Outcomes Evaluation Following Bilateral Breast Reconstruction Using Latissimus Dorsi Myocutaneous Flaps

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Abstract: The demand for bilateral breast reconstruction has recently increased. Although numerous options exist, the latissimus dorsi myocutaneous flap remains a popular technique. The benefits of additional autologous coverage are evident; however, donor site morbidity does exist. The purpose of this report is to evaluate our experience with bilateral latissimus dorsi breast reconstructions, focusing on donor site morbidity and patient satisfaction. All patients who underwent bilateral latissimus dorsi breast reconstruction at Emory University Hospital, were evaluated and included in the series. Data points queried included patient demographics, risk factors, radiation therapy, timing of the procedure (immediate or delayed), type of procedure (latissimus dorsi only, latissimus dorsi with expander, latissimus dorsi with implant), and outcomes. Outcomes included >1 additional operation, any breast and any donor-site complications. A patient satisfaction survey was performed evaluating outcomes such as aesthetic results, general satisfaction, morbidities, and functional assessment. Comparisons were made using radiation therapy, timing of reconstruction, and type of reconstruction as variables. Eighty-three patients underwent bilateral latissimus dorsi breast reconstruction with an average follow-up of 2.3 years. The method of reconstruction included latissimus dorsi with expander (n = 54), latissimus dorsi only (n = 17), and latissimus dorsi with implant (n = 12). Breast complications occurred in 34% of the patients with radiation therapy being a significant risk factor. The average number of secondary operations was 2.3 with the expander group resulting in an increased need for additional procedures. Overall patient satisfaction was 3.93/5, with the average symmetry score being 3.82/5, shape 3.84/5, nipple position 3.92/5, and inframammary fold (IMF) position 4/5. The majority of patients (n = 28/37) reported no pain (0/5) at the time of the survey. Most patients (n = 33/37) reported no impairment in daily activities, however, some did report impairment in physical activity, decreased range of motion (ROM), and pain. The latissimus dorsi remains a reliable option for bilateral breast reconstruction. Although patient satisfaction with this approach remains high, functional impairment can occur and needs to be appropriately discussed.

Key Words: breast reconstruction, latissimus dorsi, skin sparing mastectomy, radiation, functional impairment

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The latissimus dorsi myocutaneous flap has been a very reliable and predictable option for postmastectomy breast reconstruction since its reintroduction in the 1980s.[1–4] Although the literature seems to focus more on abdominal flaps and implant reconstructions, the latissimus dorsi technique remains a popular method and an excellent alterative for many reasons.[5] The benefits over implant reconstructions include the additional soft tissue coverage, use of a skin island, and the

feasibility of implant-based reconstruction in irradiated patients or in patients' otherwise not good candidates for abdominal flaps.[6] Along with genetic testing, and the increased incidence of bilateral mastectomies, we have similarly noticed an increase in the number of patients seeking bilateral breast reconstructions. It has been shown that bilateral prophylactic mastectomies in high-risk patients or contralateral prophylactic mastectomy in women with breast cancer demonstrate a 90% and 94% overall risk reduction.[7,8] These particular patients are often younger, and either have no desire to undergo transverse rectus abdominis myocutaneous (TRAM) flap reconstructions or do not have enough abdominal tissue for both sides. Expander implant reconstruction remains an excellent choice for these bilateral mastectomy defects; however, the latissimus dorsi flap (LDF) with the addition of autologous tissue to the equation often results in a more natural feeling and appearing breast. Although donor morbidity does exist following latissimus dorsi harvest, the long-term extent is unlike that often observed following TRAM flap harvest. However, the question becomes whether the benefits of adding the autologous tissue with the latissimus muscle in these cases outweighs the risk of donor site morbidities especially in bilateral reconstructions. The purpose of this series was to evaluate the feasibility of bilateral reconstruction using the latissimus dorsi myocutaneous flap with attention to outcomes and patient satisfaction regarding breast aesthetics and donor site morbidity. Bilateral reconstructions also provide a contralateral control for comparisons in patients who have had unilateral breast irradiation, a topic which in the literature with latissimus dorsi muscle flaps is limited, and will be discussed in more detail in this report.

METHODS

A retrospective chart review was performed on all patients who underwent postmastectomy breast reconstruction using bilateral latissimus dorsi flaps at Emory University Hospital between 1981 and 2007. Data points queried included patient demographics, risk factors, radiation therapy, timing of the procedure (immediate or delayed), type of procedure (latissimus dorsi only, latissimus dorsi with expander, latissimus dorsi with implant), and outcomes. The outcomes included breast and donor site complications, additional surgical procedures, recurrence rate, and mortality. Comparisons were made using 3 variables: (1) timing of reconstruction, (2) type of reconstruction, and (3) radiation therapy.

Outcomes measures were standardized for simplicity into >1 additional operation, any breast or any donor-site complication. Additional outcome data were taken from a patient satisfaction survey, performed via phone conversation with patients at least 6 months following their reconstruction. The data points queried included their satisfaction with aesthetic results, general satisfaction, morbidities, and function. They were asked to rate their aesthetic result for symmetry, shape, nipple position, inframammary fold (IMF) position, and overall satisfaction on a scale from 0 to 5 (5 being the best). Pain was assessed on a scale from 0 to 5, with 0 being no pain and 5 being severe pain. Functional impairment and disability were also queried. Statistical analysis was performed (SSPS 15.0; SPSS Inc., Chicago, IL). Differences for scores were estimated by *t* tests for comparison of means with 2 populations, and

a 1-way analysis of variance for comparison with 3 populations. All tests were 2-sided. The level of significance was set at $P < 0.05$.

Surgical Technique

The surgical technique has evolved over the years, and will differ depending on the clinical situation. Once the mastectomy has been performed, it is important to identify the thoracodorsal vessels and the anterior portion of the latissimus dorsi muscle through the anterior approach. The latissimus dorsi muscle is dissected superiorly above the pedicle, and the plane beneath the latissimus muscle is then identified and dissected. This will facilitate harvest in the prone position. For bilateral muscle harvest, the patient is then repositioned in the prone position. The skin island is typically oriented in the relaxed skin tension lines and incised with the knife. Dissection is taken down to just beneath the Scarpa's fascia, and the fascia is elevated with the skin flaps keeping the sub-Scarpa's fat on top of the muscle. This will provide more coverage over the expander and provide more autologous volume if implants are not being used. The flap is elevated and passed into the breast pocket. The donor sites are then closed over drains in the usual fashion. The patient is repositioned in the supine position, and the thoracodorsal vessels are identified. The humeral insertion is taken down. Nerve division is not routinely performed, and typically based on surgeon preference. The tissue expander is then inflated with saline and positioned in the appropriate location at the level of the IMF. The entire tissue expander is then covered by the latissimus dorsi muscle and the skin island is inset. Expansion is started about 2 weeks following the reconstructions.

RESULTS

Demographics

A total of 83 patients underwent bilateral latissimus dorsi breast reconstruction at Emory from 1981 to 2007. The average age of the patient was 45.3 years (range, 32–71). Indications included invasive carcinoma (n = 45), in situ disease (n = 19), fibrocystic disease/hyperplasia/silicone complications (n = 16), and prophylactic (n = 3). The majority was skin-sparing type mastectomies, with 19 being modified radical mastectomy defects. The timing of reconstruction was bilateral immediate (n = 52), bilateral delayed (n = 22), and mixed (n = 8). The method of reconstruction included latissimus dorsi with expander (n = 54), latissimus dorsi only (n = 17), and latissimus dorsi with implant (n = 12). Risk factors included radiation therapy (n = 17), smoking (n = 22), systemic arterial hypertension or diabetes mellitus (n = 13), with patients having ≥2 risk factors. Of the 17 patients who were irradiated, 10 had preoperative radiation therapy, and 7 had postoperative radiation therapy. The average follow-up was 2.3 years (range, 4 months–12 years). About 81 patients were alive at follow-up.

Complications

A breast complication occurred in 34% (n = 28/83) of the patients, and included major infection (n = 6 breasts), minor infection (n = 8 breasts), skin necrosis (n = 8), seroma (n = 3), and extrusion (n = 1). The incidence of donor site complications was 23% (n = 18/79). These included seroma (9 on the right side, 16 on the left side), and infection (n = 7 backs). Radiation therapy was the only variable that was found to be a risk factor for breast complications (63% vs. 35%, $P = 0.05$). The incidence of breast complications in the patients who underwent preoperative radiation therapy was 60%, compared with 71% in patients who underwent postoperative radiation therapy ($P = 0.163$). The timing of the reconstruction was associated with an increased risk of donor site complications.

Outcome

The average number of secondary operations was 2.3 (range, 0–4) with the majority of patients (n = 49) requiring more than one

TABLE 1. Method of Reconstruction as a Variable for >1 Additional Procedure

Method	N	>1 Additional Procedure	
Latissimus dorsi	18	33%	
Latissimus dorsi with implant	11	18%	
Latissimus dorsi with expander	54	53%	$P = 0.05$

TABLE 2. Patient Satisfaction With Radiation and Timing as Variables

	Radiation n = 10	No Radiation n = 27	P	Immediate N = 27	Delayed n = 7	P
Symmetry score	3.60	3.92	0.52	3.83	3.86	0.97
Shape score	3.85	3.83	0.97	3.81	3.86	0.93
Nipple position	3.67	4.00	0.53	3.96	3.57	0.51
IMF position	3.80	4.07	0.48	4.04	4.86	0.69
Overall score	3.90	3.94	0.91	3.83	4.00	0.73

IMF indicates inframammary fold.

additional surgery. The average number of secondary procedures was 5.6 per patient. Radiation therapy and the timing of reconstruction were not associated with the need for additional procedures. Latissimus dorsi with expander reconstruction was more likely to require additional procedures (Table 1). Donor site scar revisions occurred in 7 patients (bilateral) and 4 patients (unilateral), and accounted for a small percentage of the secondary procedures. Bilateral latissimus dorsi reconstruction was the definitive reconstructive procedure in 97.5% of the cases. Two patients failed this method of reconstruction requiring a TRAM and a Rubens flap. Radiation therapy did not increase the need for additional operations.

Patient Satisfaction

The satisfaction survey was completed in 37 patients with an average follow-up of 1.8 years. Overall patient satisfaction was 3.93/5, with the average symmetry score being 3.82/5, shape 3.84/5, nipple position 3.92/5, and IMF position 4/5. There were no significant differences in the overall satisfaction and aesthetic scores when comparing radiation therapy and timing of the reconstruction (Table 2). The aesthetic scores were slightly lower in patients who received radiation therapy, however, not significant. Overall satisfaction in patients who underwent preoperative radiation therapy was 3.7, compared with 3.3 for those who had postoperative radiation therapy. The timing of reconstruction (immediate vs. delayed) similarly did not appear to significantly affect aesthetic results and patient satisfaction.

The method of reconstruction also did not significantly affect patient satisfaction, except for position of the IMF, which had a higher patient satisfaction in the implant and expander groups (Table 3).

Any breast or donor-site complication did not appear to significantly affect the patient satisfaction scores (Table 4).

Functional Impairment

The majority of patients (n = 28/37) reported no pain (0/5) at the time of the survey. Seven patients had a pain rating of 1–3/5 (minimal pain) and 3 patients had moderate pain (4/5). There were no patients with severe pain. Most patients (n = 33/37) reported no

impairment in daily activities, however, 10/37 did report some impairment in physical activities, most of these stating that their arms felt slightly weaker or stiff. When specifically queried about shoulder function 78% (n = 29/37) rated this as normal, 20% (n = 7/37) as slightly impaired, and 2% (n = 1/37) as significantly impaired. About 76% (n = 28/37) had no shoulder or back pain, 16% (n = 6/37) has some slight discomfort, and 8% (n = 3/37) had significant discomfort. Similarly, 78% (n = 29/37) had normal shoulder range of motion (ROM), 20% (n = 7/37) reported slightly decreased ROM and 2% (n = 1/37) with significant decrease in ROM. About 89% (n = 33/37) reported that they would do a bilateral latissimus flap reconstruction again. Most of the remarks regarding dissatisfaction with the procedure were related to donor site morbidity.

DISCUSSION

The latissimus dorsi myocutaneous flap is a safe and reliable method of breast reconstruction for bilateral mastectomy defects. Although not as quick as expander/implant reconstructions, we feel that the extra coverage (both soft tissue and skin) provides a breast form that is closer in consistency to autologous reconstructions (Figs. 1, 2). However, donor site morbidity does occur and although the potential long-term complications are unlike those occasionally encountered with the bilateral TRAM flap techniques, some functional impairment can occur and needs to be addressed.

Radiation therapy was associated with increased breast complications, however, did not influence patient satisfaction. Radiation therapy is a well-documented risk factor for increased complications in breast reconstruction.[9,10] Kroll reported a higher complication rate following latissimus dorsi reconstruction in previously irradi-

TABLE 3. Patient Satisfaction With Method of Reconstruction as Variable

	LD Only N = 7	LD With Implant N = 4	LD With Expander N = 26	P
Symmetry score	3.14	4.75	3.87	0.12
Shape score	3.43	4.75	3.81	0.19
Nipple position	3.43	5.00	3.92	0.24
IMF position	3.43	5.00	4.00	0.04
Overall score	3.43	5.00	3.90	0.06

IMF indicates inframammary fold.

TABLE 4. Patient Satisfaction With Breast or Donor Complication as Variables

	No Breast Complications N = 25	Breast Complications N = 12	P	No Donor Complications n = 28, 31	Donor Complications n = 6	P
Symmetry score	3.96	3.54	0.34	3.82	3.83	0.99
Shape score	3.90	3.71	0.65	3.87	3.67	0.70
Nipple position	4.18	3.42	0.11	3.96	3.67	0.63
IMF position	3.96	4.08	0.74	4.06	3.67	0.39
Overall score	3.94	3.92	0.95	3.98	3.67	0.52

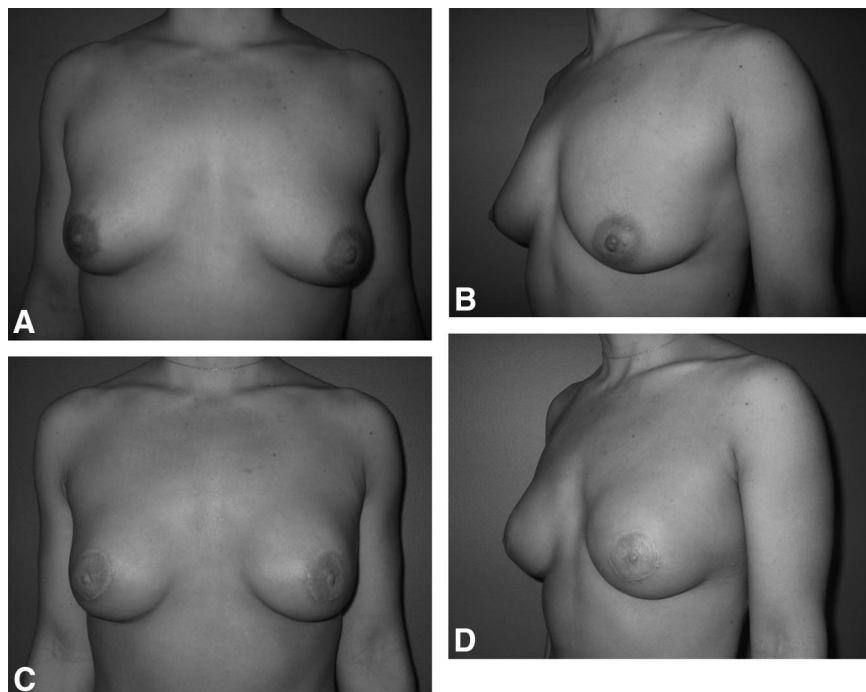IMF indicates inframammary fold.

FIGURE 1. This is a 36-year-old woman who presented with a T2 N1 left-sided breast cancer. She elected to undergo a bilateral skin-sparing mastectomy and was interested in relatively small natural looking breasts. A decision was made to perform immediate reconstruction using bilateral latissimus dorsi myocutaneous flaps with expanders. The expanders were sized appropriately and eventually exchanged for 175 mL smooth round moderate profile plus gel-filled implants at the time of nipple reconstruction. Her result at 4 years following mastectomy demonstrates favorable symmetry and shape.
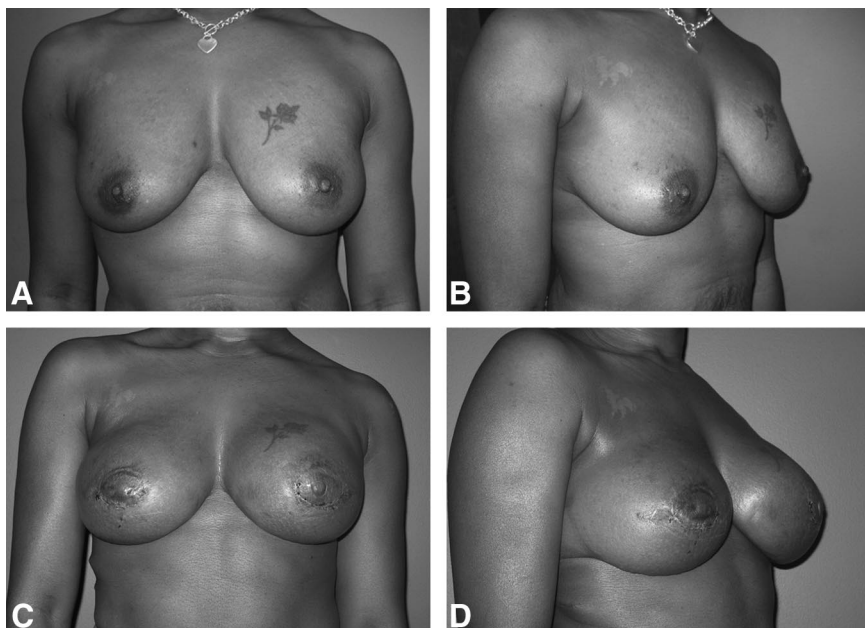
FIGURE 2. This is a 41-year-old woman with an extensive family history of breast cancer and who was diagnosed with left DCIS with microinvasion. She opted for a bilateral mastectomy and had a bilateral latissimus dorsi reconstruction with expanders. She is shown following nipple reconstruction and placement of 350 mL high profile smooth round gel implants in each side.
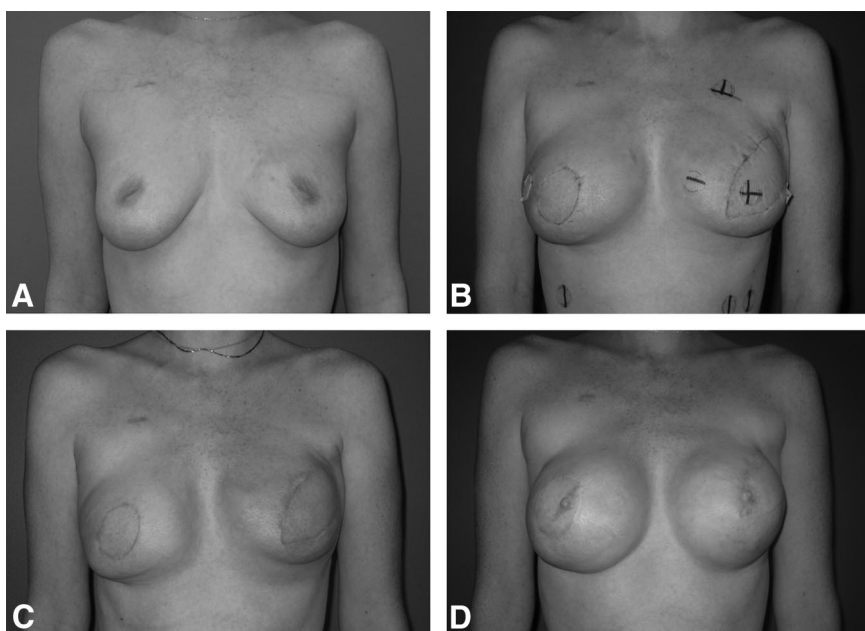

FIGURE 3. This is a 36-year-old woman with a history of left breast cancer. After completion of neoadjuvant chemotherapy, she underwent a bilateral mastectomy and latissimus dorsi with expander reconstruction. Final pathology resulted in the need for radiation therapy to the left breast (B). She had some evidence of postradiation skin changes prior to initiation of tissue expansion (C). She eventually had placement of bilateral 300 mL high profile smooth round gel implants, and nipple reconstruction. Her final result is shown 1 year following completion of radiation therapy with decent shape and symmetry. She has deferred nipple areolar tattoo at this time.

ated patients when compared with TRAM flap reconstructions; however, this was without expander use.[10] Studies discussing the use of latissimus flaps in irradiated patients are limited. Freeman evaluated 12 patients who had latissimus dorsi flap reconstruction following failed breast conservation therapy and demonstrated good aesthetic outcomes, 12.5% capsular contracture rates; however, a 25% donor site seroma rate and limited long-term follow-up.[6] They concluded that the LDF remained a good option for breast reconstruction after failed breast conservation therapy. Our results similarly demonstrate the utility of this approach even in patients with a history of radiation therapy. Patients who underwent preoperative radiation therapy had slightly lower breast complication rates and patients satisfaction score, when compared with those who underwent postoperative radiation therapy. This technique offers the

ability to replace irradiated skin with well-vascularized back skin, eliminating some of the adverse effects of radiation therapy. It also theoretically provides complete coverage of the tissue expander with vascularized tissue, which potentially renourishes the mastectomy skin flaps. The presence of a tissue expander using this technique might also be beneficial in the ability to oppose some of the contractile forces present early in the healing process. This could theoretically create a softer capsule which at the time of implant exchange can be released or adjusted to provide a better pocket for the final implant. This is felt to be the case in patients who required postoperative irradiation therapy as well. Tissue expansion will further stretch out the pocket once radiation therapy has been completed (Fig. 3). Although an irradiated TRAM or implant reconstruction is often difficult to salvage, the potential for being able to

revise a latissimus dorsi reconstruction exists as long as coverage is sufficient. Although pure autologous tissue is often preferable in a patient who has had previous radiation therapy, the LDF with expanders should not be overlooked.

The initial descriptions of the LDF for breast reconstructions were with implants.[3] The rate of capsular contracture with this technique was high (21%–75%),[11–14] which might be one of the reasons why this technique has until now been less popular. There have been many oncologic refinements in surgical technique when it comes to breast cancer management (sentinel node biopsy, skin-sparing mastectomy, IMF preservation), which have contributed to improvement in aesthetic results and outcomes following breast reconstruction. There have similarly been refinements in LDF reconstruction. One refinement has been the use of the 2-staged approach where tissue expanders are used prior to implant placement.[15,16] This has recently become more common, and is now considered one of the more critical steps in obtaining good long-term results when using the LDF. Reported capsular contracture rates are lower (<10%) when tissue expanders are used[17] and cosmetic results are more predictable. One reason for this might be that all patients essentially undergo a capsulotomy procedure with the ability to adjust the pocket secondarily when a 2-staged approach is used. This would be especially beneficial in the setting of breast irradiation. However, 1-stage reconstructions with implants can still result in very favorable outcomes in women with small- or moderate-sized breasts who do not wish to be larger. Although only a small number of patients in this series had latissimus dorsi with implant, this approach should theoretically be more feasible in bilateral reconstructions since the same volume could be placed in each breast. Another refinement in latissimus dorsi reconstruction has been preservation of the sub-Scarpa's fat layer on top of the muscle for added soft tissue coverage. This, in addition to providing a more natural breast feel, allows the tissue expander to be placed on top of the pectoralis muscle since complete coverage of the tissue expander is possible. Although the added bulk with the extended latissimus flap is often beneficial for soft tissue coverage,[18–20] it has been associated with donor site seroma rates in up to 75% of patients. It is important in bilateral reconstructions to identify and dissect the thoracodorsal pedicle from the anterior approach prior to turning the patient, which facilitates harvesting of both flaps from the prone position. Patients who underwent latissimus dorsi reconstruction with tissue expander required more secondary surgeries as would be expected; however, the actual trips to the operating room were similar between the groups.

Breast reconstruction is a staged procedure, and the latissimus dorsi method is no exception. We feel that the benefits of using the staged approach with tissue expanders, although at the expense of additional secondary procedures, does improve outcome. Despite the presence of a known second step when tissue expanders are used, the authors have previously shown that TRAM flaps will still result in more secondary procedures to completion of the reconstructive process compared with latissimus dorsi reconstructions.[21]

We have demonstrated that although overall patient satisfaction with this technique for bilateral breast reconstruction is high, donor site morbidity does exist. The most frequent donor-site complication in the literature is seroma averaging about 20% to 30%.[5,6] These early postoperative complications will resolve and are often fairly well tolerated. Although long-term issues, such as abdominal bulges or hernia occasionally seen following TRAM flap procedures, are not seen following latissimus dorsi harvest, the patients do report some morbidity. Decreased muscle function has been demonstrated following abdominal wall muscle harvest, and perhaps similar studies would be informative following latissimus dorsi muscle harvest. About 78% in our series reported no functional

impairment or pain following this procedure. Although long-term functional impairments as a result of bilateral muscle harvest are reported in up to 22% of patients, the majority of this was relatively minor. Similar patient satisfaction queries or even more informative physical evaluation scales following bilateral TRAM flap and expander/implant reconstruction would be required before any definitive comparisons could be made. Several studies have shown that latissimus dorsi muscle harvest has little effect on shoulder mobility.[18,22–24] Glassey et al recently reported no significant ROM loss at 1 year following LDF harvest in a prospective review of 22 patients.[25] Others have demonstrated some weakness, pain, loss of motion, and functional difficulties.[26–28] Although subjectively based, our series has shown similar morbidity, and is the first to focus only on bilateral latissimus dorsi muscle flap harvest. It is important that potential donor site dysfunction be discussed with the patient especially prior to initiation bilateral reconstructions. Ways to minimize latissimus dorsi donor site morbidity include partial muscle harvest and perforator flap reconstruction, which have been shown to reduce complication rates and improve shoulder ROM.[29,30] Although this is a large series, we recognize the limitations of a retrospective study design including potential bias due to loss of follow-up, selection bias, and the inability to adequately control for confounding variables. The patient satisfaction questionnaire did provide some insight into the patients subjective assessment of their outcome; however, more objective cosmetic and functional analyses would be interesting.

The latissimus dorsi myocutaneous flap is a reliable and versatile technique that can be used to reconstruct the breast following bilateral mastectomy for breast cancer or the risk of breast cancer. Although still a popular method of reconstruction, it is not without complications and potential donor site functional impairment, which needs to be discussed preoperatively.

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