Latissimus dorsi mini flap versus thoracodorsal artery perforator flap in reconstruction of partial mastectomy defects in early breast cancer: a prospective comparative study

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Background
Breast cancer is the most common cancer type among women and can lead to death. The surgical management of breast cancer has witnessed a considerable evolution in the past few decades. The aim was to compare the thoracodorsal artery perforator (TDAP) flap with the latissimus dorsi (LD) mini flap in the reconstruction of outer quadrants partial mastectomy defects in early breast cancer patients regarding feasibility, cosmesis, postoperative complications, and early musculoskeletal functional outcome.

Patients and methods
A prospective randomized study was carried out on 40 consecutive female patients complaining of early breast cancer (stages I, II), undergoing partial breast resection (lumpectomy or quadrantectomy with axillary lymph node dissection), and with a small tumor to breast volume ratio. All patients were randomized into two equal groups in a parallel manner by computer-generated numbers, and their allocation code was kept in a closed opaque envelope: group I: early breast cancer (stages I, II) who underwent mastectomy defect by either TDAP flap. Group II: early breast cancer (stage I, II) who underwent mastectomy the LD mini flap.

Results
Operation time, drain removal, and hospital stay were significantly lower in LD mini-flap group than TDAP flap group (P=0.032, P<0.05, respectively). Complications and reoperation were insignificantly different between the two groups. Shoulder mobility 6 months and breast scar satisfaction was significantly higher in LD mini-flap group than TDAP flap group (P=0.045 and 0.009, respectively). Breast scar satisfaction and total score of satisfaction were significantly higher in LD mini-flap group than TDAP flap group (P<0.05). Time of adjuvant therapy (first cycle) was insignificantly different between both groups.

Conclusions
In early breast cancer patients, the LD mini flap is a superior technique to TDAP as it had lower operation time, short hospital stays, drain removal, breast scar satisfaction, and total score of patient satisfaction but with high shoulder mobility affection.

Keywords:
breast cancer, latissimus dorsi mini flap, mastectomy, thoracodorsal artery perforator flap

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Introduction

Radiation therapy and conservative surgery have been shown to be effective in the treatment of early-stage breast cancer in several meta-analyses and randomized studies [1]. The goal of this notion in breast surgery is to achieve both more satisfactory aesthetic outcomes and minimal surgical intervention [2].

Breast surgeons should be fundamentally aware of whether patients are candidate for breast reconstruction as well as the available reconstructive options [3]. A poorer cosmetic result is likely when more than 20% of the breast volume is removed [4].

About 70% of patients with early-stage (I–II) breast cancer can accomplish breast conservation, which is oncologically safe and has an equivalent 5-year survival rate to mastectomy [5]. After breast conservation with primary closure, asymmetry, nipple or skin retraction, and volume loss often result in a poor esthetic outcome [6]. More recently, oncoplastic procedures combined with breast conservation have produced wider safety margins and improved oncologic and cosmetic outcomes [7].

Volume displacement or replacement treatments, as well as occasionally contralateral breast surgery, are

included in the oncoplastic approaches. Local flaps, latissimus dorsi (LD) myocutaneous flaps, and reduction mammoplasty/masthopexy methods are a few of those oncoplastic treatments [8].

LD flap is an autologous flap with stability and adaptability, so it is a valuable alternative for volume replacement. In certain situations, an LD flap may be utilized to restore the whole breast following a mastectomy or to fill a large quadrantectomy defect [9].

The goal of LD mini flaps, as defined by Rainsbury in 2002, is to restore partial breast abnormalities following resections of the upper and central quadrants. To spare certain patients from mastectomy, this oncoplastic strategy permits significant local excision during BCS without compromising cosmesis [10].

An alternate approach is the fasciocutaneous thoracodorsal artery perforator (TDAP) flap. Theoretically, it has the benefit of preserving the LD muscle, which lowers donor site morbidity. It is predicated on a thoracodorsal artery musculocutaneous perforator or perforator [11].

For deformities of the head, neck, and extremities, the TDAP flap is a good option. With the benefit of avoiding both primary closure of the donor site and postoperative partial or total loss of the flap, a sizable portion of the flap can be harvested on a single perforator [12].

The purpose of this study was to evaluate the feasibility, cosmoses, postoperative complications, and early musculoskeletal functional result of reconstructing outer quadrant partial mastectomy defects in patients with early-stage breast cancer using the TDAP flap against the LD mini flap.

Patients and methods

This prospective randomized study was carried out on 40 consecutive female patients complaining of early breast cancer (stages I, II), undergoing partial breast resection [lumpectomy or quadrantectomy with axillary lymph node dissection (ALND)] and with a small tumor-to-breast volume ratio. The study was done after approval from the Ethical Committee Kafrelsheikh University Hospital, Faculty of Medicine, Kafrelsheikh, Egypt, Surgical Oncology Department, Faculty of Medicine, Mansoura University, Mansoura, Egypt. An informed written consent was obtained from all patients.

Exclusion criteria were inability to attain free safety margin, locally advanced breast cancer, metastatic, inflammatory breast cancer patients, multicentric lesions, large tumor to breast volume ratio, recurrent lesions, a previous division of the thoracodorsal pedicles, ipsilateral thoracotomy with the division of the LD muscle, males with breast cancer and patient contraindicated or previous history of radiotherapy.

Randomization

All patients were randomized into two equal groups in a parallel manner by computer-generated numbers, and their allocation code was kept in a closed opaque envelope: group I: early breast cancer (stages I, II) who underwent mastectomy defect by either TDAP flap. Group II: early breast cancer (stages I, II) who underwent mastectomy the LD mini flap.

All patients were subjected to history taking, clinical history, general examination (chest, abdominal, and pelvic examination for distant metastasis) and local examination [asymmetry, enlargement, skin dimpling, skin puckering, peau d'orange, skin nodules or ulceration, assessment of breast lump: its texture, mobility, fixation to the skin, underlying muscles or chest wall, nipple retraction and axillary lymph node palpation for number and mobility, breast characteristic as cup size, tumor site and quadrants (upper outer quadrant, lower outer quadrant)], routine laboratory investigations (complete blood count, liver and kidney function tests, coagulation profile test, and tumor markers) and radiological investigations [breast and axillary ultrasound, mammogram, MRI, pathological confirmation (Turcot biopsy), and metastatic workup (abdominal ultrasound, bone survey, or scan and chest radiograph)].

Latissimus dorsi mini-flap technique

It was simpler for the surgeon and the patient to do the entire procedure while the patient was in a supine posture. Following the contour of the tumor on the skin, a 2 cm circular line was drawn around the tumor to indicate the safety margin. The apex of the axilla was used to initiate an S-shaped incision that extended through the lateral breast border and ended at the outside edge of the infra-mammary fold. Mark the LD anterior boundary after that.

Wide local excision utilizing the oncoplastic principles. The tumor was widely excised locally after the S-shaped incision was made deeply into the subcutaneous fat and extended medially to the free outer border of the pectoralis major muscle. A frozen section analysis verified the tumor's 'negative' margin status (Figs 1 and 2).

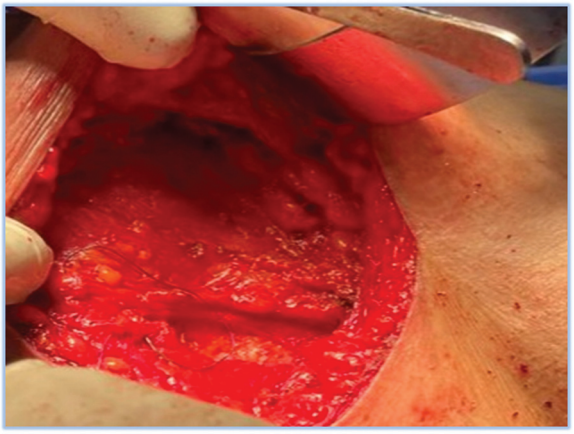
Mini flap harvest and volume replacement in the premuscular plane, a superficial subcutaneous pocket was formed, extending from the LD muscle's anterior border dorsally to the level of the costal edge inferiorly and the lumbosacral facia dorsally. The superficial premuscular pocket's dimensions were shared by the second deep muscular pocket, which was formed deep into the LD muscle. The muscle was firstly divided distally and then posteriorly, passing up to the interval between LD and teres major muscles (Fig. 3).

After division, the LD mini flap could be fully mobilized and delivered into the wound. After that, the tendon of the muscle is divided, leaving the flap attached only by the serratus anterior and thoracodorsal pedicles. This allowed maximum mobility during the flap repositioning into the defect. Moreover, the flap could be positioned more medially by division of the serratus anterior branches. Lastly the flap was folded and sutured to match the shape of the resection defect. The tendinous end of the flap was sutured to the outer free border of pectoralis major for protection of the thoracodorsal pedicle and prevention of flap retraction from the defect. The defect edges were sutured into the flap with a few interrupted sutures to fold it into a shape that conforms to the defect. By folding over the tip of the flap, its most bulky part is laid in the deepest part of the cavity (Figs 4–6).

Figure 1

Marking of site of incision for LD mini flap. LD, latissimus dorsi.

Figure 2



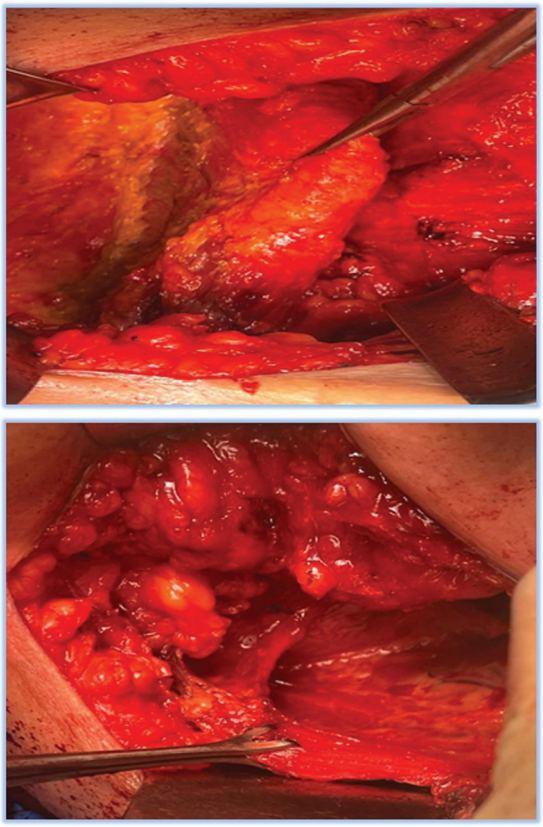
Partial mastectomy.

Thoracodorsal artery perforator flap

Using a portable Doppler, the location of the TDAP was marked preoperatively, and two anatomical landmarks were identified. The initial point was near the middle of the flap, 2 cm below the lateral border of the LD muscle, and 8 cm below the posterior axillary fold. This location corresponded to where the proximal skin perforator emerged from the thoracodorsal artery's descending branch and exited the LD muscle to enter the SC tissue. The second point was situated 1–4 cm medial to the lateral free border of the LD muscle and 3–6 cm below the inferior scapular tip.

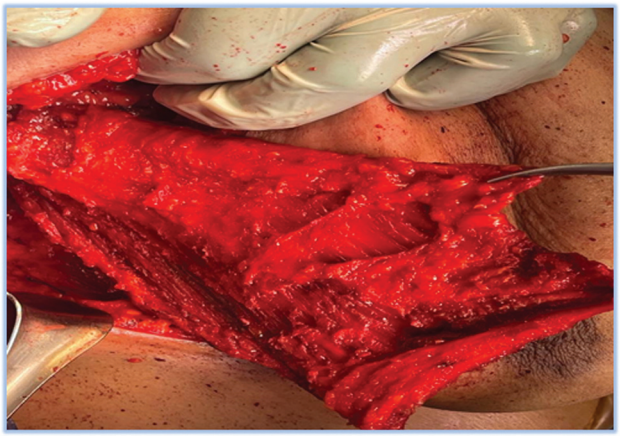
The location of the thoracodorsal artery bifurcation corresponded to this place. The TDAP flap was marked in a standing posture with the hands on the waist and the arms at the sides following the assessment

Figure 3



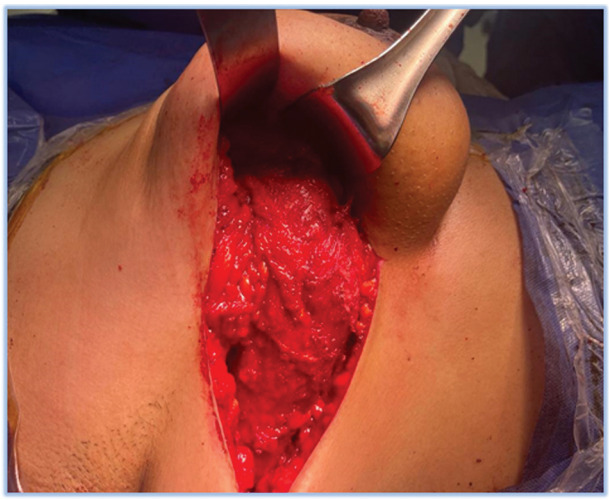
Creation of superficial and deep pockets around LD muscle. LD, latissimus dorsi.

Figure 4



Fully mobilization and delivering into the wound.

Figure 5



Filling the defect by LD mini flap. LD, latissimus dorsi.

Figure 6

Wound closure with drain.

of the location and volume deficiency. It was intended to pass over the lateral border of the LD muscle and to enclose the previously located artery's location in its middle. The potential for immediate closure of the donor site influenced the design of the TDAP flap's breadth (Figs 7–10).

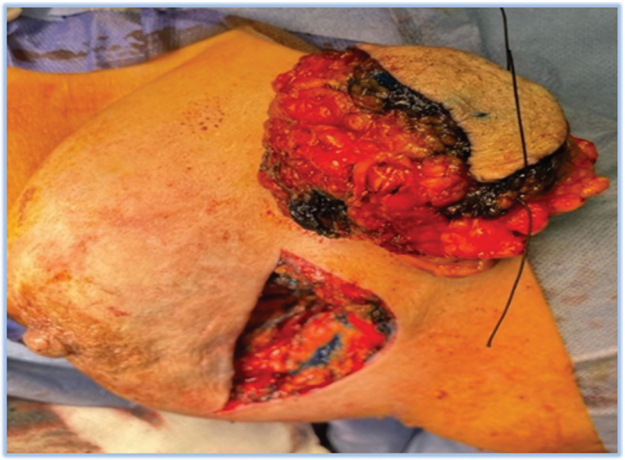
After the vascular pedicle was cut to a sufficient length to enable tension-free flap insertion into the breast defect, the donor region was immediately closed in two layers (Figs 11 and 12).

Intraoperative parameters were recorded, such as operation duration (minutes), lymph node kinds,

Figure 7

Marking of the site of the TDAP. TDAP, thoracodorsal artery perforator.

Figure 8



Partial mastectomy done with a safety margin.

Figure 9

Elliptical incision in the back.

Figure 10

TDAP perforator identification. TDAP, thoracodorsal artery perforator.

number of excised lymph nodes, number of impacted lymph nodes, and margin layout.

Axilla surgeries

Surgeries for axilla were either sentinel lymph node biopsy (SLNB) by injection of blue dye and removal of at least three to five stained lymph nodes or ALND (Figs 13 and 14).

In two surgical techniques

Tumor site: tumor size was accurately measured, the total number of axillary lymph nodes removed was recorded, multiplicity, if present, any intraoperative complication or difficulty were recorded, and the site of the mass excised was marked intraoperatively by metallic clips.

Quick DASH score

Q-DASH was used to examine the functional status of the upper extremities. A regional outcome criteria called Q-DASH was created specifically for diseases of the musculoskeletal system in the upper extremities. It is optional, assesses every function of the upper extremities, and has modules for musicians and athletes. There are 11 questions on it. At least 10 of the 11 questions must be answered in order to determine the score of the criterion that may be

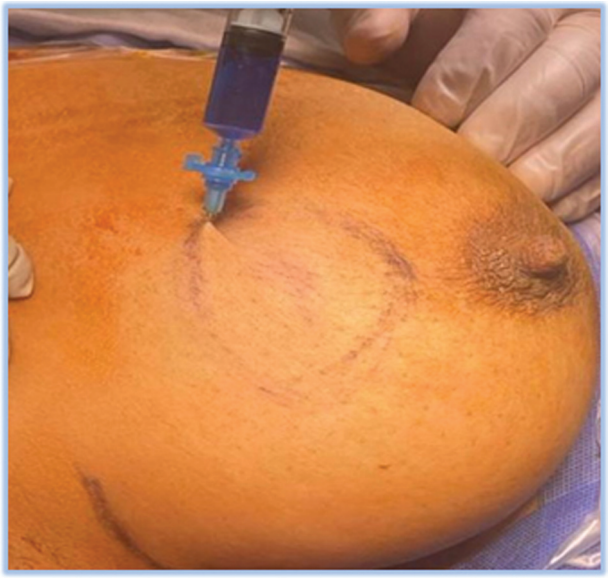
Figure 11

Passage of the flap to the site of the defect.

Figure 12

Wound closure.

Figure 13



Injection of blue dye.

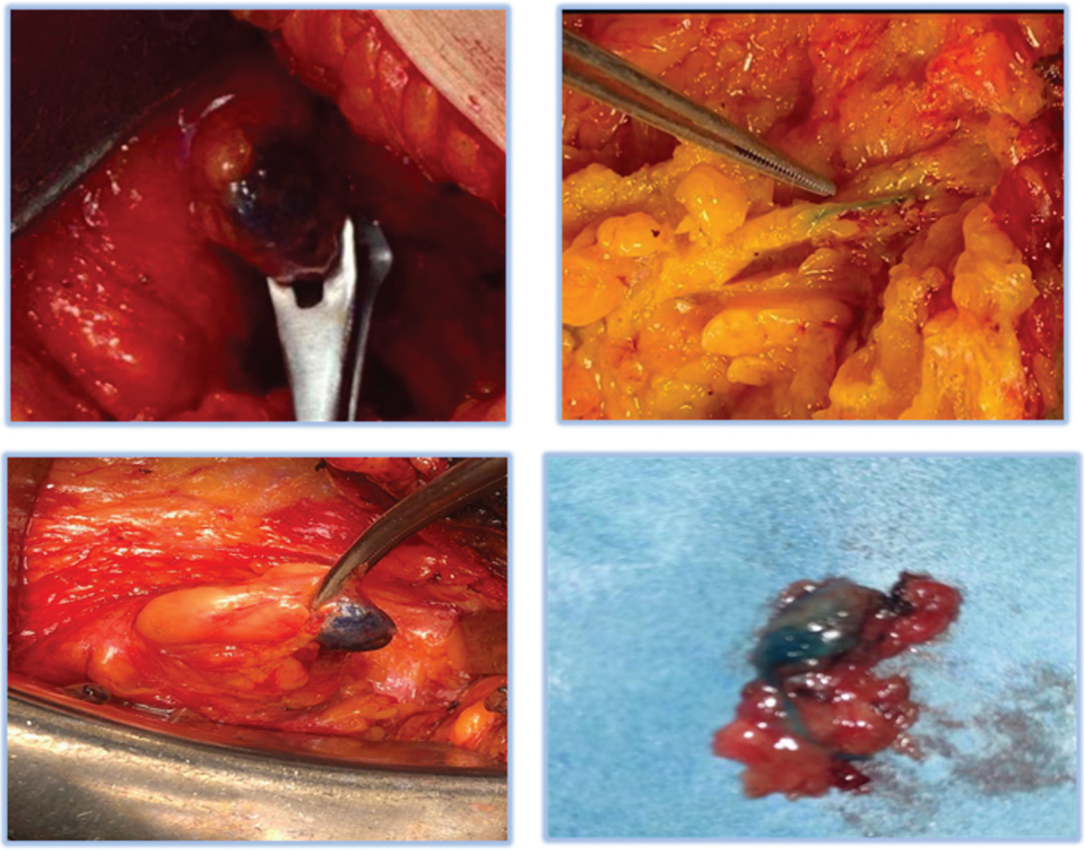
used in place of Q-DASH. Every question has a five-point Likert scale assigned to it. The overall score of the questionnaire is determined by dividing the total points earned from marked questions by the total number of marked questions, then 1 subtracted from the result, and multiplying the result by 25. A score of 0–20 indicates normal, 21–40 indicates slight disability, 41–60 indicates moderate disability, and 61–80 indicates severe disability. The validity and reliability of this scale [13]. Quick DASH Disability/Symptom score=(sum of number of responses/n−1×25), where n is equal to the number (Fig. 15).

Follow-up postdischarge

Postoperative visits were once weekly at outpatient clinic during the first month postoperatively and once monthly for 6 months. Histopathological examination: the type of the excised specimen was recorded with its safety margins, number of affected lymph nodes, tumor grading, and staging. Number of postoperative radiotherapy sessions. Number of postoperative chemotherapy sessions. Period of hormonal adjuvant therapy intake if needed. Recurrent cases if present.

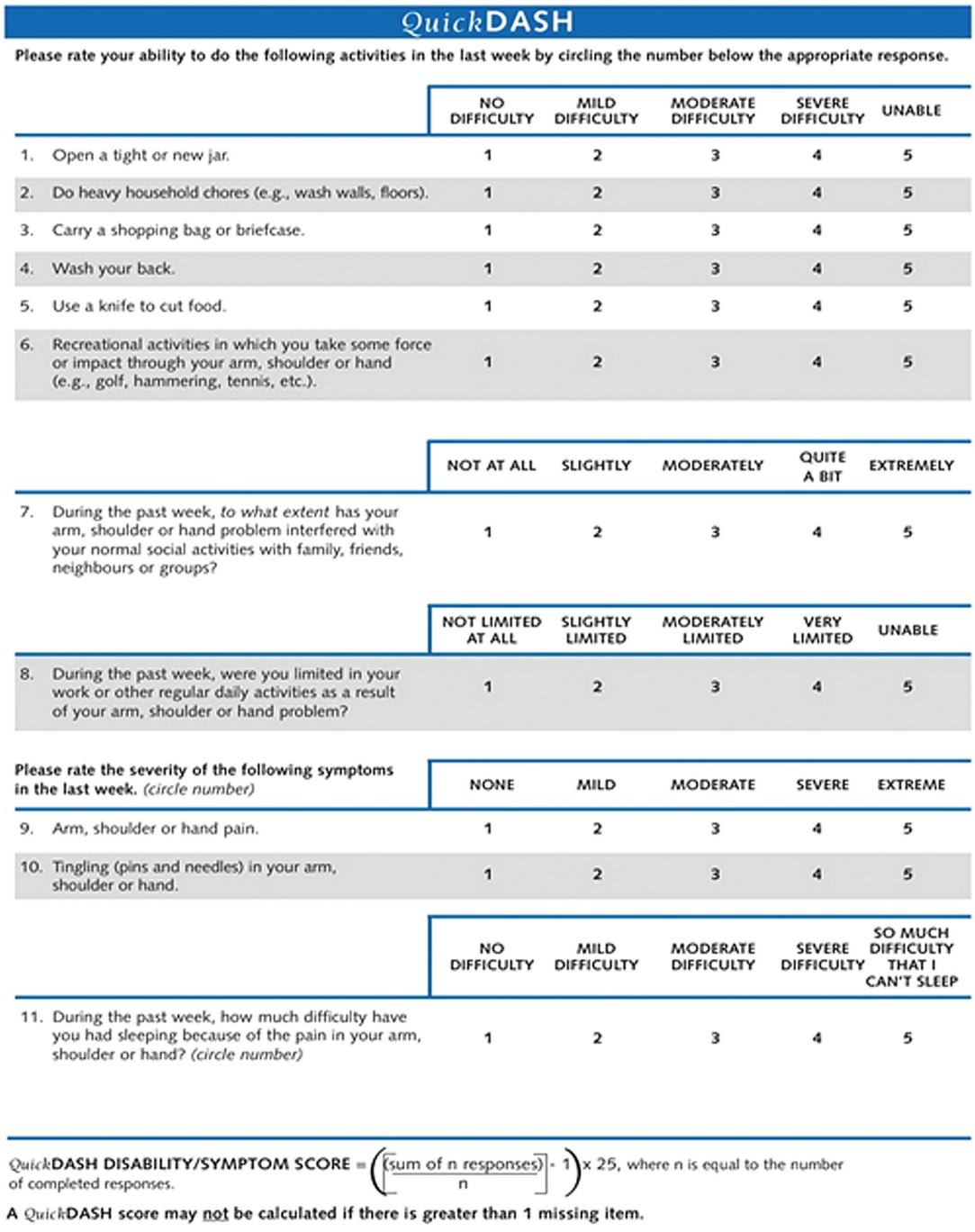
Primary outcomes include the incidence of flap loss and other complications. Secondary outcomes include operative timing, early musculoskeletal functional

Figure 14



Sentinel lymph node biopsy (SLNB).

Figure 15



QuickDASH

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Do heavy household chores (e.g., wash walls, floors).	1	2	3	4	5
3. Carry a shopping bag or briefcase.	1	2	3	4	5
4. Wash your back.	1	2	3	4	5
5. Use a knife to cut food.	1	2	3	4	5
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
7. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*	NONE	MILD	MODERATE	SEVERE	EXTREME
9. Arm, shoulder or hand pain.	1	2	3	4	5
10. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

QuickDASH DISABILITY/SYMPTOM SCORE = $\left(\left[\frac{(\text{sum of n responses})}{n}\right] - 1\right) \times 25$, where n is equal to the number of completed responses.

A QuickDASH score may not be calculated if there is greater than 1 missing item.

2/3

Q-DASH score.

outcome, oncological outcome, recurrence, and survival (Table 1).

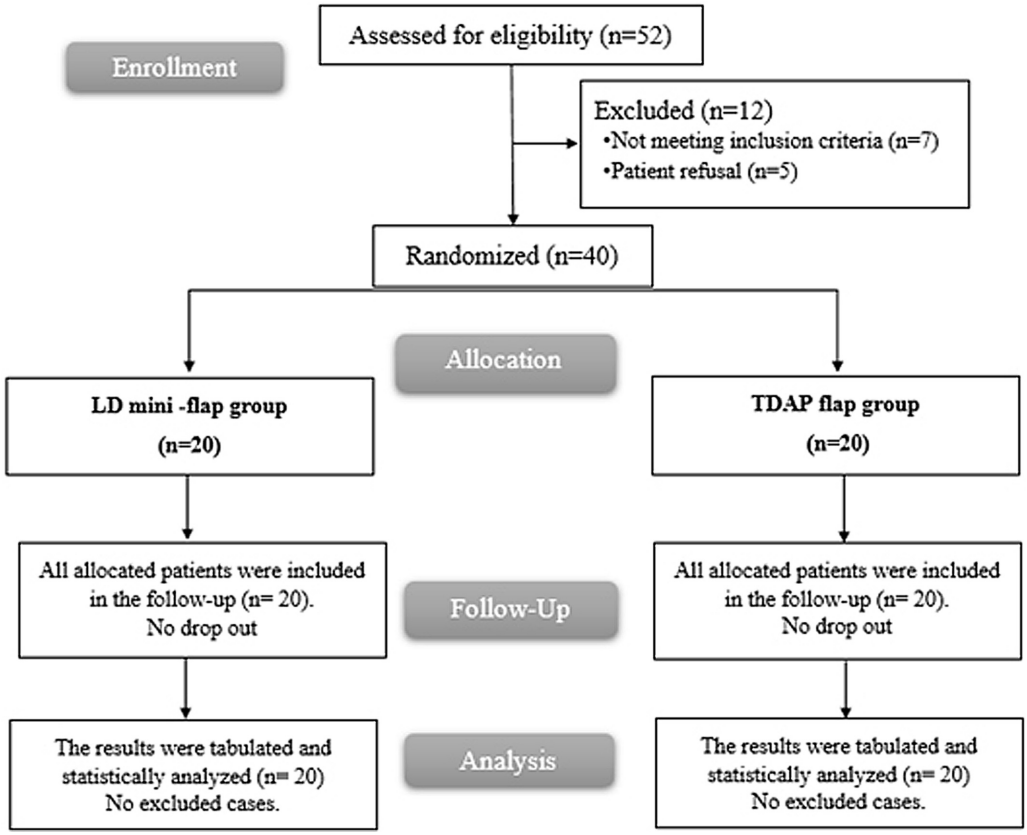
Objective outcomes were assessed according to aesthetic outcome score for the Japanese Breast Cancer Society

Subjects evaluated patients' satisfaction of the studied groups was assessed by distributing questionnaires to the patients to rate their postoperative satisfaction using a five-points Likert scale (for each of these items, a five-point Likert scale was used for scoring).

Table 1 Aesthetic outcome score for Japanese Breast Cancer Society scoring criteria for cosmetic assessment [14]

Breast size	2 (symmetric) to 0 (asymmetric)
Breast shape	2 (symmetric) to 0 (asymmetric)
Breast scar	2 (barely visible) to 0 (clearly visible)
NAC size, shape	1 (symmetric) or 0 (asymmetric)
NAC color	1 (symmetric) or 0 (asymmetric)
NAC position	1 (symmetric) or 0 (asymmetric)
Most inferior point of the breast	1 (symmetric) or 0 (asymmetric)
Overall	10–9 (excellent), 8–7 (very good), 6–5 (good), 4–3 (fair), 2–0 (poor)

Figure 16



CONSORT flowchart of the enrolled patients.

This scale ranges from 5=very satisfied, 4=satisfied, 3=neutral, 2=dissatisfied to very, to evaluate the same criteria evaluated by participants [15].

Oncologic outcome as time of adjuvant therapy (first cycle) (days) and tumor recurrence.

Statistical analysis

Statistical analysis was done by SPSS, v26 (IBM Inc., Chicago, Illinois, USA). The Shapiro–Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric variables were presented as mean and SD and compared between the two groups utilizing unpaired Student's t test. Quantitative nonparametric data were presented as the median and interquartile range and were analyzed by Mann–Whitney test. Qualitative variables were presented as frequency and percentage (%) and were analyzed utilizing the χ^2 test or Fisher's exact test when appropriate. A two-tailed P value less than 0.05 was considered statistically significant.

Results

In this study, 52 patients were assessed for eligibility, seven patients did not meet the criteria, and five patients refused to participate in the study. The remaining patients were randomly allocated into two equal groups (20 patients each). All allocated patients were followed up and analyzed statistically (Fig. 16).

Age, ASA physical status, comorbidities cup size, tumor site, quadrants, type of tumor, ER, PR, HER2, Ki76, biological classification, T stage, N stage, stage IIA, stage IIB, and NACTwere insignificantly different between the two groups. No patients underwent previous breast surgery (Table 2).

Operation time was significantly lower in LD mini-flap group than TDAP flap group (P=0.032). Types of lymph node, number of lymph node removed, number of lymph node affected, and intraoperative redo of safety margin were insignificantly different between the two groups. Failure to achieve safety margin and conversion to mastectomy did not occur in any patients in both groups (Table 3).

Regarding complication, aspiration of seroma occurred in four (20%) patients in LD mini-flap group and in TDAP flap group. Regarding reoperation, only one (5%) patient in TDAP flap group with complete flap

Table 2 Demographic data, operation time, breast and tumor characteristics of the studied groups

	LD mini-flap group (*N*=20)	TDAP flap group (*N*=20)	*P* value
Age (years)	43.3±8.81	46.35±3.47	0.158
ASA physical status			
I	17 (85)	12 (60)	0.077
II	3 (15)	8 (40)	
Comorbidities			
HTN	6 (30)	12 (60)	0.057
DM	3 (15)	0	0.072
DVT	2 (10)	0	0.147
Previous breast surgery	0	0	–
Cup size			
A	6 (30)	4 (20)	0.115
B	11 (55)	16 (80)	
C	3 (15)	0	
Tumor site			
Right	7 (35)	12 (60)	0.583
Left	13 (65)	8 (40)	
Quadrants			
Upper outer quadrant	16 (80)	18 (90)	0.376
Lower outer quadrant	4 (20)	2 (10)	
Type of tumor			
IDC	17 (85)	18 (90)	0.307
ILC	1 (5)	2 (10)	
ILC and ILC	2 (10)	0	
ER			
Positive	16 (80)	17 (85)	0.677
Negative	4 (20)	3 (15)	
PR			
Positive	17 (85)	20 (100)	0.072
Negative	3 (15)	0	
HER2			
Positive	3 (15)	0	0.072
Negative	17 (85)	20 (100)	
Ki 76 (%)			
<14	12 (60)	13 (65)	0.744
>14	8 (40)	7 (35)	
Biological classification			
Luminal A	14 (70)	16 (80)	0.279
Luminal B	2 (10)	4 (20)	
Her2 enriched	3 (15)	0	
TNBC	1 (5)	0	
Tumor stages			
T stage			
T1	2 (10)	4 (20)	0.212
T2	17 (85)	16 (80)	
T3	1 (5)	0	
N stage			
N0	10 (50)	12 (60)	0.525
N1	10 (50)	8 (40)	
M stage			
M0	20 (100)	20 (100)	–
Stage I			
T1N0M0	1 (5)	2 (10)	0.646
Stage IIA			
T1N1M0	1 (5)	2 (10)	
T2N0M0	8 (40)	10 (50)	
Stage IIB			
T2N1M0	9 (45)	6 (30)	
T3N0M0	1 (5)	0	
NACT			
Yes	9 (45)	8 (40)	0.749

Data are presented as mean±SD or *n* (%). ASA, American Society of Anaesthesiology; DM, diabetes myelitis; DVT, deep vein thrombosis; ER, estrogen receptor; HER2, human epidermal growth factor receptor 2; HTN, hypertension; IDC, invasive ductal carcinoma; ILC, infiltrating lobular carcinoma; LD, latissimus dorsi; NACT, neoadjuvant chemotherapy; PR, partial tumor response; TDAP, thoracodorsal artery perforator.

Table 3 Intraoperative data of the studied groups

	LD mini-flap group (*N*=20)	TDAP flap group (*N*=20)	*P* value
Operation time (min)	149.25±29.35	175.5±43.68	0.032*
Types of lymph node			
SLNB	10 (50)	12 (60)	0.525
ALND	10 (50)	8 (40)	
No of lymph nodes removed	7.9±5.23	6.45±3.8	0.322
No of lymph nodes affected	2.1±2.61	0.9±1.41	0.079
Intraoperative redo of safety margin			
Positive	6 (30)	2 (10)	0.114
Negative	14 (70)	18 (90)	
Failure to achieve safety margin	0	0	–-
Conversion to mastectomy	0	0	–

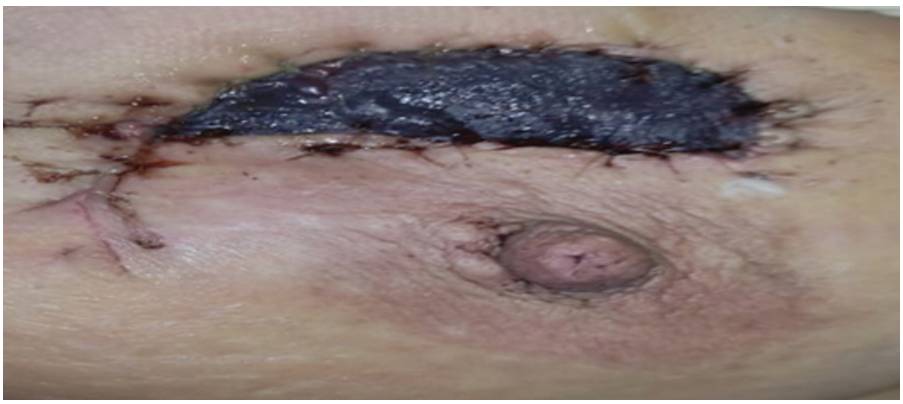
Data are presented as nean±SD or *n* (%). ALND, axillary lymph node dissection; LD, latissimus dorsi; SLNB, sentinel lymph node biopsy; TDAP, thoracodorsal artery perforator. *Significant as *P* value less than or equal to 0.05.

loss reoperated with removing of flap and conversion to Bat wing surgery. Complications and reoperation were insignificantly different between two groups. Drain removal and hospital stay were significantly lower in LD mini-flap group than TDAP flap group ($P<0.05$) (Figs 17–19).

Shoulder mobility 3–6 months was significantly higher in LD mini-flap group than TDAP flap group ($P=0.045$) (Table 4).

Regarding aesthetic outcome assessment, breast size, breast shape, NAC size, NAC color, NAC position,

Figure 17

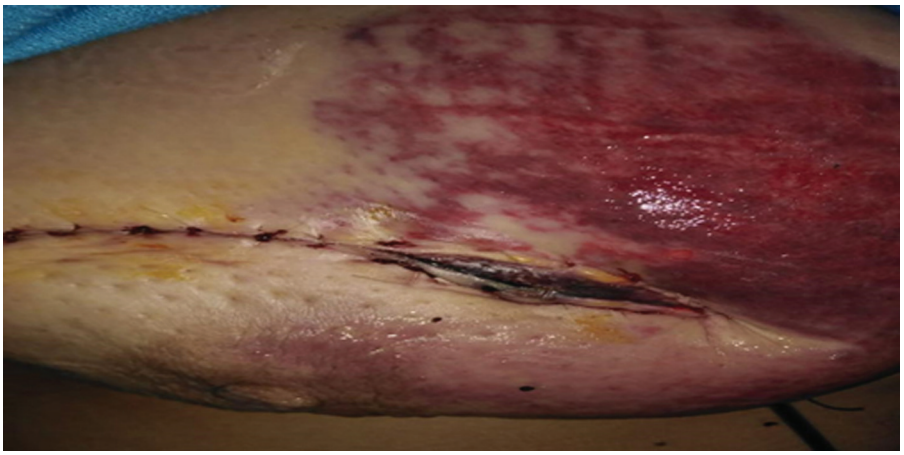


TDAP flap loss. TDAP, thoracodorsal artery perforator.

Figure 18

Wound infection and breast edema in TDAP flap. TDAP, thoracodorsal artery perforator.

Figure 19



Skin ecchymosis with TDAP flap. TDAP, thoracodorsal artery perforator.

Table 4 Postoperative data of the studied groups

	LD mini-flap group (*N*=20)	TDAP flap group (*N*=20)	*P* value
Early postoperative data			
Complications			
Breast edema	11 (55)	6 (30)	0.110
Marked seroma	4 (20)	9 (45)	0.329
Skin ecchymosis	4 (20)	5 (25)	0.705
Minor wound gap	3 (15)	2 (10)	0.633
Major wound gap	2 (10)	1 (5)	0.548
Surgical site infection	3 (15)	2 (10)	0.633
Complete flap loss	0	1 (5)	0.311
Number of wound scars	1	2	–
Aspiration of seroma	4 (20)	9 (45)	0.329
Reoperation	0	1 (5)	0.311
Drain removal	15.05±5.42	20.15±4.82	0.003*
Hospital stay (days)	1.65±0.81	5.65±3.45	<0.001*
Functional outcome			
Shoulder mobility 3-6 M assessed by Quick DASH scale	25.65±11.44	17.15±14.31	0.045*
Normal	8 (40)	15 (75)	0.029*
Slight affected	11 (55)	3 (15)	
Moderate affected	1 (5)	2 (10)	

Data are presented as mean±SD or *n* (%). LD, latissimus dorsi; TDAP, thoracodorsal artery perforator. *Significant as *P* value less than or equal to 0.05.

INF, and total score were insignificantly different between both groups. Breast scar was significantly higher in LD mini-flap group than TDAP flap group (*P*e=0.009). Regard patients' satisfaction, breast volume symmetry, breast shape, breast symmetry, and NAC were insignificantly different between both groups. Breast scar, total score, and satisfaction were significantly higher in LD mini-flap group than TDAP flap group ($P<0.05$) (Table 5, Figs 20 and 21).

Discussion

Since the 1970s, a myocutaneous LD has been the workhorse of breast reconstruction, even in microsurgery and perforator flaps [16]. TDAP flap has gained wide acceptance in recent years among reconstructive surgeons. It is becoming popular for its versatility, reliability, and considerably low morbidity. The TDAP flap is a fasciocutaneous flap that can be an alternative solution. It can offer the theoretical advantage of sparing the LD muscle and thus reducing the donor site morbidity [17].

Table 5 Aesthetic outcome assessment according to Japanese Breast Cancer Society score and patients' satisfaction according to the five-points Likert scale of the studied groups

	LD mini-flap group (*N*=20)	TDAP flap group (*N*=20)	*P* value
Aesthetic outcome			
Breast size	1.4±0.5	1.05±0.69	0.074
Breast shape	1.5±0.51	1.15±0.75	0.092
Breast scar	1.1±0.64	0.6±0.5	0.009*
NAC size	0.85±0.37	0.9±0.31	0.643
NAC color	0.85±0.37	0.85±0.37	1.000
NAC position	0.85±0.37	0.85±0.37	1.000
INF	0.7±0.47	0.8±0.41	0.478
Total score			
Excellent	8 (40)	5 (25)	0.401
Very good	5 (25)	5 (25)	
Good	4 (20)	2 (10)	
Fair	3 (15)	7 (35)	
Patients' satisfaction			
Breast volume symmetry	4.15±0.81	3.7±0.98	0.122
Breast shape	4.15±0.81	3.65±0.93	0.079
Breast symmetry	4.1±0.79	4.35±0.67	0.287
Breast scar	3.3±0.66	2.5±0.69	<0.001*
NAC	4.65±0.67	4.1±1.02	0.051
Total score	4.07±0.46	3.65±0.45	0.006*
Satisfaction			
Satisfied	13 (65)	5 (25)	0.025*
Natural	7 (35)	13 (65)	
Dissatisfied	0	2 (10)	

Data are presented as mean±SD or *n* (%). IMF, inframammary fold; LD, latissimus dorsi; NAC, nipple–areolar complex; TDAP, thoracodorsal artery perforator. *Significant as *P* value less than or equal to 0.05.

Figure 20

LD mini scar. LD, latissimus dorsi.

Figure 21

TDAP flap scar.TDAP, thoracodorsal artery perforator.

In our investigation, the operative time was with a mean value (±SD) of 2.48±0.48 min in mini-LD flap group and 2.9±0.72 in TDAP group. The operation time was significantly lower in LD mini-flap group than TDAP flap group.

The short operative time for LD mini flap can be attributed to LD mini flap may be a less complex procedure compared to certain larger flaps. The complexity of the surgical technique, the number of steps involved, and the intricacy of tissue manipulation. Also, the LD mini flap may involve less extensive tissue dissection and mobilization compared to TDAP. The LD mini flap typically relies on the blood supply from specific vascular pedicles within the muscle. Preserving

these vessels allows for a smaller, more localized dissection, reducing the need for extensive mobilization. While TDAP flaps require more intricate vascular connections or, longer vessel dissection may take longer to perform [18].

Near to our findings, Hassan *et al.* [19] noticed that the operative time was with a mean value (±SD) of 2.74 ±0.82 min in mini-LD flap group and 2.34±0.91 in perforator group. The operative time was insignificant between LD mini-flap group and perforator group. This difference may be related to the large sample size and using different perforator techniques including the lateral intercostal artery perforator flap.Also, Abdelrahman *et al.* [20] stated that the mean operative time was insignificant between LD group and TDAP group.

In our study, intraoperative redo of safety margin was present in six (30%) patients in LD mini-flap group and was present in two (10%) patients in TDAP flap group. Failure to achieve safety margin and conversion to mastectomy did not occur in any patients in either group.

In the present study regarding complications, aspiration of seroma occurred in four (20%) patients in LD mini-flap group and in TDAP flap group. Regarding reoperation, only one (5%) patient in TDAP flap group with complete flap loss reoperated with removal of flap and conversion to Bat wing surgery. Complications and reoperation were insignificantly different between the two groups. Both LD mini flap and TDAP flap procedures involve the use of autologous tissue [21]. Also, these flaps have a good blood supply, promoting adequate perfusion to the reconstructed breast, survival, healing, and reducing the risk of complications [22].

In agreement with our results, Hassan *et al.* [19] found that hematoma, major wound gap, complete flap loss, and seroma were insignificantly different between the LD mini-flap group and perforator group.

In our study, drain removal and hospital stay were significantly lower in the LD mini-flap group than in the TDAP flap group. This is due to the higher patients undergoing ALND which had negative effect on shoulder mobility and may lead to longer hospital stay. In disagreement with our results, Abdelrahman *et al.* [20] exhibited that postoperative hospital stay was insignificant between LD flap group than TDAP flap group. Also, Hassan *et al.* [19] found that postoperative hospital stay was insignificant between LD mini-flap group than perforator flap group.

Our study revealed that shoulder mobility affection at 6 months was significantly higher in LD mini-flap group than TDAP flap group. In agreement with our results, Abdelrahman *et al.* [20], who showed that mobility affection 6 months was significantly higher in LD flap group than TDAP flap group. In agreement with our results, Peintinger *et al.* [23] conducted a prospective, longitudinal study on 56 patients with invasive breast cancer who received the SLNB. In all, 25 patients received the SLNB only and 31 patients underwent the standard level I and II ALND. They showed that shoulder mobility affection was significantly lower in SNLB group than ALND.

In disagreement with our results, Hassan *et al.* [19] who found that shoulder mobility affection at 6 months was significantly lower in LD mini-flap group than perforator group. This difference may be related to different techniques and a large sample size. This difference may be related to the large sample size and using different perforator techniques including the lateral intercostal artery perforator flap.

In our study, regarding Japanese Breast Cancer Society score, five (25%)patients were excellent in LD mini-flap group and five (25%) patients were in TDAP flap group, five (25%) patients were very good in LD mini-flap group and five (25%) patients were in TDAP flap group, four (20%) patients were good in LD mini-flap group, and two (10%) patients were in TDAP flap group, three (15%) patients were fair in LD mini-flap group and seven (35%) patients were in TDAP flap group. In agreement with our results, Abdelrahman *et al.* [20] who showed that regarding Japanese Breast Cancer Society score, 12 (57.1%) patients were good in LD mini-flap group and 10 (47.6%)patients were in TDAP flap group, two (9.5%) patients were fair in LD mini-flap group and three (14.3%) patients were in TDAP flap group, however five (23.8%) patients were excellent in LD mini-flap group and six (28.6%) patients were in TDAP flap group. In contrast with our results, Amin *et al.* [24] showed that in TDAP flap group, 10% of the patients were excellent, 70% were good, and 15% patients were fair. Different surgical techniques could be accountable for this variation.

In our study, regarding both aesthetic outcome and patients' satisfaction, breast scar satisfaction was significantly higher in LD mini-flap group than TDAP flap group.

Breast scar is higher in LD mini-flap due to the size of the tissue flap used in breast reconstruction, which can impact tension on the incision site. In some cases, larger flaps, even if considered 'mini,' may place more tension on the incision, potentially influencing scar formation [25]. The location of incisions can affect scar visibility. The choice of incision placement and closure techniques can be critical in minimizing scar visibility [26]. Postoperative care and wound management practices can influence scary outcomes. Proper care, such as avoiding tension on the incision site, following wound care instructions, and using scar management techniques, can contribute to better scar appearance [27].

In our results, the total score of patients satisfaction were significantly higher in LD mini-flap group than TDAP flap group. Compared to our findings, Lee *et al.* [28] conducted their study on 213 women who underwent 216 breast constructions with various oncoplastic volume replacement techniques selected according to the volume of breast tissue excised. When the excised volume was less than 150 g, regional flaps such as a lateral thoracodorsal or thoraco-epigastric flap, or perforator flaps such as an intercostal artery perforator flap or a TDAP flap were used. When the excised volume was more than 150 g, LD flap was used. They stated that 178 (82.3%) patients were satisfied with the general and aesthetic outcomes. LD flap ranked highest. Nonetheless, Abdelrahman *et al.* [20] stated that satisfaction was insignificant between LD mini-flap group than TDAP flap group.

Limitations: small sample size that may produce insignificant results and relatively short follow-up periods.

Conclusions

In early breast cancer patients, the LD mini flap is a superior technique to TDAP as it had lower operation time, short hospital stays, drain removal, breast scar satisfaction, and total score of patient satisfaction but with high shoulder mobility affection.

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Conflict of interest

There are no conflicts of interest.

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