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ORIGINAL ARTICLE

Use of the tabbed expander in latissimus dorsi breast reconstruction

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Abstract

Latissimus dorsi (LD) myocutaneous flap breast reconstruction with a tissue expander/implant is a post-mastectomy option often used as a salvage procedure for a failed tissue expander (TE). The patient is traditionally placed in the lateral decubitus position for flap dissection and is re-prepped and re-draped in the supine position for placement of the tissue expander. A new generation of anatomically-shaped, tabbed tissue expanders are increasingly being used in place of traditional untabbed expanders. The innovative suture tabs allow for more predictable and controlled expander placement while the patient is in the lateral decubitus position, eliminating the need to reposition the patient intraoperatively. The objective of this study was to evaluate the use of tabbed tissue expanders in latissimus dorsi breast reconstruction, with respect to total operative time, complication rates, and aesthetic outcomes. The outcomes of 34 LD breast reconstruction procedures with tissue expanders were evaluated. Eight patients received tabbed tissue expanders with no position change, while 26 patients underwent an intraoperative position change. Demographic information, total operative time, and follow-up complication data were collected. Aesthetic outcomes were evaluated by three blinded individuals using a validated scoring scale. The mean operative time for procedures with no position change was 107 minutes. The mean operative time for position change cohort was 207 minutes. There was no statistical difference in complication rates or aesthetic outcomes between the two groups. In conclusion, tabbed tissue expanders decrease operative time by eliminating the need for an intraoperative position change without influencing complication rates while maintaining equivalent aesthetic outcomes.

Key Words: Breast reconstruction, tabbed tissue expander, latissimus flap, mastectomy, breast cancer

Introduction

Latissimus dorsi (LD) myocutaneous flap breast reconstruction was first described in the early 1900s [1]. Over time, it has become a common technique used for post-mastectomy breast reconstruction. Similarly, the use of tissue expanders in conjunction with the LD flap has increased in popularity [2,3]. In 2010, the number of LD flap procedures performed in the US was similar to both transverse rectus abdominis musculocutaneous (TRAM) flaps and deep inferior epigastric perforator (DIEP) flaps, particularly because of its usefulness as both a salvage technique after radiation and as an alternative in patients for whom autologous flaps are contraindicated [4].

As a pedicled flap, the LD technique is inherently more reliable than other free flap techniques, and has been very successful when used in combination with tissue expanders. Traditionally, a standard profile, round tissue expander is used, with placement occurring while the patient is in the supine position. Since the flap is dissected with the patient in the lateral decubitus position, this requires back closure, re-prepping and draping and repositioning of the patient, which can increase operative and anaesthesia time.

New anatomically-shaped, tabbed expanders are now commonly used in tissue expander/implant-based breast reconstruction (Figure 1). In the senior author's experience, a tabbed expander can be easily substituted for a traditional round expander in LD reconstruction and can be placed in a predictable and fixed location using suture tabs to secure it to the chest wall. The three tabs grant the surgeon full control over the inframammary fold, the expander height, and the medial to lateral placement. Such control eliminates the need to intraoperatively reposition the patient for tissue expander placement.

To date, the use of tabbed tissue expanders in breast reconstruction has not been reported in published reports. We wished to focus on a new use of the tabbed expander wherein the precise positioning could add significant value to the operation by decreasing operative time. Specifically, we hypothesised that tabbed expanders with latissimus dorsi breast reconstruction could obviate the need for position change. Accordingly, this study aims to evaluate the outcomes of LD reconstruction with and without a position change with respect to operative time, complication profile, and aesthetic outcomes.

Patients and methods

Patients and study design

This study was approved by the Northwestern University Institutional Review Board. A retrospective review was performed on 34 patients who underwent unilateral post-mastectomy latissimus dorsi myocutaneous flap breast reconstruction with tissue expanders. All procedures were performed by the senior author (JYSK) between July 2005 and September 2011. Eight patients representing the treatment arm underwent LD reconstruction with tabbed anatomic tissue expanders and no intraoperative position change. Twenty-six patients representing the control arm underwent LD reconstruction with a position change.

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Figure 1. An anatomically-shaped, tabbed tissue expander. Arrows point to the three suture tabs located on the periphery of the expander, which are used to suture the expander to the chest wall to avoid changes in tissue expander position.

Surgical procedure

Non-position change cohort. Patients were positioned in the lateral decubitus position, exposing the anterior and posterior operative sites. First, the skin island paddle was incised and dissected down to the LD muscle circumferentially. Next, the superior, medial, inferior, and lateral borders of the latissimus dorsi muscle were exposed and LD flap elevation was performed in a standard fashion. After complete reflection of the muscle and detachment from the points of origin on the humerus, an axillary tunnel was created through to the mastectomy incision. The flap was tunnelled into the anterior breast pocket and the back incision was closed in three layers using 0 Ticron deep, 3-0 Vicryl dermals, and 4-0 Monocryl subcuticular over two 7 mm clot stop drains.

Simultaneously, with the patient still in the lateral decubitus position, the previous mastectomy incision was incised and the mastectomy flaps were elevated. After bringing the LD muscle into the breast pocket, the tabbed tissue expander was sutured to the chest wall using 2-0 Maxon or PDS, ensuring proper placement of the inframammary fold. After placement of the expander, the LD flap was placed over the expander and sutured to the chest wall and inferior border of the pectoralis major muscle with 2-0 and 3-0 Vicryl, ensuring complete coverage of the implant. Suction drains were placed through the tunnel exiting through the axilla. The tissue expander was inflated with saline, taking care not to place undue tension on the muscle or mastectomy skin flaps. The breast mound skin was closed in two layers using 3-0 Vicryl and 4-0 subcuticular Monocryl over two 7 mm clot stop drains.

Position change cohort. In the position change cohort, a similar procedure was carried out except that the back and axillary incisions were completely closed and a new sterile prep and drape was performed before moving the patient from the lateral decubitus to the supine position. Only after closing the back and moving the patients were the mastectomy incisions opened and skin flaps elevated. At the completion of the procedure and before extubation, the final position of the expander and flap was confirmed by sitting the patient upright on the OR table.

Aesthetic evaluation

Postoperative photographs of the patients were blindly evaluated by three independent reviewers. Results were based on a set of five subscales, each with three descriptive criteria associated with scores of 0, 1, or 2 (Table I) [5]. Each photograph was randomly numbered to eliminate the possibility of the reviewers determining which photograph belonged to a particular cohort. None of the judges participated in the care of any of the patients.

Statistical analysis

All statistical analyses were performed using Prism statistical software (GraphPad Software, La Jolla, CA). Fischer exact *t*-test, Student's *t*-test, chi square tests, and one-way ANOVA tests were used where appropriate.

Results

A total of 34 breast reconstructions were performed using the latissimus dorsi flap with a tissue expander (Table II). The average age was 51 years (range 34–66) in the position change group and 55 years (range 37–67) in the non-position change group. The prevalence of type II diabetes was two (7.7%) in the position change group and zero (0.0%) in the non-position change group. There were two (7.7%) current smokers in the position change group and one (12.5%) in the non-position change group. The average body mass index (BMI) was 28.1 (17.7–49.8) in the position change group and 29.3 (20.9–35.7) in the non-position change group.

Table I. Aesthetic scoring.

	Category 0	Category 1	Category 2
Volume of breast mound	Marked discrepancy relative to contralateral side	Mild discrepancy relative to contralateral side	Symmetrical volume
Contour (shape) of breast mound	Marked contour deformity or shape asymmetry	Mild contour deformity or shape asymmetry	Natural or symmetrical contour
Placement of breast mound	Marked displacement	Mild displacement	Symmetrical and aesthetic placement
Inframammary fold	Poorly defined/not identified	Defined but with asymmetry or lack of medial definition	Defined and symmetrical
Breast mound scars	Poor (hypertrophy, contracture)	Fair (wide scars, poor colour match, but without hypertrophy, contracture)	Good (thin scars, good colour match)

Table II. Details of patients.

	No position change (n = 8) n (range or %)	Position change (n = 26) n (range or %)	p-value
Mean age (years)	55 (37–67)	51 (34–66)	0.3246
Diabetes mellitus II	0 (0.0%)	2 (7.7%)	0.4140
Current smoker	1 (12.5%)	2 (7.7%)	0.6106
Mean BMI	29.3 (20.9–35.7)	28.1 (17.7–49.8)	0.7223
Hypertension	2 (25%)	5 (19.2%)	0.6770
PVD/CAD	0 (0.0%)	0 (0.0%)	N/A
Other comorbidities	2 (25%)	10 (38.5%)	0.4326
Radiation therapy	6 (75%)	21 (80.8%)	0.6770
Follow up (weeks)	22 (1–33)	40 (5–126)	0.0668

Hypertension was present in five (19%) patients in the position change group and two (25%) patients in the non-position change group. None of the patients in either group had coronary artery disease or peripheral vascular disease. Radiation therapy was given in 21 (80%) patients in the position change group and six (75%) patients in the non-position change group. There were no statistically significant demographic differences between the two groups.

The mean operative time for the position change group was 207 minutes (range 100–343), while the mean operative time for the no position change group was 107 minutes (range 62–174). The difference in operative time was statistically significant ($p < 0.0001$).

The total number of patients with complications in the position change group was eight (31%), while the total number of patients with complications in the non-position change group was one (13%) (Table III). Two patients in the position change group (8%) developed infections requiring hospital admission for IV antibiotics vs one patient (13%) in the non-position change group. There were four patients with seroma in the position change group (15%) and no seromas in the non-position change group. There were no cases of mastectomy flap necrosis and no cases of haematoma in either group. The tissue expander had to be removed in the two cases (8%) of major infection in the position change group, while there was no incidence of premature tissue expander removal in the non-position change group. Most importantly, there were no statistically significant complication differences between the two groups.

Aesthetic outcomes were independently evaluated by three blinded reviewers, none of whom participated in any of the patients care. Based on the fact that the subscales we employed have previously demonstrated fair-to-good interrater reliability, the judges' scores were pooled for each subscale and cohort. Unpaired t-tests indicate that there was no statistically significant difference in aesthetics between the position change and non-position change group (Table IV). Each photograph could receive a score of 0, 1, or 2 on each of the five subscales based on the descriptive criteria found in Table I. The average score for breast mound volume in the position change group was 1.78, while the non-position group received an average score of 1.35 ($p = 0.11$). The position change group received a score of 1.23 for breast contour and the non-position change received a score of 1.39 ($p = 0.706$). Placement of the breast mound in the position change group received 1.61, while the non-position change group was 1.6 ($p = 0.93$). The position change group received 1.33 and 1.78 for symmetry of the inframammary fold and breast mound scars, respectively. Similarly, the non-position change group received an average of 1.28 and 1.35 for the inframammary fold and the breast mound scars, respectively. The p-values for symmetry of the inframammary fold and breast mound scars were 0.7739 and 0.11, respectively, indicating that there was no statistically significant difference between the two groups for either of the last two subscales.

Discussion

Latissimus dorsi flap breast reconstruction has been relegated to a second line choice for breast reconstruction due to the ease of tissue expander reconstruction and the development of other autologous reconstruction methods – in particular, TRAM and DIEP flaps. Despite the primary role of LD reconstruction as a salvage procedure after a failed tissue expander, especially in cases of radiation therapy, there has been a renewal of interest in

Table III. Complication outcomes.

	No position change (n = 8) n (range or %)	Position change (n = 26) n (range or %)	p-value
Operative time (minutes)	107 (62–174)	207 (100–343)	< 0.0001
Complications			
Seroma	0 (0.0%)	4 (15.4%)	0.2275
Major infection	1 (12.5%)	2 (7.7%)	0.6106
Haematoma	0 (0.0%)	0 (0.0%)	N/A
Exposure/Dehiscence	0 (0.0%)	0 (0.0%)	N/A
Mastectomy flap necrosis	0 (0.0%)	0 (0.0%)	N/A
Tissue expander removal	0 (0.0%)	2 (0.077)	0.414
Total complications	1 (12.5%)	8 (30.8%)	0.2622

Table IV. Aesthetic outcomes.

Criterion (0–2 scale)	No position change (3 raters)	Position change (3 raters)	*p*-value
Volume of breast mound	1.35	1.78	0.11
Contour of breast mound	1.39	1.23	0.706
Placement of breast mound	1.6	1.61	0.9328
Inframammary fold	1.28	1.33	0.7739
Breast mound scars	1.35	1.78	0.11

the use of tissue expanders with the LD flap as opposed to immediate implant placement [2,3].

The use and type of tissue expanders have also evolved over time [6]. Round tissue expanders were the first developed and are still often used in breast reconstruction. Some limitations of these expanders included overexpansion of the upper pole, poor lower pole expansion, and difficultly creating natural breast ptosis. To address some of these issues, anatomically-shaped expanders were developed [7-9]. These were available with an integrated valve design or with two chambers and a removable external port as an evolution of the original Becker expander-implant so that they remain in place as the permanent implant. Additional shapes have since been developed, including crescentic expanders [10]. Tabbed tissue expanders are the latest innovation in the field of expanders. They are anatomically-shaped, textured tissue expanders with an integrated port and three tabs. To our knowledge, there are to date no published reports describing the use of tabbed expanders in breast reconstruction.

We endeavoured to focus our evaluation of tabbed expanders in a clinical milieu, where positional control of the expander may have a heightened importance, namely traditional position change latissimus dorsi breast reconstruction. Here, the tabs allow the tissue expander to be sutured into the correct position while the patient remains in the lateral decubitus position. In the senior author's experience, the advantage of avoiding a position change is 2-fold. First, there is no time spent re-positioning, re-prepping, and re-draping the patient. Second, the latissimus dorsi donor site can be closed simultaneously while the LD flap is inset in the breast.

Importantly, there are no statistically significant differences in complication rates between the position change and non-position change groups. The data suggests that position change or lack thereof does not affect the complication profile in LD reconstruction. Furthermore, our experience is comparable with complication rates previously reported for LD reconstruction with tissue expander/implant reconstruction [2,11-13].

In addition, to evaluate any differences in complication rates, we thought it pertinent to determine if the elimination of an intraoperative position change had an effect on aesthetic outcomes. Using a validated set of subscales, we found that there is no difference in aesthetic outcomes between patients who were repositioned intraoperatively and those who were not. This, in conjunction with the lack of significant difference in complication outcomes, suggests that positioning the patient in the lateral decubitus position for the entire surgery produces the same results as moving the patient, yet decreases operative time substantially. Such a substantial decrease in operative time improves operative efficiency and reduces the amount of time the patient is under anaesthesia, both of which are significant incentives to avoid intraoperative repositioning.

While it may be more challenging to place the expander with the patient in the lateral decubitus position, the medial, lateral, and inframammary folds can be marked preoperatively and used as a guide. Any minor position irregularities may be corrected during the definitive procedure when the tissue expander is exchanged for a permanent implant.

In conclusion, the advent of tabbed expanders allows for precise positioning of the subsequent implant reconstruction. We investigated a new application of this technology to the traditional latissimus dorsi implant technique. We noted a significant improvement in operative efficiency by obviating a position change, and found that this did not result in a difference in complication profile or aesthetic outcomes.

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