Use of Single-recipient Vessels for Cross-chest Abdominal Flap–based Breast Augmentation as an Outpatient

Paul Deramo, MD*
Carlos A. Martinez, MD†
Sean G. Boutros, MD, FACS†

Background: Breast reconstruction with autologous tissue following mastectomy for breast cancer has become the standard of care. Microvascular breast augmentation is an alternative for patients with failed breast prostheses, including painful capsular contractures or poor cosmetic outcomes. We present a series of 4 patients who underwent microvascular breast augmentation with cross-chest flap recipient vessels.

Methods: We perform a bilateral DIEP flap reconstruction in an outpatient setting following a modified recovery protocol, focused on decreasing postoperative pain and narcotic requirements, allowing early ambulation and discharge. This includes harvest of the flap via abdominal microfascial incisions and rib-sparing vessel dissection. Cosmetic microvascular augmentation of the contralateral breast was performed via cross-chest flap recipient vessel anastomoses, where the pedicle was tunneled across the chest and anastomosed to the primary flap.

Results: Four patients underwent flap-based breast augmentation with cross-chest recipient vessels. Two patients underwent immediate DIEP flap breast reconstruction of the affected side and contralateral flap-based augmentation, while 2 patients underwent bilateral breast augmentation with DIEP flaps for cosmetic purposes due to undesired cosmetic results following implant-based augmentations. No intraoperative complications were reported, and all patients were discharged within 23 hours without signs of flap compromise or need for operative take-backs. Mean follow-up was 23 weeks.

Conclusions: The DIEP flap is recognized as an option for breast augmentation, although its limitations are several, including the pain and recovery associated with autologous tissue-based breast reconstruction. Enhanced recovery protocols help reduce this burden, making it more acceptable and feasible. *(Plast Reconstr Surg Glob Open 2020;8:e2978; doi: 10.1097/GOX.0000000000002978; Published online 15 July 2020.)*

INTRODUCTION

Breast reconstruction following mastectomy for breast cancer has become the standard of care in the United States. Autologous breast reconstruction using deep inferior epigastric perforator (DIEP) flaps, first described in the early 1990s, allows patients to benefit from simultaneous removal of abdominal fat and breast reconstruction while providing a durable result that avoids the long-term complications of implant-based reconstructions. The DIEP flap has gained immense popularity as a result of the more favorable donor-site morbidity when compared with other autologous reconstructive techniques. The senior author has previously demonstrated the viability of outpatient DIEP flap reconstruction in breast cancer patients with 23-hour observation, emphasizing limited fascial incision, rib-sparing technique, and multimodal pain control.[1]

In breast cancer reconstruction, some authors have used cross-chest tunnel for flap recipient vessels in cases with poor contralateral vessel viability or in preservation of the left internal mammary (IM) artery for patients at risk of coronary artery disease.[2–4] Recently, Satake et al published their experience of cross-chest abdominal flap for contralateral breast augmentation in 32 patients who underwent unilateral breast reconstruction with a DIEP flap and simultaneous augmentation of the contralateral

breast using a superficial inferior epigastric artery (SIEA) flap.[5] Reports on microvascular breast augmentation as an alternative for patients with failed breast prostheses are limited due to the complex and costly nature.[6–9] Painful capsular contracture remains the main indication for salvage and reconstruction of the affected breast, although poor cosmetic outcomes with deforming results are common in our experience. Furthermore, these reports had various recipient vessel harvest sites, and patients required postoperative hospitalization, leading to prohibitively high costs for elective surgery.[10–12]

In breast cancer patients or those with indications for microvascular breast augmentation, decreased morbidity and postoperative pain are paramount. To this end, we present a series of 4 patients who underwent DIEP flap breast augmentation with cross-chest flap recipient vessels following our outpatient microsurgical breast reconstruction protocol.

METHODS

As previously reported, we perform a bilateral abdominally based flap reconstruction in an outpatient setting following a modified recovery protocol, focused on decreasing postoperative pain and narcotic requirements, allowing early ambulation and discharge. For patients with unilateral breast cancer, the abdominal tissue is divided to allow for DIEP flap on the reconstructed side and a smaller DIEP flap on the augmented side. In cases of bilateral reconstruction following failed breast protheses, the abdominal tissue is divided to allow for 2 DIEP flaps. We do not typically perform preoperative imaging studies to assess the status of the perforators, and decisions are based on caliber size and number of perforating vessels found during abdominal dissection.

All patients receive multilevel intercostal and transverse abdominis plane blocks with a mixture of 20 mL of liposomal bupivacaine (Exparel, Pacira, San Diego, Calif.) and 60 mL of 0.25% bupivacaine hydrochloride (Marcaine, Hospira, Lake Forest, Ill.) before flap harvest and chest dissection. During flap dissection, superficial inferior epigastric arteries are dissected to the femoral vessels, and DIEP pedicles are dissected to the iliac vessels. Abdominal microfascial incisions range from 1.2 to 2.5 cm, depending on the caliber of the perforators and flap requirements (Fig. 1). The reduced size of the abdominal incision minimizes morbidity and postoperative pain, comparable to that of laparoscopic port sites. Additionally, rib-sparing IM vessel dissection was performed in all patients, further minimizing postoperative pain and perioperative respiratory morbidity. Arterial anastomoses are performed with 9-0 microsutures in an interrupted fashion, and veins are anastomosed via coupling devices. As previously reported by the senior author, we perform dual venous drainage with the IM vein for the DIEP pedicle and with an IM perforating vein or second IM vein for the superficial epigastric vein.[13] Patients are observed operatively with Doppler checks and discharged home within 23 hours.

In cases of unilateral breast cancer, we modified our algorithm in microvascular breast augmentation for contralateral symmetry to include cross-chest flap recipient
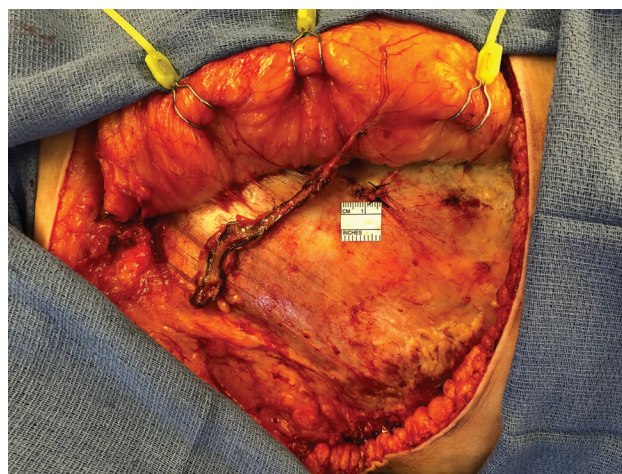

Fig. 1. Microfascial incision. In the case of single perforators, the microfascial incision ranges from 1.2 to 2.5 cm, whereas the incision for multiple perforators is based on the distance between the perforators, ranging from 1.5 to 3.5 cm.

vessel anastomoses to the branches of the deep inferior epigastric artery/vein (DIEA/DIEV) on the primary flap, limiting IM vessel dissection to one chest. An inframammary incision with suprapectoral dissection is performed to create a pocket underneath the pectoralis fascia and breast tissue. This pedicle is then tunneled across the contralateral chest, taking extreme care to avoid twisting or rotation, and an end-to-end anastomosis is performed to branches of the DIEA/DIEV on the primary flap; arterial and venous anastomoses are performed as previously mentioned (Fig. 2). After flow to the flap is confirmed, de-epithelialization and secure placement in the pocket is completed. Of note, the limited supra-sternal tunnel created in the deep subcutaneous tissue is ample to facilitate the passage of the pedicle, while avoiding the risk of postoperative symmastia.

RESULTS

Between August 2018 and September 2019, 4 patients underwent cross-chest breast reconstruction following unilateral or bilateral disease. Two patients with unilateral breast cancer underwent mastectomy and immediate DIEP flap breast reconstruction of the affected side, using approximately two thirds of the available abdominal tissue. Depending on the patient, the size of the contralateral breast, the abdominal tissue size, and vascular anatomy, DIEP flap breast augmentation for symmetry was performed with approximately one third the abdominal tissue (Fig. 3). Two additional patients underwent bilateral augmentation with DIEP flaps following failed prostheses. The first was a female with history of bilateral breast implants for cosmetic purposes performed in 1992 and replacement in 1995 with poor aesthetic results and painful bilateral capsular contractures type Baker III who underwent removal of ruptured silicone implants followed by bilateral breast reconstruction with DIEP flaps (Fig. 4). The other was a patient with a history of unilateral breast cancer who previously underwent unilateral mastectomy
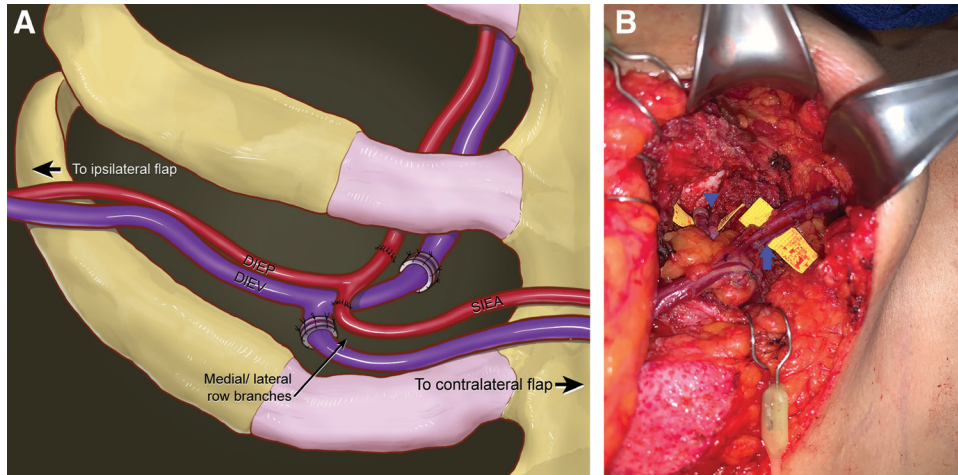
Fig. 2. A, The pedicle of the SIEA flap used in contralateral augmentation is tunneled across the chest and anastomosed to branches of the DIEA/DIEV on the primary (ipsilateral) flap. B, Blue arrow indicates the SIEA pedicle anastomoses to the DIEP branches; blue arrowhead indicates the primary anastomosis between the DIEA/DIEV and the internal mammary artery/vein.

and reconstruction with a latissimus dorsi flap and contralateral mastopexy with bilateral implants 2 decades ago. We performed removal of implants and bilateral DIEP flaps.

The mean age and body mass index were 51 years and 28 kg/m², respectively. All patients were nonsmokers, and none had a relevant history of comorbidities or abdominal surgeries. Only 1 patient underwent radiotherapy and chemotherapy before reconstruction due to unilateral breast cancer. Mean operative time, including unilateral mastectomy if required, was 341 ± 25 minutes (range, 316–371 minutes), with an estimated blood loss of <200 ml for all patients. No intraoperative complications were reported, and all patients underwent laser angiography using indocyanine green (SPY system) to assess perfusion of both flaps and mastectomy skin flaps.

All patients were discharged within 23 hours without signs of flap compromise or need for operative take-backs. Mean follow-up was 23 weeks. One breast cancer patient required full thickness skin grafts due to a small area of necrosis of the mastectomy skin flap. No further postoperative complications were observed.

DISCUSSION

Breast reconstruction with the DIEP flap has become one of the most popular techniques in autologous-based reconstructions. The advantages regarding donor-site morbidity are obvious and have been discussed in great detail, along with the outstanding long-term aesthetic outcomes.

The logical next step is to further the use of DIEP flap to achieve symmetry of the contralateral breast in cases of unilateral cancer, although its limitations are several. First and foremost, the pain and recovery associated with autologous tissue–based breast reconstruction has historically precluded its routine use in a cosmetic-oriented
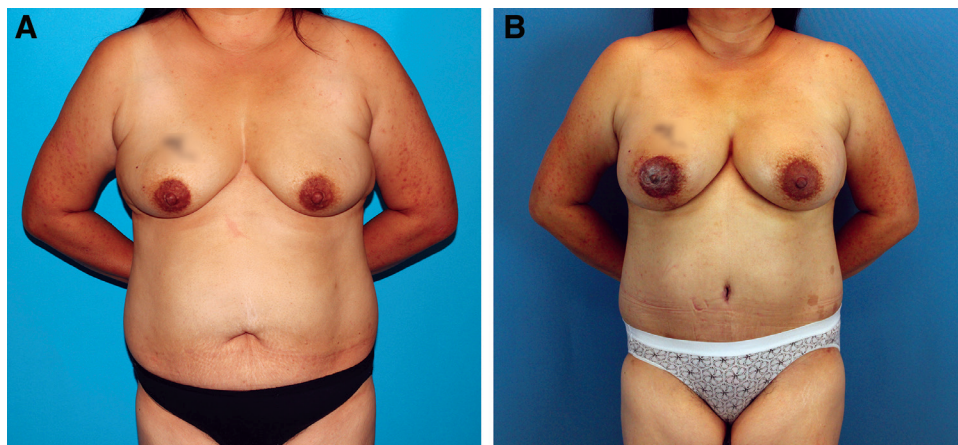

Fig. 3. A, A 49-year-old woman with a history of right-sided breast cancer underwent a skin-sparing mastectomy followed by immediate reconstruction with a DIEP flap and contralateral augmentation with a SIEA flap. B, Postoperative results at week 24, 5 days after undergoing right nipple reconstruction with a septal cartilage graft.
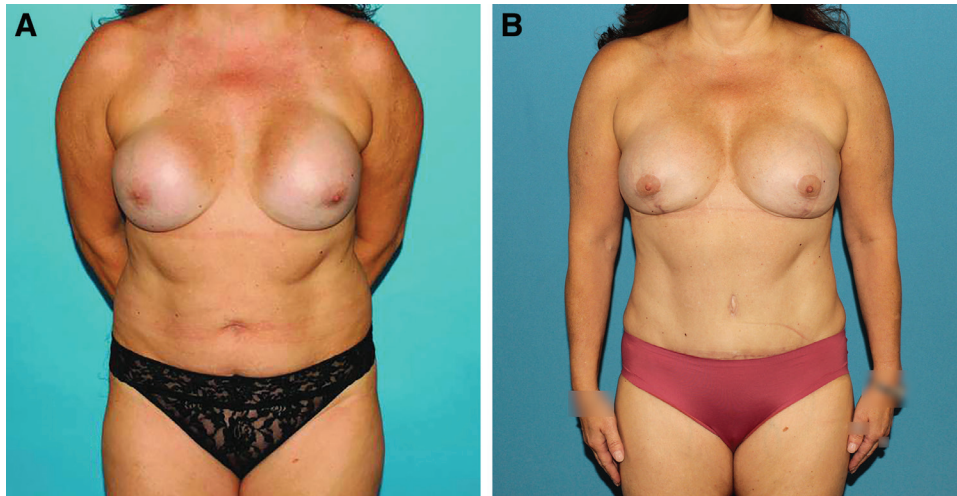
Fig. 4. A, A patient with a history of bilateral implants with poor aesthetic results and bilateral capsular contractures type Baker III underwent bilateral breast augmentation with DIEP flaps. B, Postoperative results of the patient at week 19.

procedure. Enhanced recovery protocols help reduce this burden, making it more acceptable.

The cost associated with inpatient hospital treatment can be significant, and this is yet another barrier for adoption of this procedure for cosmetic reasons, such as breast augmentation.[14–16] The outpatient DIEP flap protocol that we have described for reconstruction yielded an obvious adoption of these techniques for aesthetic reasons. The decreased cost in care associated with this procedure being performed as an outpatient lowers the financial burden and potentially increases the availability of these procedures to patients who are suffering from chronic implant issues, including capsular contracture malposition and shape abnormalities, which cannot be corrected with an implant.

Even with improved recovery protocols and avoidance of rib harvest, every surgical maneuver done on a patient has some drawback in regards to morbidity, time in the operative room, and increased recovery. The use of cross-chest anastomosis is a very logical application that significantly decreases the morbidity on one of the sides. Even with avoidance of rib harvest, the dissection of intercostal muscles has an invariable pain associated with this procedure, and cross-chest anastomosis can lessen this issue, while providing excellent perfusion in both flaps. Two prior reports of cross-chest anastomosis used anterograde and retrograde IM arteries in end-to-end fashion for arterial supply to each flap.[2,3] This is supported by previous publications demonstrating the reliability of the retrograde limb of the IM artery for DIEP flap recipient.[17] In both reports, third rib cartilage was removed to microvascular anastomoses, thus limiting the cosmetic benefit of this technique. In another series of cross-chest flap recipient vessel dissection for DIEP flap reconstruction, various techniques of using the anterograde IM artery for perfusion of both flaps were included, and rib cartilage was removed to facilitate microvascular anastomoses.[4] In a more recent series of cross-chest flap design for

contralateral breast augmentation, the authors performed an operation similar to our protocol; however, no mention was made of rib preservation, and the mean hospital length of stay was 5 days.[5] To our knowledge, we are the first to describe outpatient cross-chest abdominal-based flap breast augmentation for either reconstruction or cosmetic indications.

In 2 of our patients, breast reconstruction was performed following unilateral mastectomies. These patients desired larger volume and were unwilling to have an implant placed. For these patients, cross-chest anastomosis allows for cosmetic augmentations of the contralateral breast with autologous tissue at the same time of breast reconstruction of the contralateral breast with acceptable morbidity. Furthermore, the use of a cross-chest anastomosis only requires monitoring of one site, as the secondary flap monitors the primary anastomosis.

Though we routinely select lower intercostal spaces for anastomosis, there is some risk of medial depression at the site where the pectoralis muscle is divided to reach the underlying IM vessels. This issue is obviously mitigated with cross-chest anastomosis because there is no concern for depression at the site, as no pectoralis muscle is divided. Although the dissection of the pedicle to its branching origin allows us to easily accommodate the cross-chest anastomosis without risk of tension or stress to the vessels, cases where anatomical anomalies might be encountered, such as a DIEA with no branches at the submuscular portion, merit specific consideration during dissection and may not be deemed feasible due to perfusion risks. While none of our patients presented with midline weakness or bulges of the rectus abdominis muscles, fascial plication to correct rectus diastasis can be performed at the time of surgery if concerns arise during dissection.

Another topic of concern is the possibility of future malignancy. In the case of bilateral DIEP flap breast augmentation, we place the flap below the pectoralis fascia

so that any future mastectomy may be performed without the need to elevate or debulk the flap. If concern for close margins is present, the dermis of the DIEP flap can easily be taken along with the mastectomy specimen, thereby allowing for clear margins of resection.

We understand that the limited fascial incision and rib-sparing approach require a steep learning curve, and so this technique is not for everyone, but for microsurgeons with considerable flap experience, we believe that this method spares patient the morbidity and aesthetic deformity common in bilateral IM vessel dissection. Particularly, when rib is spared, microvascular work is done on one set of IM vessels, and the breast is tacked appropriately medially; there should be minimal contour deformity, thus sparing the future need and cost of fat grafting.

CONCLUSION

In our experience with cosmetic microvascular breast augmentation, the use of an outpatient DIEP protocol, stressing minimal incision with rib-sparing techniques and cross-chest flap recipient vessels, can safely be performed as an outpatient, potentially decreasing the need for subsequent revision surgeries.

Sean G. Boutros, MD, FACS
Houston Plastic Craniofacial and Sinus Surgery
9230 Katy Freeway, Suite 600
Houston, TX 77055
E-mail: drseanboutros@drseanboutros.com

REFERENCES

1. Martinez CA, Reis SM, Rednam R, et al. The outpatient DIEP: safety and viability following a modified recovery protocol. *Plast Reconstr Surg Glob Open*. 2018;6:e1898.
2. Lee JH, Varon DE, Halvorson EG. Unilateral internal mammary recipient vessels for bilateral DIEP flap breast reconstruction. *Plast Reconstr Surg Glob Open*. 2017;5:e1359.
3. Kosutic D, Lambe GF. The use of single recipient internal mammary vessels for bilateral deep flap breast reconstruction in a recipient-vessel-depleted patient. *Microsurgery*. 2018;38:120–121.
4. Zeltzer AA, Andrades P, Hamdi M, et al. The use of a single set of internal mammary recipient vessels in bilateral free flap breast reconstruction. *Plast Reconstr Surg*. 2011;127:153e–154e.
5. Satake T, Muto M, Kou S, et al. Contralateral unaffected breast augmentation using zone IV as a SIEA flap during unilateral DIEP flap breast reconstruction. *J Plast Reconstr Aesthet Surg*. 2019;72:1537–1547.
6. Rabey NG, Lie KH, Kumiponjera D, et al. Salvage of failed prosthetic breast reconstructions by autologous conversion with free tissue transfers. *Eplasty*. 2013;13:e32.
7. Levine SM, Lester ME, Fontenot B, et al. Perforator flap breast reconstruction after unsatisfactory implant reconstruction. *Ann Plast Surg*. 2011;66:513–517.
8. Visser NJ, Damen TH, Timman R, et al. Surgical results, aesthetic outcome, and patient satisfaction after microsurgical autologous breast reconstruction following failed implant reconstruction. *Plast Reconstr Surg*. 2010;126:26–36.
9. Gurunluoglu R, Shafighi M, Schwabegger A, et al. Secondary breast reconstruction with deepithelialized free flaps from the lower abdomen for intractable capsular contracture and maintenance of breast volume. *J Reconstr Microsurg*. 2005;21:35–41.
10. Banwell M, Trotter D, Ramakrishnan V. The thoracodorsal artery and vein as recipient vessels for microsurgical breast reconstruction. *Ann Plast Surg*. 2012;68:542–543.
11. Schwabegger AH, Gschnitzer C, Ninkovic MM. Contour deformity at the internal mammary recipient site. *Br J Plast Surg*. 1999;52:674.
12. Antony AK, Kamdar M, Da Lio A, et al. Technique of internal mammary dissection using pectoralis major flap to prevent contour deformities. *Plast Reconstr Surg*. 2009;123:1674–1675.
13. Boutros SG. Double venous system drainage in deep inferior epigastric perforator flap breast reconstruction: a single-surgeon experience. *Plast Reconstr Surg*. 2013;131:671–676.
14. Ali R, Bernier C, Lin YT, et al. Surgical strategies to salvage the venous compromised deep inferior epigastric perforator flap. *Ann Plast Surg*. 2010;65:398–406.
15. Krishnan NM, Purnell C, Nahabedian MY, et al. The cost effectiveness of the DIEP flap relative to the muscle-sparing TRAM flap in postmastectomy breast reconstruction. *Plast Reconstr Surg*. 2015;135:948–958.
16. Atherton DD, Hills AJ, Moradi P, et al. The economic viability of breast reconstruction in the UK: comparison of a single surgeon's experience of implant; LD; TRAM and DIEP based reconstructions in 274 patients. *J Plast Reconstr Aesthet Surg*. 2011;64:710–715.
17. Salgarello M, Visconti G, Barone-Adesi L, et al. The retrograde limb of internal mammary vessels as reliable recipient vessels in DIEP flap breast reconstruction: a clinical and radiological study. *Ann Plast Surg*. 2015;74:447–453.