Lateral transpositional flaps in management of outer quadrant breast cancer: An assessment of the oncological safety and cosmetic outcome

Original Article

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ABSTRACT

Background: The incorporation of plastic surgery techniques in breast-conserving surgery for breast cancer and the emergence of oncoplastic breast surgery was an evolution in breast cancer surgery. It allows wider excisions with better oncological and aesthetic outcomes. The study aims to present the lateral transpositional flap (LTF) from the lateral wall of the chest as an alternate option for latissimus dorsi myocutaneous flap with a precise patient selection.

Patients and Methods: From January 2021 to March 2024, 40 female patients diagnosed with outer quadrants breast cancer were operated upon using quadrantectomy and LTF reconstruction LTF. Follow-up was planned for at least 12 months for the postoperative complications and the aesthetic outcome as well as the impact on the shoulder functions.

Results: The mean age of patients was 38.7±7.39 years. Four patients received neoadjuvant chemotherapy for downgrading of tumor size. The mean mammographic tumor size was 1.9±1x1.7±0.9. The mean weight of resected specimens was 65.5±6.7 gms. Only two patients developed minor wound complications which were managed conservatively without the need for any revisional surgery. Only two patients presented with fat necrosis. Only one patient developed loco-regional recurrence with no distant metastasis. No cases reported any shoulder dysfunctions.

Conclusion: According to the current results, the LTF is an effective, reliable, and feasible technique for breast reconstruction for outer quadrant breast cancer in carefully selected patients. It is oncologically safe with low morbidity and good cosmetic outcome.

Key Words: Breast-conserving surgery, lateral transpositional flap, oncoplastic breast surgery.

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INTRODUCTION

The multidisciplinary team management of breast cancer leads to a considerable improvement in the outcomes and the cure of breast cancer to reach a cure rate of more than 95% in the early stages[1]. The breast-conserving surgery (BCS) comprising the wide local excision of the tumor and postoperative radiotherapy was proven to be a safe and effective alternative method to mastectomy with equivalent survival rates[2].

The neoadjuvant chemotherapy was proved to be effective in downsizing tumors when the tumor-to-breast ratio is deemed unsuitable for BCS[3,4]. The cavity following BCS together with postoperative mandatory radiotherapy leads to deformity of the breast and unacceptable cosmetic results in about 30–40% of cases[5].

The oncoplastic breast surgery was introduced in 1996, it involves the incorporation of plastic surgery techniques in BCS in breast cancer which allows wider excisions with better oncological and aesthetic outcomes[6]. In addition, this leads to a better quality of life for women performing such procedures from a physical, emotional, and psychological point of view[7].

Many plastic surgery techniques, including volume displacement techniques ranging from local dermo-glandular flaps to reduction mammoplasty and mastopexy according to the site of tumor, presence of ptosis, tumor to breast ratio, and experience of the surgeon. In the case of small to medium-sized breast volume replacement may be needed. The latissimus dorsi myo-cutaneous flaps were the hallmark for volume replacement for partial breast defect reconstruction. However, it carries the risk of morbidity and complications[8–10].

In 1986, Holmstrom and Loosing described the lateral thoracodorsal flap (LTDF) in lateral breast defect reconstruction[11]. Similarly, Munhoz et.al, in 2006, described the use of LTDF and lateral intercostal perforator flaps in the reconstruction of breast defects.

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These perforator flaps usually require localization of perforator using hand held Doppler and careful dissection of perforator vessels[12].

The current study aims to present the lateral chest wall transpositional flaps based on excess lateral chest wall tissue based on dermal and sub-dermal plexus for breast defects in the outer breast quadrants. It represents an effective alternative to latissimus dorsi myo-cutaneous flap and perforator based flaps in appropriately selected patients.

PATIENTS AND METHODS:

Study design

From January 2021 to June 2024, forty female patients diagnosed with breast cancer in the outer quadrant of the breast were recruited to perform BCS in the form of quadrantectomy with immediate reconstruction using Lateral transpositional flap (LTF) from the lateral chest wall tissue. The study was conducted in the Department of General Surgery, Benha University. The study design was approved by the ethical committee and informed written consent was obtained from all participants for inclusion in the study after discussion and education about the procedure.

All the patients were subjected to full history taking, clinical breast and axillary examination, and bilateral sono-mammography. A true-cut needle or excisional biopsy was obtained from the affected lesion and confirmed its malignant nature.

Inclusion criteria included patients with breast cancer in the outer quadrant who were eligible for lumpectomy excision volumes of up to 1/3rd of the breast volume with the availability of adequate redundant lateral chest wall skin and subcutaneous fat for oncoplastic volume replacement using LTF. Stage of the tumors included were T1, T2, and T3 tumors after down-staging with neoadjuvant chemotherapy and preoperative wire localization. Exclusion criteria included patients with T4 tumors, multi-centric tumors, inflammatory breast tumors, and patients with diffuse micro-calcifications or patients with distant metastasis.

Surgical technique

Preoperative considerations and flap design

All the patients included in the study were preoperatively reviewed in the breast surgery unit by the multidisciplinary team, the decision to perform the procedure was taken and the resection plan and markings were done. The markings were done while the patient is in the upright position (standing or sitting) to allow accurate evaluation of the anatomical landmarks. (Figure 1) taking in consideration different variables including breast size, tumor size, location, and the estimated defect.

Firstly the lateral extremity of the breast is marked and the resection area is marked on the breast to obtain a rough estimate of the breast defect volume. The flap is designed as a transposition flap. The length is determined from the edge of the breast defect to the posterior axillary line and ranging from 8 to 11 cm. The width is determined to allow easy closure of the donor site without tension and ranging from 3 to 6 cm. The thickness of the flap according to availability of sufficient skin and subcutaneous tissue and ranging from 2 to 5 cm and can be determined by pinching test. The base of the flap is determined at the anterior axillary fold and usually narrower than the sides of the flap which are more convex to allow more harvesting of tissue as possible. No hand-held doppler ultrasound is used to locate perforators.

Operative technique

After induction of general endotracheal anesthesia and muscle relaxation. The operation was done in three stages as follows:

The first stage is tumor resection

The standard quadrantectomy technique is performed for tumor resection and dissection continued overlying the whole tumor and the surrounding safety margin, the tumor was then, excised down to the pectoral fascia with at least a 1-cm safety margin from all directions (Fig. 2). The margins of the specimen were marked by threads and sent to the frozen section for histopathological examination for radial marginal assessment. In the case of certain margin infiltration, a wider re-excision is performed. If the tumor is near the skin it is removed together with the tumor.

The second stage is axillary surgery

Axillary surgery is done through the same resection incision due to the proximity of outer quadrant lesions to the axilla. The incision is deepened down till reaching the clavi-pectoral fascia, which was exposed and opened to enter the axillary space. Sentinel lymph node biopsy (SLNB) or axillary dissection was done according to the preoperative decision for each patient. In the case of positive SLNB, axillary dissection is performed. Special attention is taken not to harm the thoracodorsal pedicle which should be spared if future reconstruction using LD flap is needed. A single drain is left in the axilla if axillary dissection is performed.

The third stage is flap harvesting and reconstruction

The flap length is checked ensuring that the tip of the flap reaches the most distal end of the defect. The width of the flap is determined by pinching test to incorporate

amount of tissue needed and to ensure a tension-free closure of the donor site. The base of the flap should not be narrower than 3 cm to ensure adequate blood supply of the flap through the dermal and subdermal plexus. The flap is harvested by opening the skin and subcutaneous tissue and beveling out as much fat as possible from the sides of the flap. The flap is raised including the fascia overlying the LD and serratus muscles. Few of the lateral intercostal perforators need to be severed to obtain adequate mobility of the flap into the defect and a few intercostal perforators at the base of the flap may be preserved to ensure adequate blood supply (Fig. 3).

If the skin overlying is removed with the tumor, then a skin paddle is marked and designed to match the defect size and the remaining flap is de-epithelized and the bridge of tissue between the defect and donor site is opened (Fig. 4).

The whole flap is rotated and introduced into the breast defect and its edge is fixed to the pectoral fascia with 2/0 vicryl sutures. A single surgical drain is typically left in the breast region (not in the flap donor site). The donor site incision is closed in a layered fashion (Fig. 5).

The operative data including positive margins and need for re-excision, the weight of the specimen, type of axillary surgery, flap dimensions, and the operative time were recorded and assessed. also, the final appearance of the flap and donor site (Fig. 6) was assessed for the aesthetic outcome.

All the patients were discharged on the first postoperative day with a drain in place the drains were removed when discharge was less than 50 cc/24 h. Patients were reviewed in the outpatient clinic after 1 week and 2 weeks for assessment of the presence of postoperative complications and to plan the adjuvant therapy.

Follow-up and outcomes

The primary outcome was the management of breast cancer and reconstruction using LTF with minimal postoperative complications.

The 2ry outcome was obtaining good aesthetic outcomes and patient satisfaction with no impact on the shoulder functions.

The follow-up was planned for 1 month for the early postoperative complications including hematomas, seromas, wound infection, wound dehiscence, or flap loss, and up to 1 year at least for the aesthetic outcome and shoulder functions.

A patient questionnaire was used to assess the cosmetic result and patient satisfaction concerning the symmetry of both breasts, the shape of the scar, the keloid, and lastly the nipple-areola complex. The Likert scale[13] (1=bad, 2=poor, 3=fair, 4=good, and 5=excellent) was used to achieve this. The Shoulder Pain and Disability Index was used to assess the functional outcome of the shoulder (SPADI)[14]. Eight questions were used in the assessment to gauge how difficult it is for the person to perform different daily tasks that need the use of the upper extremities.

Patients were instructed to mark each question on a 10-cm visual analog scale to respond to the questions. 'No pain at all' and 'worst pain imaginable' are the verbal anchors for the pain dimension, and 'no difficulty' and 'so difficult it required help' are the verbal anchors for the functional tasks. A total score is calculated by averaging the scores from the two dimensions. The following is the overall disability score: ___% is the patient score/80×100. It is believed that the degree of impairment to shoulder function increases with each scale's result. Three months after surgery, this functional outcome was tested, and 6 and 12 months later, it was assessed again.

Statistical analysis

Universities, Dusseldorf, Germany's G*power 3.1 program was used to estimate the sample size. The primary outcome of the current study, postoperative problems, was used to calculate the sample size. Taking into inconsideration a 20% drop during follow-up. A 24 patients were recruited, with an effect size of 0.9, 95% power, and 0.05 type one error (2 tailed).

Student's t test was used to conduct statistical analysis for quantitative parameters that were described by mean, SD, and range (lowest and maximum). For qualitative data that were expressed as frequency with percent, the χ^2 test was employed. (IBM SPSS) software, version 21.0 (2013; IBM Corp., Chicago, Illinois, USA), was employed. A significance threshold of less than 0.05 was applied to probability values.

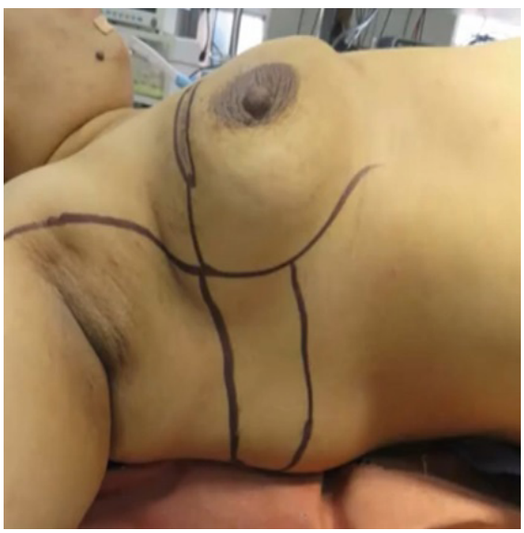

Fig. 1: Preoperative marking and flap design.

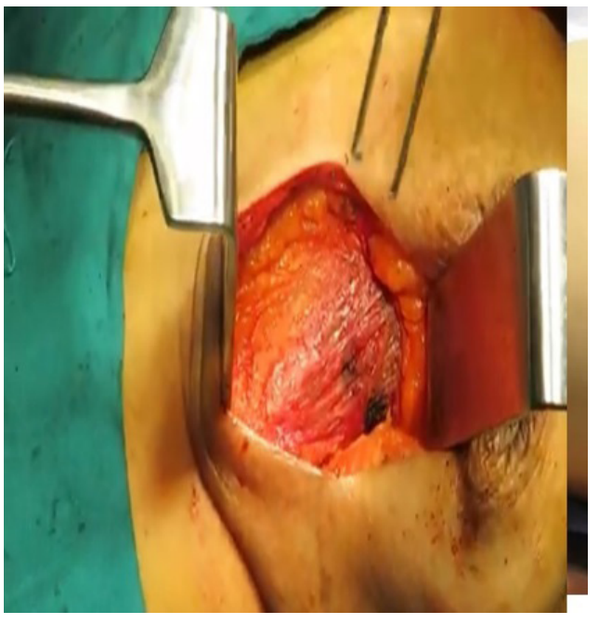

Fig. 2: Complete excision of the tumor with a safety margin.

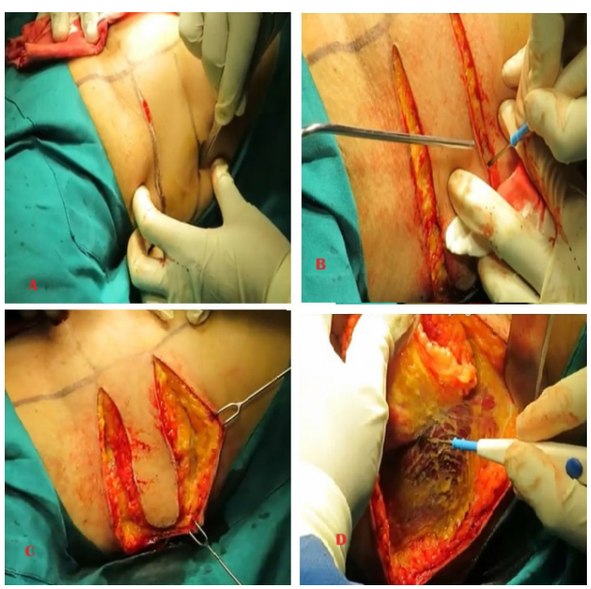

Fig. 3: Flap harvesting.

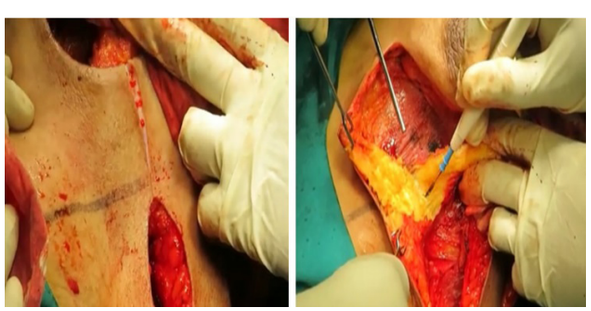

Fig. 4: Opening bridge of tissue between the cavity and the flap.

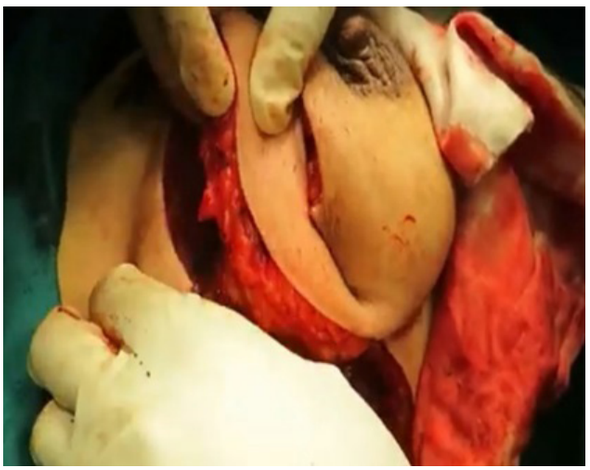

Fig. 5: Flap rotation into the breast defect.

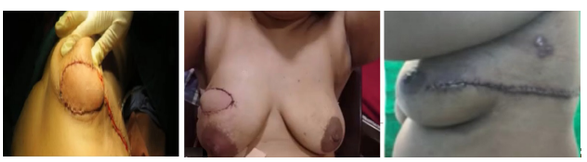

Fig. 6: Aesthetic outcome of the flap and donor site.

RESULTS:

The mean age of the included patients was 38.7±7.39 years. 21 patients had breast cup size B, 17 patients had breast cup size C and two patients had breast cup size D. The mean size of the tumors (SD) was 1.9±1x1.7±0.9 cm. According to the TNM classification, T1 tumors were found in 22 cases, T2 tumors in 14 cases, and T3 tumors in 4 cases. Other sociodemographic data and tumor characteristics are listed in (Table 1).

Table 2 shows that the mean operative time of the procedure was 154±21.34 min. The surgical margins were free in all cases and no cases required re-excision. Mean resection defect values (length, height, thickness) were 6.22±1.15 cm×3.7±0.42 cm×3.2±0.35 cm. One case the tumor was superficial and the overlying skin was excised. The mean weight of the excised specimen was 65.5±6.7 gm. SLNB was proved negative in 25% of cases while level I and II axillary dissection was done in 75% of cases. No contralateral summarization was needed in any of the patients.

The mean period of follow-up was 13.67±1.23 months and ranged between 12 and 15 months. As regards the postoperative complications two cases reported wound infection which was managed conservatively by oral antibiotics. Two patients developed clinically fat necrosis. No marginal skin or flap necrosis occurred in any of our patients. All the patients received their adjuvant therapy according to the recommended guidelines and protocols (Table 2).

Concerning the cosmetic outcomes, the results assessed by the patients were excellent in 33 patients, good in 5 patients, fair in 2 patients, and no poor or bad results (Table 3).

Final outcomes were satisfactory with none of the patients complaining about the hard consistency of the reconstructed breast and high satisfaction was obtained in all patients at their last follow-up visit. Using SPADI score for the shoulder functions assessment, there was minimal shoulder dysfunction reported immediately postoperative that was completely recovered after 6 months (Table 4).

Table 1: Patients' demographic data and tumor characteristics

Variable	*N*=40
Age Mean±SD (Years)	38.7±7.39
Body Mass Index (BMI) Mean±SD kg/m^2	31.1±4.1
Comorbidities and special habits	
Diabetes mellitus *n* (%)	2 (5)
Hypertension *n* (%)	2 (5)
Smoking *n* (%)	3 (7.5)
Tumor and Breast characteristics	
Breast cup size	
B *n* (%)	21 (52.5)
C *n* (%)	17 (42.5)
D *n* (%)	2 (5)
Tumor location	
Outer upper *n* (%)	26 (65)
Outer lower *n* (%)	14 (35)
Tumor size Mean±SD (cm)	1.9±1×1.7±0.9
Pathological Type of the tumor	
Invasive ductal carcinoma *n* (%)	34 (85)
Invasive lobular carcinoma *n* (%)	6 (15)
TNM classification (*n*)(%)	
T1 *n* (%)	22 (55)
T2 *n* (%)	14 (35)
T3 *n* (%)	4 (10)
N0 *n* (%)	18 (45%)
N1 *n* (%)	22 (55)
N2 *n* (%)	0
M0 *n* (%)	40 (100)
M1 *n* (%)	0
Neoadjuvant chemotherapy *n* (%)	24 (60)

Table 2: Operative findings and postoperative sequelae

Variable	*N*=40
Operative time (min) Mean±SD	154±21.34
Defect size	
Length (cm) Mean±SD	6.22±1.15
Height (cm) Mean±SD	3.7±0.42
Thickness (cm) Mean±SD	3.2±0.35
Intraoperative margins assessment	
Positive *n* (%)	0
Negative *n* (%)	20 (100)
Weight of excised specimen (gm) Mean±SD	65.5±6.7
Axillary surgery	
Sentinel lymph node biopsy *n* (%)	10 (25)
Axillary dissection (level I and II) *n* (%)	30 (75)
Flap size (cm)	
Length Mean±SD	9.5±1.8
Width Mean±SD	5.2±1.2
Thickness Mean±SD	2.8±0.85
Postoperative complications	
Wound infection *n* (%)	2 (5)
Hematoma *n* (%)	1 (2.5)
Seroma *n* (%)	1 (2.5)
Marginal skin necrosis *n* (%)	0
Flap necrosis *n* (%)	2 (5)
Asymmetry *n* (%)	0
Follow-up period (months) Mean±SD	13.67±1.23
Adjuvant therapy (*n*) (%)	
Radiotherapy	40 (100)
Chemotherapy	34 (85)
Hormonal therapy	24 (60)

Table 3: Assessment of Aesthetic outcomes

Variables	*N*=40
Excellent *N* (%)	33 (82.5)
Good *N* (%)	5 (12.5)
Fair *N* (%)	2 (5)
Poor *N* (%)	0
Bad *N* (%)	0

Table 4: Shoulder dysfunctions at 3, 6 months compared with initial reports postoperatively according to SPADI

Shoulder functional disability	Immediate postoperative	After 3 months	After 6 months	*P* value
LTF Group *N*=42				
Minimum–maximum	2–8	0–4	0	<0.001*
Mean±SD	6.33±1.33	2.67±0.92	0	

DISCUSSION

Breast conservative therapy comprising wide local excision and postoperative radiotherapy for breast cancer patients has become the milestone to improve the quality of life of such patients prohibiting the psychological and physical mastectomy drawbacks in selected patients. In addition, the incorporation of plastic surgery techniques into breast cancer surgery helps in the restoration of shaping and contour maintaining oncologic safety[10,15]. Patients in developing countries usually present in a later stage with larger tumors and axillary lymph node metastasis. The latissimus dorsi flaps were the standard feasible technique in partial breast reconstruction especially in cases of loco-regional advanced tumors[16].

In many patients there is sufficient redundancy in the lateral chest wall, this tissue may be transferred to outer quadrant breast defects using the technique of LTF. Careful patient selection is crucial, especially inpatient patients with small to medium-sized breasts who require volume replacement and are good candidates for the technique. The defect site and dimensions should match the amount of tissue transferred from the lateral chest wall. Patients with outer quadrant breast cancers are also good candidates for the technique. Many authors recommended that it is not an optimum choice for central or inner quadrant lesions. In addition, the inadequacy of lateral chest wall fat is inapplicable for the technique and an alternate method of volume replacement may be utilized such as Latissimus dorsi flaps or thoracodorsal artery perforator flaps[17].

From the advantages of the technique is that it does not require perforator identification and dissection, and it avoids the morbidity which may be associated with LD flaps and reserve the muscle for possible future reconstruction if needed. This makes the lateral transpositional flaps more applicable and can help in saving more time and resources[18].

The mean age of the study group was 38.7±7.39 years. This age was relatively younger than expected. This may be a reflection to increased community awareness and the Egyptian presidential initiative for women's health and screening for early breast cancer.

The quadrantectomy resections allowed wider margins of excision and decreased the rates of re-excision and positive margins in frozen section assessment, especially when the reconstructive option is available[19].

The blood supply of the flap is derived from the dermal and subdermal plexus which make the identification of perforators unnecessary and can either be preserved or severed if they restrict the flap mobility and rotation[18].

The flap design was originally described by Holmstrom and Lossing in delayed breast reconstruction following mastectomy combined with subpectoral implant[11].

Holmstrom and Lossing similarly described the same flap harvesting technique and reported flap necrosis in 3.5% of cases.

In our study, only 2 (5%) cases developed minor wound infection that was managed conservatively. In a series by Yang *et al*. reported the application of LTDF in 20 cases with lateral breast defects with a similar low rate of complications[20].

The lateral transpositional flaps were utilized by many authors in combination with implant reconstruction with promising outcomes[21].

Many authors described the utility of perforator based flaps that may be similarly harvested from the lateral chest wall for lateral breast defects. These techniques appear to be more demanding as they require hand held doppler identification of dominant perforator and operative magnification which is not needed in the technique of LTF as fore mentioned[22–24].

One of the most common complications of oncoplastic breast surgery is fat necrosis. The diagnosis of fat necrosis is problematic and usually misdiagnosed as local recurrence. It needs to be evaluated by an experienced radiologist and even a biopsy to rule out malignancy and local recurrence. We observed in our study only 2 (5%) cases of fat necrosis and both required tru-cut needle biopsy to rule out malignancy. This is comparable with the study by Nakada *et al*., who reported fat necrosis ranging between 16 and 56%[25].

Only one patient in our study developed local recurrence at 12 months of follow-up. This highlights the feasibility and oncological safety of the procedure.

Concerning the cosmetic outcomes, the average percentage of excellent results was 82.5%, good in 12.5%, and fair in 5% of cases. No poor results. These results agree with study by Afsharfard and colleagues who reported excellent to good results in 85% of cases. The procedure restores the original breast mold and contour and no breast symmetry procedures were needed in the contralateral breast. No significant changes were reported to the flap following radiotherapy apart from skin changes which were similar to that of the irradiated breast[26].

Blackburn and colleagues have documented that breast reconstruction using the LD had an impact on the shoulder function and some daily life activities, with a significant negative impact not only on the patients themselves but their families as well. And this can occur due to muscle transposition in breast reconstruction[27].

The current study revealed very limited shoulder dysfunctional outcomes in cases of LTF. A previous study reported shoulder dysfunction in the commonly used TDAP flap and LD flap using SPADI[10]. And this can be due to the limited tissue transposition when compared with other techniques. The study also demonstrated inter-periodic significant differences during the follow-up at 3, and 6 months.

The main strength of our study is that despite the limited recent data about the use of lateral transpositional flap LTF in breast reconstruction following BCS, the study is among the first prospective studies to explain the role of LTF flap in breast reconstruction in a series of breast cancer patients in Egypt. In addition, the relatively long follow-up period (mean follow-up of 13.67±1.23 months) was important to assess the long-term outcomes.

We believe that the LTF flap is under-estimated as an oncoplastic reconstructive option following BCS, and we feel it deserves greater prospective studies for better evaluation of the outcomes and improvements in the technique.

CONCLUSION

The lateral transpositional flap LTF from the lateral chest wall is an effective, reliable, and feasible technique for breast reconstruction for outer quadrant breast cancer in carefully selected patients. It is oncologically safe with low morbidity and good cosmetic outcome.

CONFLICT OF INTEREST

There are no conflicts of interest.

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