

LICAP Versus TDAP for Reconstruction of Partial Breast Defects

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Abstract

Background

Perforator flaps are the latest development in reconstructive surgery. Pedicled chest wall perforator flaps can be utilized in many cases of partial breast reconstruction. This research compares the outcome and technique of Thoracodorsal Artery Perforator Flap (TDAP) and the Lateral Intercostal Artery Perforator Flap (LICAP) in reconstruction of partial breast defects.

Methods

Patient records were reviewed for the time period between 2011-2019 at the breast unit of the National Cancer Institute of Cairo University. Eighty three patients were accessible for the study. (46 cases of TDAP flap and 37 cases of LICAP flap). Relevant clinical data were extracted from patients' records. A special visit was organized for all 83 patients ,where a digital photograph was taken in an antro-posterior view. The photographs were later processed via BCCT.core software to obtain an objective cosmetic outcome assessment.

Results

Complication rates and cosmetic outcome were comparable for both techniques. TDAP flap flap proved to require more tedious dissection and preoperative Doppler mapping to localize perforator vessels. On the other hand LICAP was technically easier with more consistent perforators.

Conclusion

Pedicled chest wall perforator flaps constitute an excellent reconstructive option in partial breast defects. They have replaced musculocutaneous flaps to a large extent.

Background

The surgical management of breast cancer has undergone considerable modifications along time. Breast conserving surgery is now the standard of care in early stage breast cancer. In recent years, there have been reports highlighting a survival benefit for breast conservation over mastectomy.[1]

In many instances, conservative breast surgery still results in significant defects that might alter the volume and contour and hence, the aesthetic outcome of the patient. The preservation of an aesthetically pleasing breast is now one of the goals of breast conserving treatment.

Perforator flaps are the latest development in breast reconstruction. Originally described by Koshima, these flaps are based on branches of main vessels that perforate through muscle or fascia. The idea behind this technique is to reduce donor site morbidity to an absolute minimum by keeping the muscles with their main blood supply in place.[2]

This concept has revolutionized the field of reconstruction in general. For breast reconstruction there are two types of perforator flaps at hand : the free, and the pedicled perforator flaps.

Free perforator flaps have anatomically distant donor sites such as the abdominal wall. Based on deep or superficial inferior epigastric perforator vessels (DIEPSIEP), these flaps require microvascular anastomosis to one of the main vessels supplying the breast (usually Internal thoracic vessels). Another example are the superior gluteal and inferior gluteal perforator flaps (SGAP,IGAP).

Pedicled perforator flaps are based on branches of vessels in the vicinity of the breast. Thoracodorsal artery perforator flap (TDAP) is based on perforating vessels of the longitudinal (lateral) terminal branch of the thoracodorsal artery. These vessels perforate through the latissimus dorsi muscle to share in the blood supply of the skin over the back and lateral part of chest wall. The lateral intercostal artery perforator flap (LICAP) relies on the lateral perforating vessels of the 6th -8th intercostal vessels which perforate the intercostal muscles and serratus anterior to supply the skin of the lateral part of the chest wall.

Both flaps (TDAP and LICAP) are indicated for the reconstruction of partial breast defects involving the lateral aspects of the breast. This research compares the technicalities and outcome of both techniques.

Methods

This is a retrospective non randomized study comparing the outcome and technical aspects of the TDAP and the LICAP for the reconstruction of partial breast defects.

Both techniques have been performed at different time frames at the same institution (National Cancer Institute of Cairo University) by the same surgical team. Indications were similar in both study groups namely:

- Early stage breast cancer patients who required excision of 20% or more of their breast volume.
- Patients requiring skin excision such as those:
- With tumours close or attached to but not infiltrating the skin.
- With misplaced scars of previous open biopsies, which needed wider excision due to infiltrated margins.
- Breast cancer patients with unfavourable breast/tumour ratio, who were downstaged by neoadjuvant chemotherapy to allow breast conservation.

Review of patients' records between January 2011 – December 2019 revealed 52 cases of TDAP flap and 40 cases of LICAP technique who have completed their adjuvant treatment. Of those, only 46 cases of TDAP flap and 37 cases of LICAP flap have been accessible for this study.

Relevant clinical data were extracted from patients' records. A special visit was organized for all 83 patients ,where a digital photograph was taken in an anteroposterior view.

The photographs were later processed via BCCT.core software to obtain an objective cosmetic outcome assessment.

Results of both groups were recorded in tables and data were statistically described in terms of mean \pm standard deviation (\pm SD), and, or frequencies (number of cases) and percentages when appropriate.

Comparison of numerical variables between the study groups was done using the Student *t* test for independent samples in normally distributed data and Mann-Whitney *U* test for independent samples in not normal data. For comparing categorical data, chi square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *p* values less than 0.05 was considered statistically significant. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) release 15 for Microsoft Windows (2006).

Patients

The demographic data and comorbidities of the study groups are illustrated in the following table:

	TDAP	LICAP
Mean Age	42 (34-52)	39 (31-49)
Mean BMI	33.2 Kg/m ² (31.2-36)	30.6 Kg/m ² (29.3-34.1)
Diabetic	4	2
Hypertensive	3	2

The clinical TNM stage for the study groups at initial presentation are illustrated in the following table:

TNM	TDAP	LICAP
T2N0	9	13
T2N1	33	21
T3N0	4	2

Six patients of the TDAP group and three patients of the LICAP group received neoadjuvant chemotherapy for downstaging to enable breast conservation.

All patients in both groups underwent preoperative Doppler mapping to allocate the site of perforators preoperatively. In addition, intra-operative frozen section examination was done for all specimens in order to verify negative margins of excision before flap elevation was started.

Results

The mean operative time for TDAP was 229 minutes (range 310-180) while that of LICAP was 176 min (range 220-166). Average TDAP flap dimensions were 18 x 9cm (range length 14-21 cm, range width 7-12cm). The average size of the flaps harvested in the LICAP group was 21 x 11 cm (range length 17-23, range width 10-13 cm).

A well developed isolated perforator vessel could be identified and adequately dissected as a pedicle in 3 patients of the TDAP group and in 7 patients of the LICAP group. In the rest of TDAP cases a piece of latissimus dorsi muscle was harvested around the perforator vessels, while in the LICAP group a mesentery of subcutaneous fat was maintained around the perforators. Fig. 1

Preoperative Doppler mapping for TDAP showed that one or two perforator vessels are present in 80% of cases in a quadrant formed through the intersection of four lines:

Two horizontal lines 9 cm and 11 cm downward from the level of the posterior axillary fold with the arm abducted 90° and two vertical lines 1 and 4cm medial to the anterior border of latissimus dorsi muscle. Figure.2

In the LICAP group a perforator or two were detected preoperatively in all cases at the medial lower angle of a triangle formed by the anterior and posterior axillary lines with its base formed by a horizontal line at the level of the inframammary fold. Figure.3

Intraoperatively the Doppler mapping proved accurate in 87% of cases of TDAP and 100% of LICAP group.

Complications occurred in 8 patients in the TDAP group (17.4%). The most common complication was venous congestion that occurred in four patients. The condition was completely reversible within 48 hours in three patients and progressed to superficial sloughing in one patient. There were two cases of minor wound infection at the recipient site that responded to repeated dressing. One patient suffered a postoperative hematoma that was surgically evacuated. Another case presented with fat necrosis in the breast tissue around the flap but needed no further intervention.

The complication rate was 11% in the LICAP group. Two patients presented with seroma, one in the axilla and one in the breast. Another two patients presented with minor wound infection at the recipient site.

Cosmetic outcome of the TDAP group as evaluated by the BCCT.core software showed 11% (5 cases) to have excellent, 59% (27) good, 28% (13) fair and 2% (1) with poor result.

The LICAP group on the other hand had 22% excellent (8 cases), 51% (19) good and 27% (10) fair cosmetic result.

The results of both study groups are summarized in the following table:

	TDAP	LICAP	p-value
Mean operative time	229 min. (310-180)	176 min.(220-166)	0.053
Mean Flap dimensions	Length: 18cm (21-14) Width: 9cm (7-12)	Length: 21cm(23-17) Width: 11cm (13-10)	0.096
Isolated perforator pedicle	3 cases	7 cases	0.166
Conjugate pedicle (muscle/fat)	43 cases	30 cases	0.166
Location of perforator by preop. Doppler mapping	37 patients within a quadrant (9 patients outside quadrant)	37 patients in a triangle (all within the triangle)	<i>0.013</i>
Doppler accuracy	40 patients (location found by Doppler was correct intraoperative)	37 patients (location found by Doppler was correct intraoperative)	0.064
Complications	8 patients	4 patients	0.594
Venous congestion	4	0	0.186
Wound infection	2	2	0.770
Hematoma	1	0	0.913
Seroma	0	2	0.381
Fat necrosis	1	0	0.913
Cosmetic outcome			0.470
Excellent	5	8	
good	27	19	
fair	13	10	
poor	1	0	

Discussion

The concept of perforator flaps has brought about significant enhancements to the field of breast reconstruction. Angrigiani et al were the first to describe the TDAP flap in 1995.[3] However, Hamdi et al

were the first to report elaborately on chest wall perforator flaps for partial breast reconstruction.[4] McCulley et al described the use of LTAP and LICAP for immediate or delayed reconstruction after partial mastectomy.[5] Kim et al published their experience on TDAP and LICAP in small to medium sized breasts. They found comparable rates of patient satisfaction and acceptable cosmetic outcome for both techniques. A higher rate of fat necrosis was noticed with the LICAP technique.[6]

This research illustrates the experience of a single surgical team with two chest wall perforator flaps described for partial breast reconstruction.

The TDAP flap has proven to be more tedious and in need of a steep learning curve to master. Its most common complication in this limited experience was venous congestion. The perforators for this flap are seemingly not consistent and might lie in some cases outside the anatomical boundaries described for them. It is advisable to perform preoperative Doppler mapping, whenever a TDAP flap is planned.

On the other hand, LICAP flaps are a very easy to learn technique with many possible ways to fashion the skin paddles and several possible arcs of rotation. This versatile flap could be based on the lateral thoracic pedicle(LTAP) or the lateral intercostals perforators.

The lateral intercostals perforators are apparently very consistent in their anatomical location and more abundant than in case of the TDAP. They can be always found at the described anatomical location. Thus, a preoperative Doppler mapping might not be necessary in all cases. In this research the only point of comparison that reached a statistical significance was the location of perforators. Still, this result might be a subject to bias due to inconsistent measurements. Further anatomical studies are needed to verify this difference between the surface anatomy of the perforators of LICAP and TDAP.

The surgical management of breast cancer has witnessed a noticeable de-escalation from total mastectomies to more limited resections. The resulting defects were initially managed by latissimus dorsi miniflaps.[7] This technique, however, still left behind significant donor site morbidity. Perforator flaps have emerged as a very suitable reconstructive option in these cases with very limited donor site morbidity. These flaps are optimal in patients where considerable volume resections are planned but still a mastectomy is not indicated.

Conclusion

Pedicled perforator flaps combine the best of two worlds. They retain the major advantage of perforator flaps by leaving behind minimal donor site morbidity, while maintaining a reliable pedicle. According to this limited experience, it is now the technique of choice whenever a partial breast defect is considered for reconstruction. Musculo-cutaneous flaps form no longer an acceptable option in these cases. The ease and practicality of chest wall perforator flaps as well as their minimal morbidities have brought them to the front lines in partial breast reconstruction.

Declarations

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Availability of data and materials

Please contact the author for data request.

Authors' contributions

TH arranged for statistical analysis and pathological information .SNT and AO were responsible for data collection and organization and collaborated with TH in writing the final manuscript. The authors have all read and approved this final manuscript.

Ethics approval and consent to participate

The study was done after approval of the ethical committee of the National Cancer Institute of Cairo University.

Consent for publication

Consent for publication was obtained from patients.

Competing interests

The authors declare that they have no competing interests.

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Figures

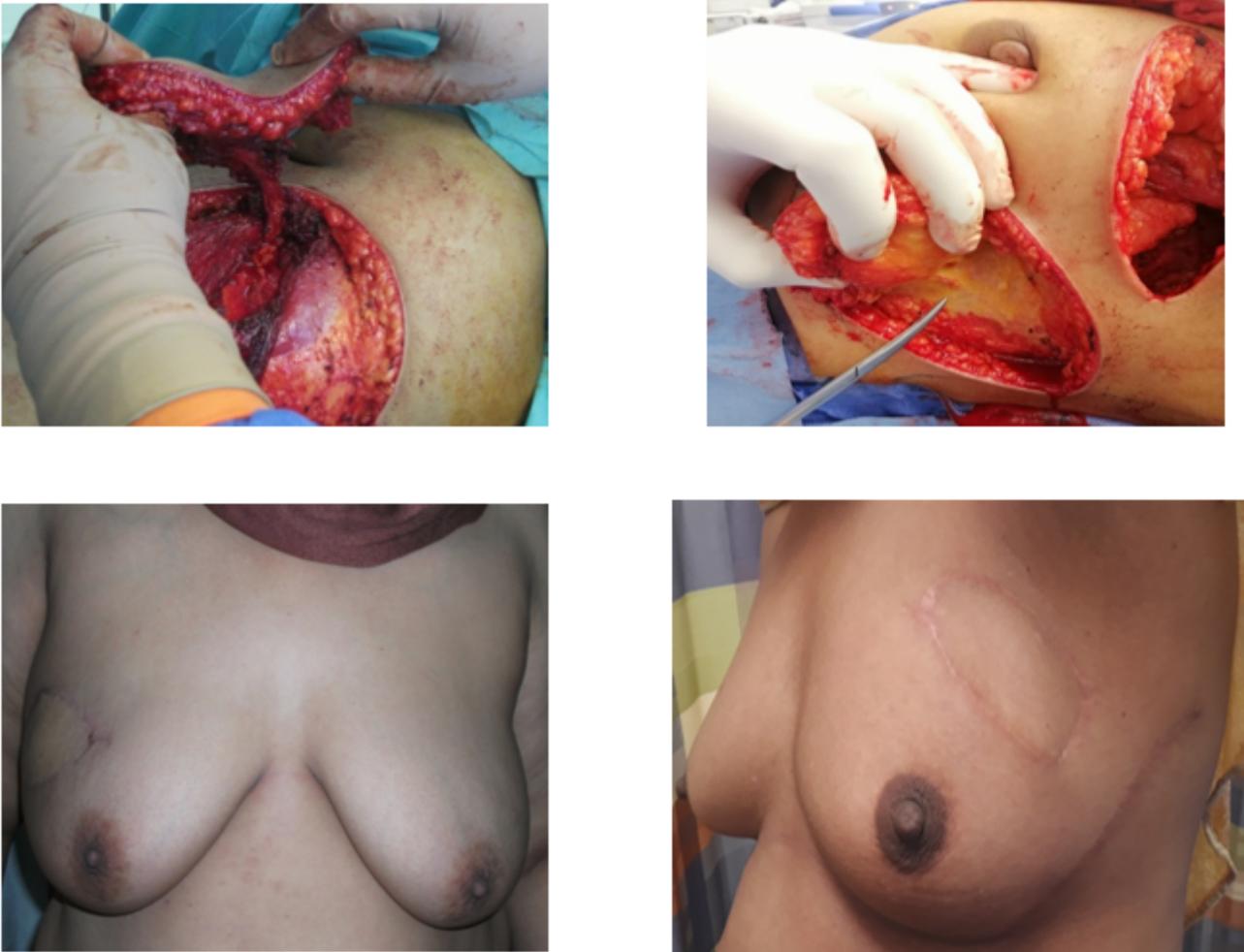


Figure 1

TDAP (left), LICAP (right)

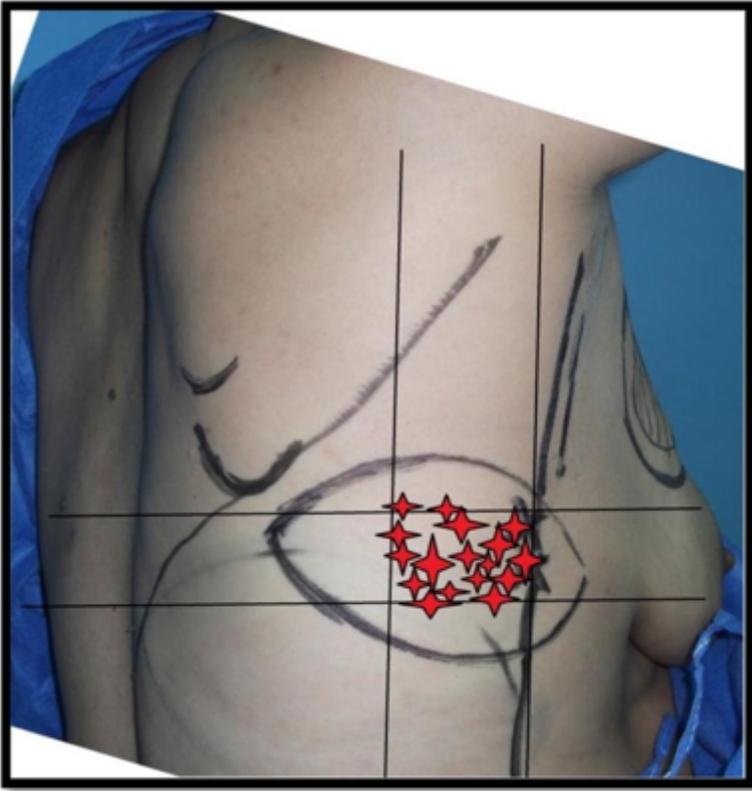


Figure 2

boundaries of the quadrant where TDA perforators were most frequently found



Figure 3

perforators of LICAP flap were consistently found in the lower medial angle of a triangle.