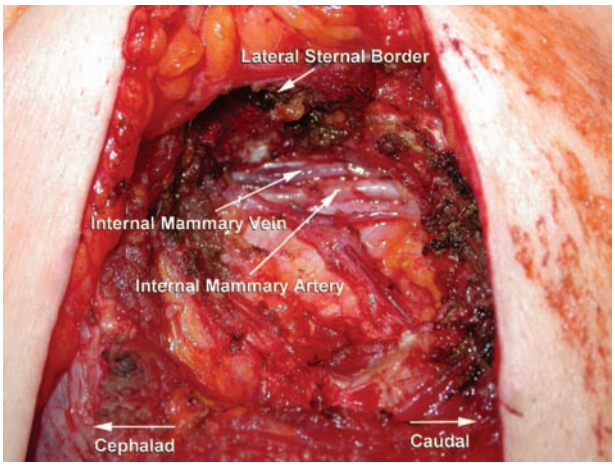
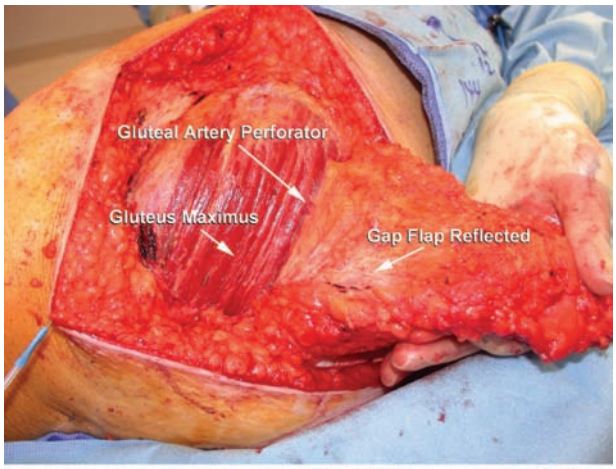


FIG. 2. Internal mammary artery and vein dissected out.



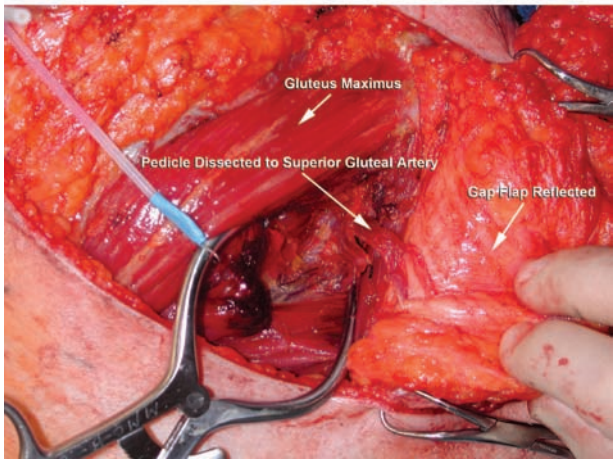


FIG. 3. (*Above*) The flap is elevated with the dominant gluteal artery perforator identified. (*Below*) The perforator is dissected down to its origin through the deep gluteal fascia.

gluteal fascia to reach the larger-caliber vessels in the subgluteal fat pad as they emerge from the sacral foramina (Fig. 3, *below*). Extreme care must be taken in this portion of the dissection, as entry into the large venous confluence or a poorly controlled arterial branch point in the tight confines of this portion of the harvest can make for unnecessary blood loss and possible injury to the flap pedicle. Once adequate vascular caliber is attained, the flaps are harvested and passed off the field. The donor sites are closed in three layers without additional undermining, and the patient is returned to the supine position. The flaps are then brought into the field, where they are contoured and de-epithelialized before the microvascular anastomosis is completed (Fig. 4). Management of the mismatch between the often large flap vein and the recipient internal mammary vein is addressed with the MCA microvascular coupling device (Synovis Micro

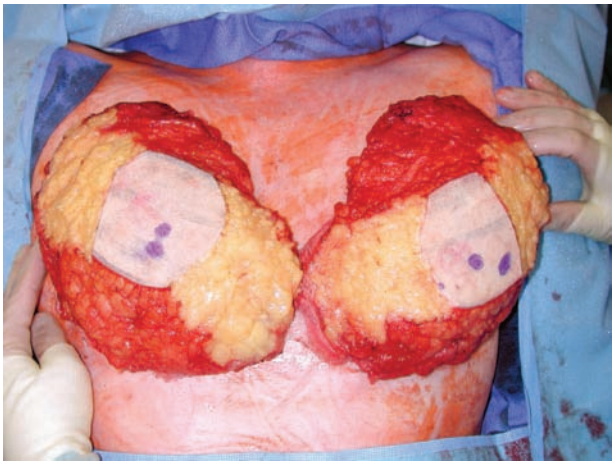


FIG. 4. Flaps deepithelialized and contoured before anastomosis.

Companies Alliance, Birmingham, Ala.), as previously described by our group.[8] Once anastomosis is complete, an implantable Doppler device (Cook Vascular, Inc., Leechburg, Pa.) is applied to the venous side of the anastomosis and the flaps are inset sequentially to provide the most aesthetically pleasing shape (Fig. 5).

Our patients then spend one night in the intensive care unit for flap monitoring and are subsequently transferred to the regular inpatient unit on postoperative day 1. Oral analgesics are typically sufficient for pain control, and patients are ambulatory on the first day after surgery. An additional 2 to 3 days are then spent in the hospital for observation before discharge.

Second-stage reconstruction to include nipple reconstruction, flap contouring, and revision of the gluteal donor site, if necessary, follows 2 months later. It is our opinion that

FIG. 5. Intraoperative view of bilateral skin-sparing mastectomy and immediate nipple reconstruction.

some of the tissue removed from the buttock is offset by removal of the superficial gluteal fascia. This leads to some release of the bulk of the gluteus maximus, much like a fasciotomy. The resulting protrusion of the muscular tissue may help preserve the contour of the buttock and prevent depression formation. It has been our experience that some flattening and lifting of the buttock always occur but that depressions or other contour irregularities are rare. Suction-assisted lipectomy of the areas around the donor site may further enhance contour and symmetry. The breast flap is contoured with suction-assisted lipectomy or direct excisional sculpting if necessary. The second stage of the reconstructive protocol is performed on an outpatient basis. Tattooing of the nipple-areola complex follows 8 weeks later and is performed in the office setting.

Patient Population

Our experience includes 20 patients (40 flaps) who underwent bilateral simultaneous gluteal artery perforator flap breast reconstruction over a 1-year period. The average patient age was 43 years. Sixteen patients had insufficient abdominal fatty tissue volume for a deep inferior epigastric perforator flap to be considered. Two patients had prior colostomies, one patient had a prior abdominoplasty, and one patient had a history of multiple benign soft-tissue excisions from the abdominal area.

All patients within this series were in good health. One patient had mild hypertension, one had a goiter, and one was diagnosed with fibromyalgia. One patient was a smoker but quit in the 2 weeks before her procedure.

Fourteen patients underwent immediate bilateral reconstruction at the time of mastectomy. Six women had delayed reconstruction, and three had failed implant reconstruction requiring explantation and capsulectomy (Figs. 6 and 7).

Of the patients who underwent immediate reconstruction, the average mastectomy weight was 445 g. The average flap weight was 573 g. Insufficient donor volume was never a problem with this group of studied patients. The average number of perforators utilized per flap was 1.6, and the average skin paddle size was 7.8 × 22.6 cm. Seven patients also underwent immediate nipple reconstruction.

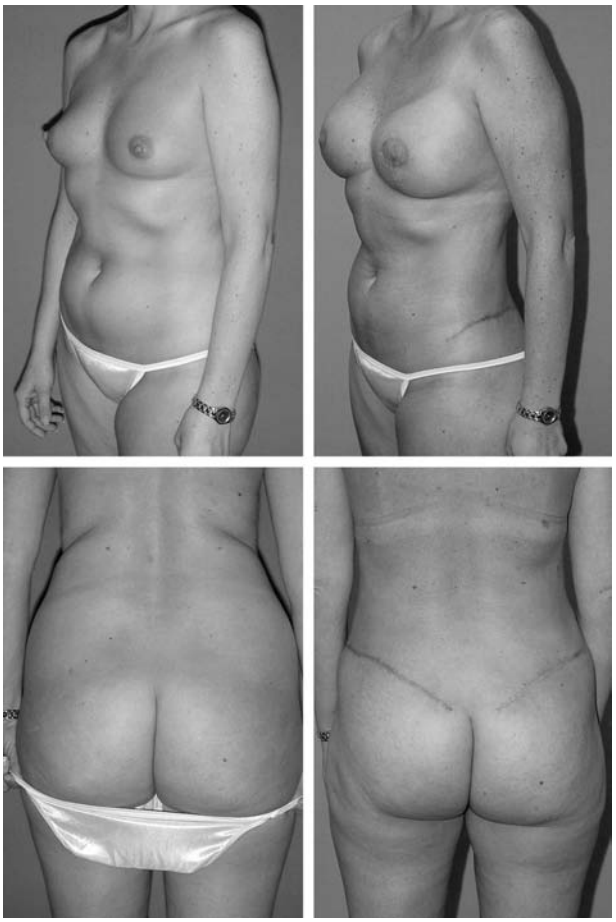


FIG. 6. (*Above*) A BRCA-positive patient before (*left*) and after (*right*) bilateral skin-sparing mastectomy and immediate simultaneous superior gluteal artery perforator flap reconstruction. (*Below*) Gluteal donor site before (*left*) and after (*right*) reconstruction.

RESULTS

The average bilateral flap harvest time was 3 hours 28 minutes, including donor-site closure. The average total reconstruction time was 7 hours 47 minutes. In those patients who underwent bilateral mastectomy and immediate reconstruction, the average total operative time was 10 hours 26 minutes inclusive.

No patient within this series required blood transfusion. There were no flap "take backs" and no flap failures. The average hospitalization was 4 days.

One patient developed partial necrosis of her native breast skin after skin-sparing mastectomy which healed by secondary intention without sequelae. One patient who underwent immediate nipple reconstruction experienced partial necrosis of her reconstructed nipple requiring revisional closure. One patient devel-

FIG. 7. (*Above, left*) A patient with a history of failed implant reconstruction. (*Above, right*) View of the patient after bilateral implant removal, capsulectomy, and simultaneous superior gluteal artery perforator flap reconstruction. (*Below*) Gluteal donor site before (*left*) and after (*right*) reconstruction, with minimal resultant scarring.

oped a donor-site seroma requiring serial aspiration.

DISCUSSION

The list of desirable options shortens rapidly for autogenous breast reconstruction when the abdomen is no longer an option. For these patients, the only remaining option is often an implant reconstruction with or without a latissimus flap. The latissimus flap provides only marginal volume alone and typically requires an underlying implant to provide satisfactory volume[9,10] at the expense of muscle sacrifice. For the patient with a desire to avoid implants and an abdomen that is not an option for harvest, a quandary presents itself. The addition of radiation therapy into the equation further complicates the situation, as most authorities agree that implants perform poorly in a radiated environment.[11–14] It is our opinion that the superior gluteal artery perforator flap provides the best option for these patients and fills the void in the armamentarium of the plastic surgeon quite logically. It avoids the complications associated with implants in the postradiation patient and gives the remaining patients a real option other than implants when their abdomen is not sufficient. We prefer this flap over the inferior gluteal artery perforator flap for a number of reasons. First, and most importantly, use of the superior gluteal artery perforator avoids exposure of and dissection around the sciatic nerve, which exits the sacrum closely adjacent to the inferior gluteal artery below the pyriformis muscle. This anatomy has been described in detail previously, and we believe avoidance of the potential risk to the sciatic nerve is advisable. Second, a flap of adequate volume to provide a breast reconstruction with the proper aesthetics would potentially empty the lower buttock of fatty protection over the ischial bony prominences, which could lead to long-term problems with pressure tolerance in the remaining soft tissues.

The limiting factor for routine incorporation of this technique into the repertoire of the breast reconstructive surgeon is the need for well-tuned microsurgical skills and familiarity with the perforator flap surgical technique. The remaining historic limitation with regard to bilateral reconstruction has been addressed within our center as described herein. The average reconstructive time of 7 hours 47 minutes for bilateral reconstruction compares favorably to that for unilateral superior gluteal artery perforator flap reconstructions, which typically take 5 to 6 hours.[6] The benefits of one major operation as opposed to two as required with staged protocols are intuitive. Patients benefit from less overall physical and mental stress. They are exposed to the risks of one general anesthetic. Completing both mastectomies, when required, and both reconstructions in one setting provides the best opportunity for symmetry and the optimal aesthetic result. Patients reap the benefits of one set of physician/hospital charges as opposed to two, as well as a shortened overall recovery.

CONCLUSIONS

The gluteal artery perforator flap fills a void for the patient who desires autogenous breast reconstruction but has insufficient abdominal fatty tissue volume. We use and recommend a

team approach for the performance of bilateral simultaneous gluteal artery perforator flap breast reconstruction. This procedure remains technically demanding, but for the dedicated microsurgeon it provides an option that is safe and reproducible with the capacity to produce excellent aesthetic outcomes.

Frank J. DellaCroce, M.D.
4429 Clara Street, Suite 340
New Orleans, La. 70115

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