Comparison of the Pedicled Latissimus Dorsi Flap with Immediate Fat Transfer versus Abdominally Based Free Tissue Transfer for Breast Reconstruction

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Background: Abdominally based free tissue transfer (FTT) and latissimus dorsi and immediate fat transfer (LIFT) procedures are both fully autologous options for breast reconstruction. The former is specialized and requires comfort with microsurgical technique, whereas LIFT combines a common set of techniques familiar to all plastic surgeons. Comparing the two methods for clinical effectiveness and complications for equivalency in outcomes may help elucidate and enhance patient decision-making.

Methods: A retrospective review of a prospectively maintained database between March of 2017 and July of 2018 was performed to compare the LIFTs and FTTs performed by the senior surgeon. Outcomes of interest included postoperative complications, flap success, and follow-up revision and fat-grafting procedures.

Results: Sixty-five breasts were reconstructed by FTT; and 31 breasts were reconstructed with LIFT. Demographics were similar ($p > 0.05$). LIFT had a shorter length of operation time (343 ± 128 minutes versus 49 ± 137 minutes) ($p < 0.0001$) and a shorter length of stay (1.65 ± 0.85 days versus 3.83 ± 1.65 days) ($p < 0.001$). FTTs had a shorter time until drain removal (13.3 ± 4.3 days versus 24.0 ± 11.2 days) ($p < 0.0001$). The number of major (requiring operation) and minor complications were not statistically different (i.e., FTTs, 20.0 percent major and 27.7 percent minor; LIFT, 12.9 percent major and 19.35 percent minor) ($p > 0.05$). The need for revisions (FTTs, 0.80 ± 0.71; LIFT, 0.87 ± 0.71) and fat grafting (FTTs, 41.54 percent; LIFT, 58.8 percent) was not statistically different ($p > 0.05$).

Conclusions: Both the LIFT and abdominally based FTT have similar outcomes and complication rates. However, LIFT may be preferred in patients who require shorter operation times. The LIFT may be the fully autologous breast reconstruction of choice for nonmicrosurgeons. (*Plast. Reconstr. Surg.* 146: 137e, 2020.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, III.

Autologous breast reconstruction has been shown to have better general and aesthetic patient satisfaction rates than implant-based reconstruction.[1–3] The principal abdominally based free flaps used in breast reconstruction are the free transverse rectus abdominis musculocutaneous (TRAM), deep inferior epigastric artery perforator (DIEP), and superficial inferior epigastric artery (SIEA) flaps. The latissimus dorsi and immediate fat transfer (LIFT) procedure is a latissimus dorsi flap with immediate

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Received for publication June 3, 2019; accepted January 29, 2020.

DOI: 10.1097/PRS.0000000000007027

Disclosure: *Dr. Song receives royalties from Elsevier for Plastic Surgery, 3rd and 4th editions, and from Biomet Microfixation for Sternalock. The other authors have no disclosures to report.*

Related digital media are available in the full-text version of the article on www.PRSJournal.com.

fat grafting that may offer an acceptable alternative when purely autologous reconstruction is desired.[4–6] The latissimus dorsi pedicled flap has long been used in autologous breast reconstruction.[7–9] A latissimus dorsi flap alone is often limited in volume and historically has been augmented with an implant. However, advances in fat-grafting technique and technology has paved the way for reliable large volume fat transfer in a single setting. Using fat grafting in lieu of an implant for adequate breast volume avoids risks of a prosthetic device such as capsular contracture, device extrusion, device migration, or periprosthetic infection.[9]

Advantages of the LIFT procedure are the ability to use the patient's own tissues without the need for microsurgical expertise. It can also be used to salvage previous attempts at flap-based or prosthetic reconstructions.[4] Disadvantages are the need for the lateral decubitus position, need for intraoperative repositioning, large back scar, and the possibility of upper extremity donor-site morbidity such as functional shoulder loss of strength.

However, outcomes between the LIFT versus abdominally based free tissue transfer (FTT) reconstruction remain to be discerned. We present the first comparison study between LIFT versus abdominally based FTT for breast reconstruction. We compared outcomes and revision rates of both procedures using data from our single-surgeon experience over a 15-month period to preclude variability in indication, technique, and postoperative protocol. Specifically, we looked at differences in total operative time, length of stay, surgical outcomes, and revision procedures. Comparing both procedures by a single surgeon with the same protocols allows for improved ability to discuss variations in surgical risk between the reconstructive options, patient-doctor decision-making, and patient expectations regarding secondary operations. Variables associated with multisurgeon/multicenter trials are thus mitigated in this comparison and may serve as a preamble to establish equivalency in outcomes for further studies.

PATIENTS AND METHODS

Retrospective Review

After institutional review board approval (IRB 2018-173), a retrospective review was performed to analyze outcomes of patients who underwent the LIFT procedure or abdominally based FTT between March of 2017 and July of 2018 performed by the senior surgeon. Data were analyzed per breast with the exception of length of operation, which was analyzed per patient. Outcomes of interest included postoperative recipient-site complications, flap success, and revision and fat-grafting procedures. Examples of postoperative complications were as follows: infection or cellulitis, seroma, dehiscence, hematoma, flap failure, and flap vessel issues (i.e., thrombosis, ischemia).

Patient Selection

We offer both abdominally based and LIFT flaps to all primary breast reconstruction patients during preoperative consultation regardless of body mass index. However, we do not present abdominally based FTT and LIFT reconstruction as interchangeable approaches. Instead we counsel patients that the LIFT procedure is an alternative to the gold standard DIEP flap in appropriate patients. Factors that may be an indication for the LIFT procedure include lack of abdominal adiposity, hypercoagulable disorder, or inability to tolerate a prolonged operative and postoperative course. Furthermore, we prefer the LIFT procedure for salvage after both autologous and prosthetic-based reconstruction.

Surgical Methods

The LIFT procedure is performed as described previously.[6] Key tenets of the approach include harvest of an extended latissimus dorsi flap and injection of fat in situ before release from the spinous processes. In situ fat transfer is crucial to maximize operator control while injecting into the latissimus muscle itself, the subcutaneous tissue, and the skin paddle. We preferentially inject fat into the aspect of the flap that will become the inferior breast pole. Fat can be safely injected into the muscle, as there is not a large plexus of veins. Rather, the vessels are small and the area directly surrounding the vascular pedicle is spared.

Postoperatively, all patients are admitted to a unit at our institution where the nurses and staff are trained in the nuances of flap management. We follow the enhanced recovery after surgery protocol for all breast reconstruction patients, as described previously.[10] We do not use volumetric imaging to measure fat resorption. However, we estimate 60 to 80 percent graft take in the well-vascularized muscle bed provided by the latissimus and perform revision fat grafting at 3 months after the index operation if sufficient volume is not maintained.

Statistical Analysis

We calculated descriptive statistics for the outcomes of interest. Continuous variables between the two groups were compared using the two-sample *t* test or Wilcoxon rank sum *t* test as appropriate based on normality of data. Categorical variables were compared using Pearson chi-square and Fisher's exact test, as appropriate. Logistic regression analysis was performed to examine the odds of complications between the abdominally based FTT and LIFT cohorts. A two-tailed value of $p < 0.05$ was considered statistically significant. All statistical analyses were performed using SAS Version 9.3 (SAS Institute, Inc., Cary, N.C.).

RESULTS

Sixty-five breasts were identified as having undergone abdominally based FTT in 46 patients and 31 breasts had undergone the LIFT procedure in 25 patients. The abdominally based free flaps included 43 DIEP (66.15 percent), 20 muscle-sparing TRAM (30.77 percent), and two SIEA (3.08 percent) flaps. Demographics were not statistically different between the LIFT and abdominal flap cohorts ($p > 0.05$) as represented in Table 1. This included age (abdominally based FTT, 51.9 ± 9.9 years; LIFT, 56.4 ± 11.1 years), body mass index (abdominally based FTT, 29.9 ± 4.76 kg/m^2; LIFT, 28.2 ± 6.2 kg/m^2), diabetes (abdominally based FTT, 7.7 percent; LIFT, 12.9 percent), and current tobacco use (abdominally based FTT, 6.2 percent; LIFT, 9.7 percent) (all $p > 0.05$). In addition, the use of neoadjuvant chemotherapy and adjuvant radiation therapy was not statistically different between the two groups ($p > 0.05$) (Table 1).

Mastectomy was performed for cancer or ductal carcinoma in situ in 44 (67.7 percent) abdominally based FTT patients and 29 (93.5 percent) LIFT patients. Prophylactic mastectomies were performed in 16 abdominal flap patients (24.6 percent) (with four recorded as having *BRCA* gene mutations, and the remainder as having contralateral breast cancer) and two (6.5 percent) LIFT patients (one with *BRCA* mutation, and the remainder for contralateral breast cancer).

For abdominally based FTT, 28 (43.1 percent) were immediate and 37 (56.9 percent) were delayed. Among patients receiving abdominally based FTT, 11 (16.9 percent) had nipple-sparing mastectomies, 25 (38.5 percent) had skin-sparing mastectomies, and 29 (44.6 percent) were not specified because of mastectomies being performed at outside hospitals and/or distant history of breast reconstruction. For the LIFT procedure, 16 (51.6 percent) were immediate and 15 (48.4 percent) were delayed. Incision types before LIFT reconstruction included seven nipple-sparing mastectomies (22.6 percent), 17 skin-sparing mastectomies (54.8 percent), and seven not specified (22.6 percent). The proportions of immediate versus delayed cases were similar between cohorts ($p = 0.4325$). For abdominally based FTT, 38 flaps (58.5 percent) were bilateral cases; for LIFT flaps, 12 (38.7 percent) were bilateral ($p = 0.0701$) (Table 2). The mean volume of fat graft used for the LIFT procedure was 204.0 ± 114.6 ml.

Overall, the LIFT procedure had a shorter length of operation (343 ± 128 minutes) compared with abdominally based FTT (491 ± 137 minutes) ($p < 0.0001$) (Table 2). When analyzing length of operation by laterality and timing of reconstruction, LIFT procedures remained significantly shorter in the immediate unilateral ($p = 0.0410$), delayed unilateral ($p = 0.0009$), and delayed bilateral groups ($p = 0.0155$). However, there was no significant difference in length of operation between LIFT and abdominally based FTT in patients undergoing immediate bilateral reconstruction ($p = 0.9361$).

Table 1. Demographics of the Abdominally Based FTT versus LIFT Autologous Breast Reconstruction Cohorts*

Characteristic	Abdominally Based FTT (%)	LIFT (%)	*p*
No. of breasts			
Total	65	31	
Right	30 (46.2)	15 (48.4)	
Left	35 (53.8)	16 (51.6)	
Mean age ± SD, yr	51.9 ± 9.9	56.4 ± 11.1	0.0514
Mean BMI ± SD, kg/m^2	29.9 ± 4.76	28.2 ± 6.2	0.1453
DM	5 (7.7)	4 (12.9)	0.4640
HTN	19 (29.2)	9 (29.0)	0.9840
Connective tissue disease	0 (0)	1 (3.23)	0.3229
Current active smoking status (or quit <4 wk)	4 (6.2)	3 (9.7)	0.6778
Patients with neoadjuvant chemotherapy	15 (23.1)	8 (25.8)	0.7695
Patients with adjuvant radiation therapy	18 (27.7)	7 (22.6)	0.5936

BMI, body mass index; DM, diabetes mellitus; HTN, hypertension.
*No statistical differences between demographics were detected when comparing the two groups ($p > 0.05$).

Table 2. Operative Data of the Abdominally Based FTT versus LIFT Autologous Breast Reconstruction Cohorts*

Characteristic	Abdominally Based FTT (%)	LIFT (%)	*P*
Timing of reconstruction			0.4325
Immediate	28 (43.1)	16 (51.6)	
Delayed	37 (56.9)	15 (48.4)	
Laterality of reconstruction			0.0701
Unilateral	27 (41.5)	19 (61.3)	
Bilateral	38 (58.5)	12 (38.7)	
Mastectomy incision type			
NSM	11 (16.9)	7 (22.6)	
SSM	25 (38.5)	17 (54.8)	
Other/not recorded	29 (44.6)	7 (22.6)	
Mean free flap weight ± SD, g	755.8 ± 227.6	N/A	
Mean free flap ischemia time ± SD, min	50.5 ± 13.4	N/A	
Mean volume of fat graft ± SD, ml	N/A	204.0 ± 114.6	
Mean length of operation ± SD, min	491.4 ± 137.2	342.6 ± 127.8	<0.0001
Delayed unilateral	425.7 ± 136.3	250.0 ± 59.5	<0.0001
Immediate unilateral	448.9 ± 122.5	345.9 ± 74.5	0.0410
Delayed bilateral	570.0 ± 84.5	397.5 ± 31.8	0.0155
Immediate bilateral	555.0 ± 184.1	563.3 ± 84.3	0.9361

NSM, nipple-sparing mastectomy; SSM, skin-sparing mastectomy; N/A, not applicable.
*Length of operation is analyzed per patient; all other variables are analyzed per breast.

Similarly, the LIFT procedure had a shorter length of hospital stay (1.65 ± 0.85 days) than the abdominally based FTT procedure (3.83 ± 1.65 days) ($p < 0.0001$). Follow-up data such as drain removal, complications, and reoperation rates are shown in Table 3. Abdominally based FTT had a shorter time until drain removal (13.3 ± 4.3 days) compared with LIFT (24.0 ± 11.2 days). The number of overall, major (requiring operation), and minor complications including infection/cellulitis, seroma, dehiscence, hematoma, and flap issues and/or failure were also not statistically different (abdominally based FTT, 20.0 percent major and 27.7 percent minor; LIFT, 12.9 percent major and 19.4 percent minor).

Average follow-up time was 8 ± 4.6 months for the abdominally based FTT patients and 7.9 ± 4.2 months for the LIFT patients ($p > 0.05$). The percentage of a reoperation for any ipsilateral reconstruction, including further fat grafting, implant placement, mastopexy, and so forth was not statistically different (abdominally based FTT, 66.2 percent; LIFT, 71.0 percent; $p = 0.6372$). A statistical difference was also not detected when comparing the mean number of subsequent revision procedures between the two groups (abdominally based FTT, 0.80 ± 0.71; LIFT, 0.87 ± 0.72; $p = 0.6179$). When analyzing fat grafting revision procedures alone, the percentage undergoing reoperation for fat grafting was also not statistically different (abdominally based FTT, 41.5 percent; LIFT, 54.8 percent; $p = 0.2214$). A statistical difference was also not detected when comparing the mean number of additional follow-up fat-grafting procedures between the two groups (abdominally based FTT, 0.45 ± 0.56; LIFT, 0.68 ± 0.70; $p = 0.0865$). The total amount of fat graft used in these secondary procedures was not statistically different (abdominally based FTT, 110.4 ± 120.7 cc; LIFT, 143.4 ± 90.3 cc; $p = 0.3274$). Examples of postoperative results of the LIFT procedure are shown in Figures 1 and 2. [**See Figure, Supplemental Digital Content 1**, which shows an example of the LIFT procedure and its postoperative result in a 49-year-old woman with a history of left breast cancer who underwent left skin-sparing mastectomy and immediate reconstruction with a tissue expander. Four months later, the patient underwent subsequent LIFT reconstruction with a total of 320 ml of fat graft. Anterior (*above, left*), right lateral (*above, center*), and left lateral (*above, right*) preoperative photographs. Anterior (*below, left*), right lateral (*below, center*), and left lateral (*below, right*) photographs 10 months after LIFT, ***http://links.lww.com/PRS/E114***.] Also, an example of an abdominally based FTT is shown in Figure 3. [**See Figure, Supplemental Digital Content 2**, which shows an example of abdominally based FTT in addition to the postoperative result of the muscle-sparing free TRAM flap in a 43-year-old woman with a history of right breast cancer who had a bilateral total mastectomy with immediate bilateral muscle-sparing free TRAM flaps. The muscle-sparing free TRAM flap is one of the abdominally based free flaps that can be used for breast reconstruction. Anterior (*above, left*), right lateral (*above, center*), and left lateral (*above, right*) preoperative photographs. Anterior (*below, left*), right lateral (*below, center*), and left lateral (*below, right*) photographs 10 months after muscle-sparing free TRAM flap surgery, ***http://links.lww.com/PRS/E115***.]

F1, F2

Table 3. Postoperative Follow-Up Data of the Abdominally Based FTT versus LIFT Autologous Breast Reconstruction Cohorts*

	Abdominally Based FTT (%)	LIFT (%)	*p*
Drains			
Time until drain removal ± SD, min	13.3 ± 4.3	24.0 ± 11.3	<0.0001
Complications: major vs. minor			
Total	29 (44.6)	11 (35.5)	0.3961
Major (operative)	13 (20.0)	4 (12.9)	0.5689
Minor (nonoperative)	18 (27.7)	6 (19.4)	0.3777
Complications: by type			
Infection or cellulitis	4 (6.2)	3 (9.7)	0.6778
Seroma	6 (9.23)	7 (22.6)	0.0739
Dehiscence	9 (12.9)	3 (9.7)	0.7458
Hematoma	10 (15.4)	1 (3.2)	0.0977
Flap failure	5 (7.7)	0 (0)	0.1714
Flap vessel issues (thrombosis, ischemia)	6 (9.2)	0 (0)	0.1724
Follow-up revision and fat-grafting procedures			
Reoperation for any ipsilateral revision (e.g., fat grafting, implant placement, mastopexy)	43 (66.2)	22 (71.0)	0.6372
Mean of total no. of ipsilateral revisions ± SD	0.80 ± 0.71	0.87 ± 0.72	0.6179
Reoperation for fat grafting	27 (41.5)	17 (54.8)	0.2214
Mean total amount of fat graft ± SD, cc	110.4 ± 120.7	143.4 ± 90.3	0.3274
Total requiring contralateral revisions	37 (56.9)	13 (44.8)	0.2777

*Complications were analyzed in two ways: (1) by major (requiring follow-up operation) and minor (no follow-up operation required) and (2) complication type (may or may not have required a follow-up operation).

Fig. 1. Example postoperative result of delayed LIFT without prior tissue expansion in a 40-year-old woman with a history of left breast cancer who underwent left skin-sparing mastectomy along with chemotherapy and radiation therapy 2 years before presentation. Abdominally based free flap reconstruction was contraindicated because of a history of hypercoagulability, including multiple pulmonary embolisms. She presented without prior tissue expansion and subsequently underwent left LIFT reconstruction. Additional fat grafting and contralateral symmetrizing reduction were performed at 3 months after the index operation. The total fat graft used in all procedures was 455 ml. Anterior (*above, left*), right lateral (*above, center*), and left lateral (*above, right*) preoperative photographs. Anterior (*below, left*), right lateral (*below, center*), and left lateral (*below, right*) photographs 6 months after LIFT.

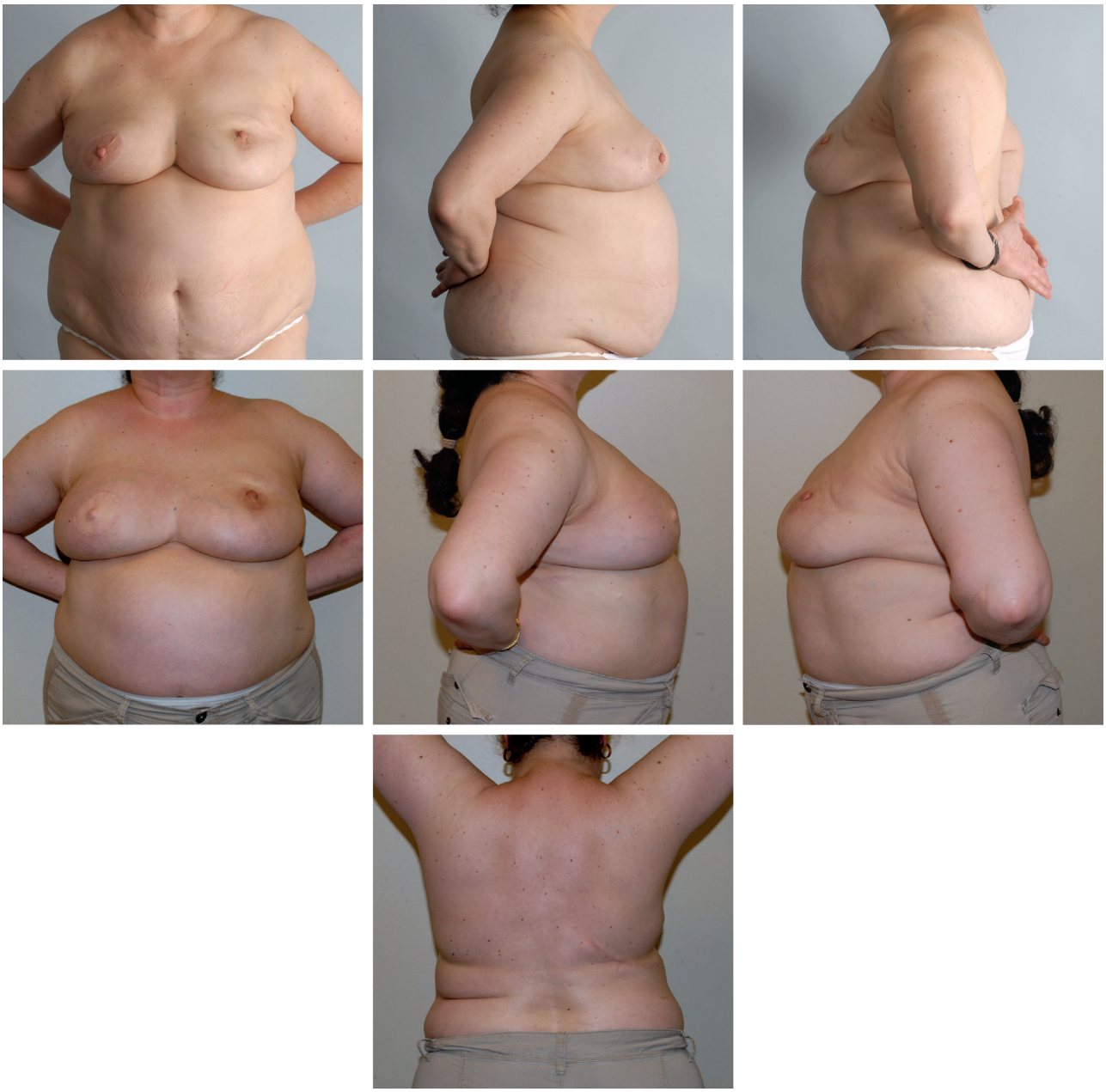

Fig. 2. Example postoperative result of delayed LIFT in a 49-year-old woman with a history of right breast cancer who underwent right skin-sparing mastectomy and immediate LIFT reconstruction. Abdominally based free flap reconstruction was contraindicated because of a history of multiple cesarean deliveries. Additional fat grafting and nipple reconstruction were performed at 5 months after the index operation. The total fat graft used in all procedures was 385 ml. Anterior (*above, left*), right lateral (*above*, *center*), and left lateral (*above*, *right*) preoperative photographs. Anterior (*center*, *left*), right lateral (*center*, *center*), and left lateral (*center*, *right*) postoperative photographs. (*Below*) Posterior donor-site photograph 17 months after LIFT.

Logistic regression analysis was also performed to examine the odds of complications between the two cohorts. No statistically significant difference in the odds of any complications or individual complications such as seromas, cellulitis, dehiscence, or hematoma was detected between the abdominally based FTT and LIFT groups ($p > 0.05$). There was also no difference in the odds of flap failure, flap issues, or need for reoperation for complications between the two cohorts ($p > 0.05$).

DISCUSSION

We present the only direct comparison study between the LIFT procedure versus abdominally based FTT for breast reconstruction performed

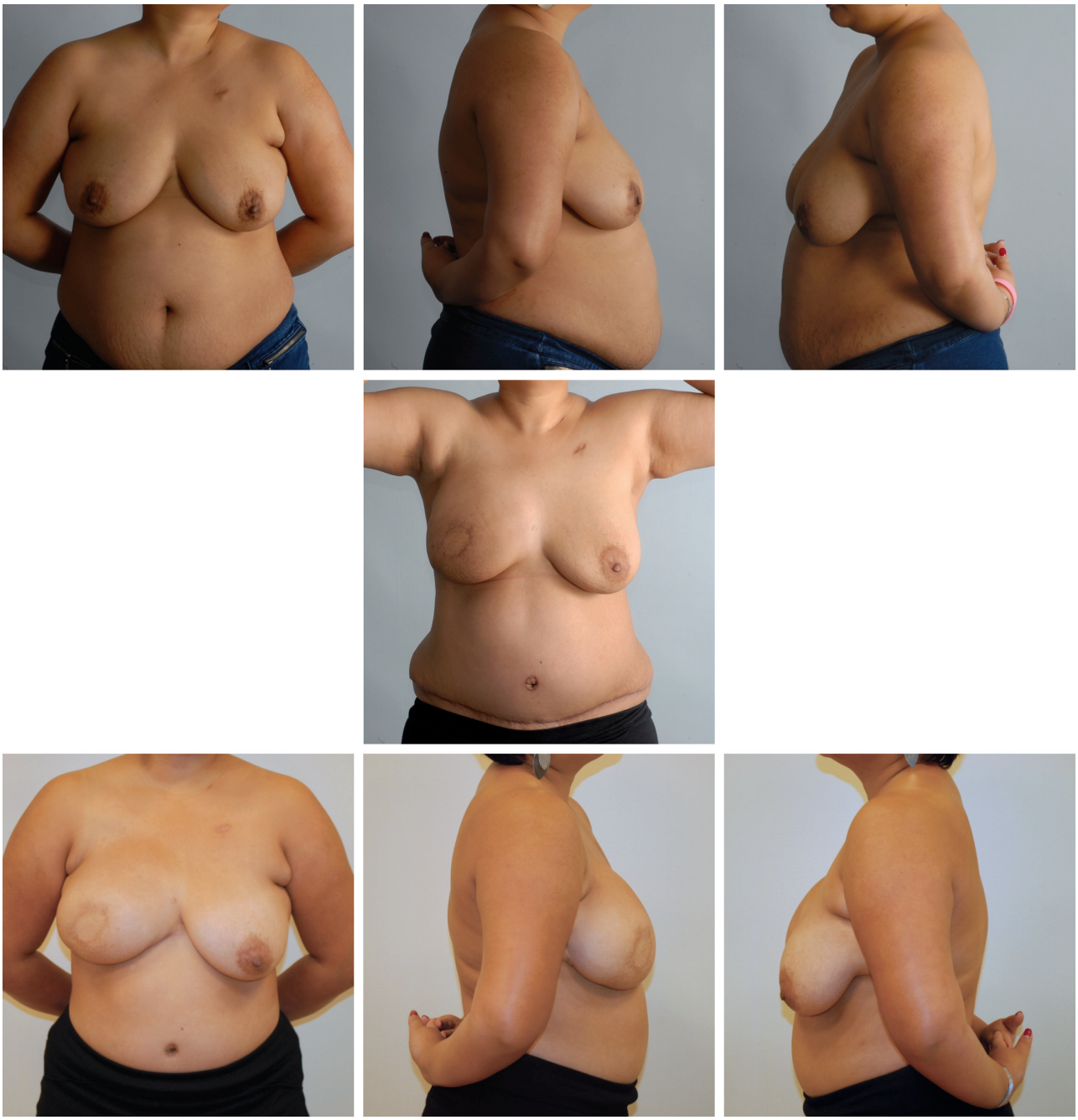

Fig. 3. Example postoperative result of the deep inferior epigastric artery (DIEP) flap in a 35-year-old woman with a history of right breast cancer who underwent right skin-sparing mastectomy and immediate reconstruction with a left DIEP flap to the right breast. Anterior (*above*, *left*), right lateral (*above*, *center*), and left lateral (*above*, *right*) preoperative photographs. (*Center*) Donor site 2 months after DIEP flap surgery. Anterior (*below*, *left*), right lateral (*below*, *center*), and left lateral (*below*, *right*) photographs 11 months after DIEP flap surgery.

by a single surgeon with the goal of mitigating the multiple technique and metric variations associated with multisurgeon trials. The LIFT procedure has the advantage of a purely autologous-based reconstruction such as the DIEP flap but without the additional length of stay, operative time, or need for microsurgery. When additional breast volume is often needed, the latissimus dorsi flap can be combined with either a prosthesis or autologous fat grafting. However, fat grafting eliminates the risks associated with prosthetic devices, making LIFT an attractive option for women who desire purely autologous reconstruction and surgeons who desire to provide it.

The LIFT option may also be preferred in patients who have had multiple abdominal operations in the past, which can potentially damage perforators from the deep inferior epigastric system. The LIFT is also preferred over abdominally based FTT in patients who may need cardiac bypass in the future, which would preclude the use of the internal mammary artery as the recipient artery. Based on the similar complication rates and requirements for secondary revision procedures found in our study, both abdominally based FTT and the LIFT procedure are excellent options for patients desiring purely autologous breast reconstruction. Most major outcome measures such as complication rates, flap failure rates, the need for reoperation for complications, and the need for revision procedures were not statistically different between the two groups.

Furthermore, the LIFT procedure may be preferred in patients that require shorter operation times because of comorbid medical conditions. LIFT procedures remained significantly shorter in all groups except for immediate bilateral reconstruction; the difference could be attributable to the confounding factors of the inability to operate simultaneously with the breast team and the need for two changes in patient position. Our results also showed that patients with the LIFT procedure had a shorter length of hospital stay than abdominally based FTT procedures. This is similar to findings of previously published trials; the length of stay for abdominally based FTT procedures has been found to be significantly higher than for latissimus dorsi flaps with implants (4.6 days versus 2.5 days; $p < 0.05$).[11] Because of the shorter length of stay associated with LIFT compared to abdominally based FTT, LIFT may be the more cost-effective option. The mean charge per flap has been reported to be $40,704 for the traditional latissimus dorsi flap (without implants or fat grafting), $82,320 for the DIEP flap, and $69,909 for the free TRAM flap.[11] The mean hospital cost per flap was $12,017 for the latissimus dorsi flap, $23,616 for the DIEP flap, and $20,756 for the free TRAM flap. In addition, although not directly studied in this investigation, one can infer that in patients with severe obesity with severely protuberant abdomens, the LIFT procedure may be the better autologous alternative compared with the abdominally based FTT because of the lack of risk of abdominal donor-site problems.

A study from Levine et al.[12] in 2012 compared outcomes between delayed abdominally based autologous reconstruction (e.g, TRAM, DIEP, and SIEA flaps) versus pedicled latissimus dorsi flaps plus implants. All subjects in the study had a history of breast irradiation and all flaps were delayed, whereas our study included both immediate and delayed flaps and patients with and without a history of irradiation. Levine et al. found that patients with abdominally based reconstructions had fewer complications and flap failures compared with latissimus dorsi flap plus implant reconstructions (28.0 percent versus 30.4 percent, and 2.7 percent versus 5.4 percent, respectively); however, these findings were not statistically different. This could be attributed to the use of prosthetics. In contrast, we found a nonstatistically significant higher rate of complications for abdominally based FTT compared with the LIFT procedure (abdominally based FTT, 20.0 percent major and 27.7 percent minor; LIFT, 12.9 percent major and 19.4 percent minor).

Another study from Bennett et al.[13] analyzed complication rates of 2343 patients undergoing various types of breast reconstruction. For abdominally based FTT, the authors found complication rates of 73.9 percent ($n = 48$ of 65) in SIEA flaps, 47.4 percent ($n = 185$ of 390) in DIEP flaps, and 35.8 percent ($n = 34$ of 95) in free TRAM flaps, with an average of 48.5 percent for all abdominally based free flaps. They found a complication rate of 39.4 percent ($n = 28$ of 71) in traditional latissimus dorsi flaps. The results of these studies combined with our findings suggest that differences in complication rates between autologous abdominally based FTT and latissimus dorsi flaps for breast reconstruction are mixed and may be surgeon dependent and possibly predicated on the use of an implant.

The small patient numbers represent a limitation of this study and may explain why no statistical difference was observed in complications between the two groups. Length of follow-up is also a limitation of this study; however, we believe that the importance of demonstrating our early results of the LIFT procedure outweighed this limitation given the recall of textured devices and subsequent increase in requests for implant removal and fully autologous reconstruction. Another possible limitation of our study is the measure of operating time. These times are recorded by operating room staff and reflect the points at which patients enter and leave the operating room. Therefore, the length of operation time does not necessarily indicate flap harvest time, because it can include variable times in patient intubation, surgical-site preparation, position changes, and other factors. Furthermore, extrapolation of our results may be limited, given

that this is a single-surgeon and single-institution study. However, for this first comparison of the LIFT versus abdominally based FTT, we wanted to exclude as much variability in indication, technique, and postoperative protocol as possible. Because of the desire to limit multiple variables often associated with disparate surgeon skill set, experience, and technique, it was valuable to perform a direct comparison.

Future directions include looking at long-term satisfaction of LIFT versus abdominally based FTT patients. Currently published studies are mixed regarding satisfaction between the traditional latissimus dorsi with and without prosthesis and abdominally based perforator free flaps (DIEP). A study from Yueh et al.[1] on 116 extended pedicled latissimus dorsi (90 with prosthesis and 26 without prosthesis) and 117 DIEP flaps reports a higher level of general satisfaction with the DIEP flap compared with the latissimus dorsi flap (80.3 percent versus 56.9 percent; $p < 0.001$). In comparison, a smaller study by Lindegren et al.[14] on 24 DIEP and 21 latissimus dorsi flaps with a prosthesis showed that patients' opinions regarding overall aesthetic results were not significantly different ($p > 0.05$), but patients were less satisfied with the DIEP than the latissimus dorsi donor-site scar ($p = 0.036$). This study also compared health-related quality of life between the DIEP and latissimus dorsi flaps with implant and found no significant difference (including emotional and social outcomes).[14] The impact on satisfaction and other patient-reported outcomes of adding a prosthesis to otherwise autologous breast reconstruction remains unclear.

It would be worthwhile to repeat this same analysis with DIEP flaps and the LIFT flap because the LIFT solely uses the patient's own autologous fat tissue rather than a prosthesis, which may ultimately increase satisfaction in the long run, especially given increasing patient concerns regarding breast implant-associated anaplastic large cell lymphoma. Another outcome that warrants future investigation is perioperative and postoperative pain. A study published in 2004 by Misra et al.[15] found that DIEP flap patients require less postoperative morphine than traditional latissimus dorsi flap patients (0.21 mg/kg versus 0.47 mg/kg; $p < 0.001$). However, this was before the use of enhanced recovery after surgery for breast reconstruction, which has greatly reduced opioid use after breast reconstruction. Thus, further investigation, including other abdominally based free flaps and latissimus dorsi flaps augmented solely with autologous fat, is warranted.

CONCLUSIONS

We present the only direct comparison study of LIFT versus abdominally based FTT for breast reconstruction. Both procedures are excellent purely autologous breast reconstructive options. The LIFT procedure may be the better autologous option in patients that require shorter operation times because of comorbid medical conditions or with severe obesity, which may result in donor-site problems. LIFT may also be the more cost-effective option because of the shorter length of stay associated with the LIFT compared with the abdominally based FTT. Furthermore, LIFT is an excellent autologous option for the nonmicrosurgeon to achieve outcomes and complications similar to those of the gold-standard DIEP and other abdominally based free flaps. The LIFT procedure is key to optimizing outcomes and making wholly autologous breast reconstruction accessible to all surgeons and patients.

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