

## Early Experience in Lateral Intercostal Artery Perforator Flap in Oncoplastic Breast Surgery in Breast Conservation Therapy

Aroun kumar Nagalingam, Ravisankar Palaniappan, Selvakumar, Kuralarasi Sudha  
Ravichandran, Magalakshmi Narayanasamy\*

Department of General Surgery, Sri Venkateshwaraa Medical College Hospital and Research Centre, Ariyur, Puducherry,

\*Corresponding Author: Magalakshmi Narayanasamy

\*Email ID: dr.maganarayanan@gmail.com

### KEYWORDS

Lateral Intercostal Artery Perforator Flap, Breast-conserving surgery, Oncoplastic breast surgery.

### ABSTRACT

**Introduction:** Breast cancer remains the most prevalent cancer among women worldwide, significantly impacting health outcomes. Breast-conserving surgery (BCS) has become a cornerstone of early-stage breast cancer management, offering oncological safety and superior aesthetic outcomes compared to mastectomy. Oncoplastic breast surgery (OBS), incorporating techniques like the Lateral Intercostal Artery Perforator (LICAP) flap, bridges this gap by enhancing breast reconstruction through natural tissue restoration. This study evaluates the effectiveness of LICAP flap reconstruction in achieving satisfactory cosmetic outcomes post-BCS.

**Methods:** Thirteen women with early-stage breast cancer, aged 35-60 years, underwent BCS with LICAP flap reconstruction. Preoperative imaging, histopathological assessment, and Doppler mapping were utilized for surgical planning. Postoperative outcomes were assessed using standardized photographic analysis, the Surgeon-Assessed Scoring System (SASS), the Patient and Observer Scar Assessment Scale (POSAS), and patient satisfaction scores on a 0–10 numeric rating scale. Data were analyzed using SPSS version 16, with statistical significance set at  $p < 0.05$ .

**Results:** The LICAP flap demonstrated excellent outcomes, with mean patient satisfaction scores of 8.2 and SASS scores of 8.2. Aesthetic evaluations showed excellent breast symmetry in 10 patients and good symmetry in 3. Scars were highly noticeable (mean score: 8.3,  $p < 0.001$ ), but complications were minimal, with only one mild infection managed conservatively.

**Conclusion:** The LICAP flap is a reliable oncoplastic tool, yielding high patient satisfaction and superior cosmetic outcomes. Despite minor limitations, such as noticeable scarring, its low complication rate and efficacy in addressing tissue loss validate its clinical application. Further studies with larger sample sizes and extended follow-ups are warranted.

### Introduction

Breast cancer is the most prevalent cancer among women worldwide, with significant mortality rates. Globally around 2.3 million women were diagnosed with breast cancer leading to 670,000 deaths. The global age-standardized incidence rate is 46.8 cases per 100,000 women, indicating a widespread impact across different regions.<sup>1</sup> In India 98,337 deaths had been reported in 2022, which translated to an age-standardized mortality rate of 13.7 per 100,000 women, placing it first worldwide for breast cancer mortality.<sup>2</sup>

Breast cancer treatment is multifaceted and involves a combination of surgery, radiotherapy, chemotherapy, hormone therapy, and targeted therapies. The specific treatment plan depends on various factors, including the stage and type of cancer, and the patient's overall health.<sup>3</sup>

Surgical methods are often considered the first line of treatment, which aims to remove the tumor and surrounding tissue which includes Mastectomy and Breast-Conserving Surgery (BCS).

Among the surgical options, BCS, also referred to as lumpectomy has emerged as a cornerstone in early breast cancer management.<sup>4,5</sup> It is associated with better cosmetic outcomes and improved quality of life compared to mastectomy, as it allows for greater preservation of breast appearance. Further advantages of BCS include reduced side effects, reduced operative time, and diminished psychological burden of mastectomy.<sup>6,7</sup>

The evolution of breast cancer treatment has led to the integration of oncoplastic breast surgery (OBS), which bridges the gap between cancer surgery and plastic surgery. OBS enhances the traditional BCS by incorporating reconstructive techniques to address the aesthetic deformities of wide local tumor excision. OBS improves cosmetic outcomes and reinforces patient confidence and satisfaction, making it an integral component of modern breast cancer care.<sup>8,9</sup> Oncoplastic breast surgery is categorized into two tiers based on resection volume

and reconstructive complexity. Level one procedure address defects under 20% by simple tissue mobilization and reshaping, while level two, for resections of 20-50% employs advanced mammoplasty techniques like reduction or mastopexy to ensure symmetry and aesthetic outcomes.

The Lateral Intercostal Artery Perforator (LICAP) flap is a breast reconstruction technique utilizing skin and fat from the lateral chest wall, supplied by intercostal artery perforators. This muscle-sparing approach minimizes functional impairment and offers a natural-looking alternative to implants or free flaps. The LICAP flap provides excellent aesthetic outcomes and is associated with favorable recovery times and low complication rates, resulting in high patient satisfaction.<sup>10,11</sup>

This study aimed to evaluate the effectiveness of Lateral intercostal artery perforator flap reconstruction in achieving satisfactory cosmetic outcomes following breast conservation surgery. The specific objectives were to assess the technical feasibility of the LICAP flap, evaluate aesthetic outcomes using standardized scoring systems, and compare breast symmetry (shape, size, and projection) between the reconstructed and contralateral breasts.

## Methodology

Thirteen women between the ages of 35 and 60 with early-stage breast cancer participated in the study. Oncoplastic breast surgery employing the LICAP flap was available to all patients with unifocal lesions in the outer quadrant of early breast cancer that had been histologically proven. Patients who had a history of previous breast cancer therapy, inner quadrant or multifocal lesions, locally advanced breast cancer or were pregnant or nursing were not included in the study.

Mammography and ultrasonography were used in the preoperative evaluation to characterize the tumor's size, position, and relationship to the surrounding anatomical structures. Core needle biopsy was used to confirm the cancer diagnosis and immunohistochemistry and histological grading came next.

The lateral intercostal artery perforator (LICAP) flap reconstruction involved a systematic approach beginning with Doppler mapping that identified and protected the lateral intercostal artery perforator after the tumor was excised by the surgical oncologist. Subsequently, a vascularized flap consisting of adipose and cutaneous tissue was harvested from the lateral chest wall. Following the tumor excision with appropriate margins, this flap was carefully positioned, remodelled and inset was given into the surgical defect. In the end, the donor site was carefully closed, with an emphasis on avoiding tension on the wound closure and attaining the best possible aesthetic outcomes.

Participants in the trial were evaluated for aesthetic outcomes using the patient satisfaction score and the patient and observer Scar Assessment Scale (POSAS) after the LICAP and post-operative period. Additionally, a Surgeon-Assessed Scoring System (SASS) was used to evaluate factors such as areola-nipple alignment, scarring, and mammary symmetry. SPSS version 16 was used to evaluate the data using the proper statistical techniques, and a p-value of less than 0.05 was deemed significant.

## Results

### Aesthetic Outcomes

The aesthetic outcomes were objectively assessed using standardized photographic analysis. Frontal and lateral views were captured preoperatively and postoperatively and evaluated for breast symmetry, contour, and volume restoration.

Patient satisfaction was measured using a numeric rating scale (0–10), where 0 indicated "not satisfied at all" and 10 represented "extremely satisfied." The mean patient satisfaction score was 8.2, ranging between 7 and 10.

**SASS:** Patient satisfaction was consistently high, according to an examination of surgeon-assessed breast scarring characteristics. **Table 1** shows that scar size earned a mean score of 8.1 ( $\pm 2.8$ ), while scar noticeability and placement were scored with mean ratings of 8.3 ( $\pm 2.6$ ).

**Analysis of Breast Symmetry:** Shape, size, and projection of the contralateral and rebuilt breasts were compared as part of the cosmetic scoring process. The analysis demonstrated the efficacy of the LICAP flap procedure by showing that 10 patients had outstanding symmetry and 3 patients had good symmetry. (Figure 1)

### CASE 1:



**Figure 1:** a) Sitting with arms side b) Sitting with Arms elevated c) Right oblique view

**Table 1** summarizes subjective symptoms associated with scars, including numbness, stinging and tingling sensations, tightness, movement restrictions, noticeability, location, and size of the scar, along with their mean scores and statistical significance. Among the symptoms, noticeability scored the highest mean value ( $8.3 \pm 2.6$ ), indicating that patients perceive the scar as highly noticeable, and this was statistically significant ( $p < 0.001$ ). Similarly, the size of the scar also had a high mean score ( $8.1 \pm 2.8$ ) and was significant ( $p < 0.001$ ), highlighting its impact on patient perception.

While tightness had a moderate mean score ( $3.0 \pm 2.8$ ), it was statistically significant ( $p < 0.001$ ), suggesting its prominence among sensory symptoms.

**Table 1: Subjective symptoms reported by study population**

Symptoms	Mean	( $\pm$ SD)	p
Numbness	5.8	(3.4)	.195
Paresthesia	2.9	(2.7)	.212
Subjective tightness	3.0	(2.8)	<0.001
Movement restrictions	2.9	(2.8)	.236
Noticeability	8.3	(2.6)	<0.001
Location of the scar	8.3	(2.6)	.401
Size of the scar	8.1	(2.8)	<0.001

**Postoperative Wound Infection:** One patient developed a mild wound infection, which was managed conservatively with antibiotics and regular dressing changes. No major complications, such as flap necrosis or significant donor site morbidity, were observed, highlighting the safety and reliability of the technique.

## Discussion

BCS offers patients the dual benefit of oncological control and improved psychological and physical well-being due to the preservation of breast contour and volume.<sup>4,5</sup>

A partial breast reconstruction is carried out after the surgical oncologist removes the tumor and a margin of surrounding breast tissue in the first step of the breast-conserving technique. Vascularized adipose tissue taken from the upper back and axilla is frequently used in this surgery to fill in the ensuing defect. Depending on tumor size, location, and breast volume, the strategy includes either volume displacement (for 20–50% volume loss), which involves tissue mobilization and contouring, or volume replacement (for >50% volume loss), in which resected breast tissue is replaced with tissue from another region of the body.<sup>8,9</sup>

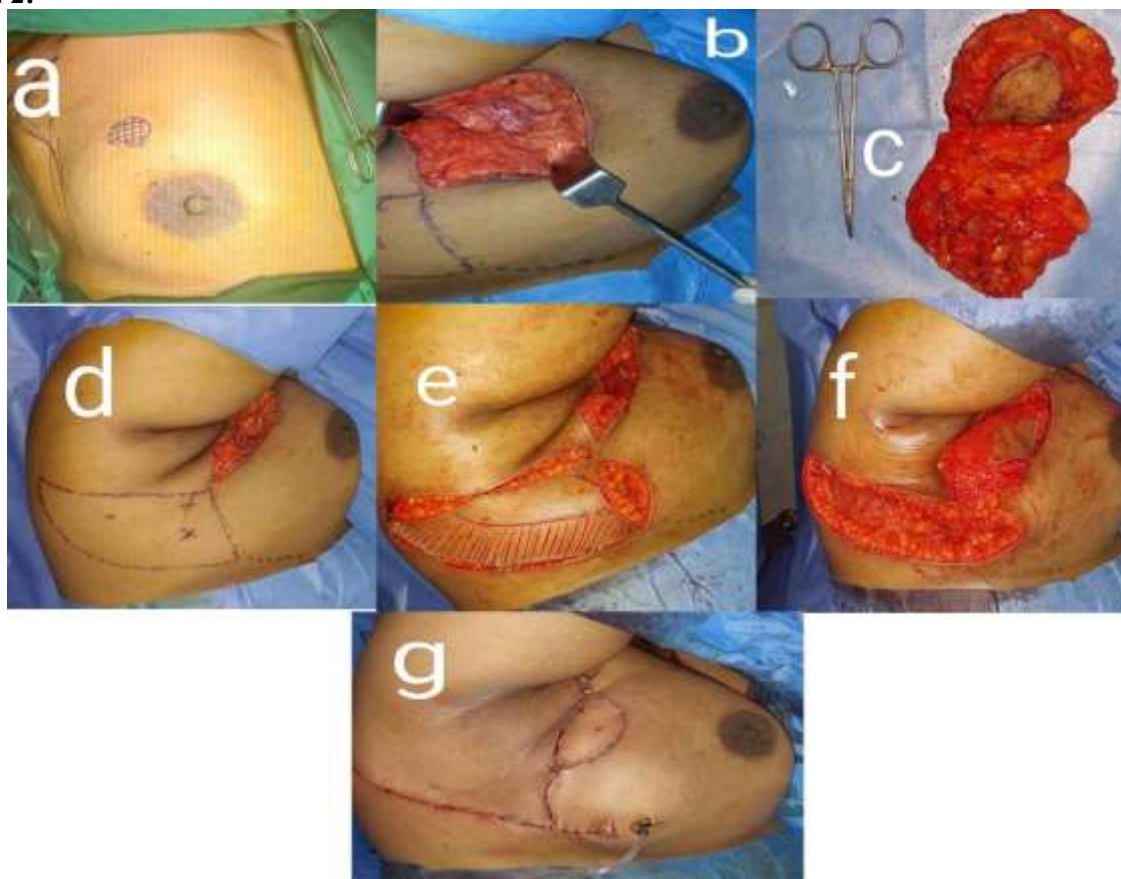
According to the study's findings, individuals having breast-conserving surgery can achieve satisfactory aesthetic results using the LICAP flap, a dependable and efficient oncoplastic technique. The technique's effectiveness in restoring breast symmetry and shape is demonstrated by the high mean scores in surgeon-assessed cosmetic outcomes (8.2) and patient satisfaction (8.2). Its safety and practicability in clinical practice are further supported by the low rate of complications. The study's results are consistent with previous research; Agrawal S *et al.*<sup>12</sup> found that more than 90% of patients were happy with their breast symmetry and surgical scars following BCS reconstruction using chest wall perforator flaps, indicating comparable satisfaction metrics.

When compared to other oncoplastic techniques, such as the Thoracodorsal Artery Perforator (TDAP) flap, studies have shown that both methods yield excellent cosmetic results but may vary in their application based on individual patient needs.<sup>13</sup> The choice between these techniques often depends on factors such as tumor size,

location, and patient preference. However, the LICAP flap has gained recognition as a versatile option capable of addressing small-to-moderate breast defects effectively.<sup>12</sup>

The LICAP flap reconstruction procedure comprised several key steps. (**Figure 2**) First, Doppler mapping was employed to identify and preserve the lateral intercostal artery perforator. Subsequently, vascularized adipose-cutaneous tissue was harvested from the lateral chest wall. Following tumor excision with appropriate margins, the harvested flap was inset into the resulting defect. Finally, the donor site was meticulously closed, prioritizing aesthetic outcomes and minimizing tension on the closure.<sup>14,15</sup>

## CASE 2:



**Figure 2:** a) Flap marking b) Tumor defect c) Flap raised d) Pedicle perforator flap e) Donor site closure after flap insertion f) Specimen for HPE

In the current study, patients reported a moderate mean score for tightness, which was similar to the reports of Jacobs J *et al.*<sup>16</sup> noting that some patients report sensations of tightness or discomfort in the surgical area, which may be attributed to tissue manipulation during flap harvesting and closure.

Additionally, the study finds a high mean score for size ( $8.1 \pm 2.8$ ) and scar noticeability ( $8.3 \pm 2.6$ ), both of which are statistically significant ( $p < 0.001$ ). These results are consistent with earlier studies that highlighted scar visibility as a significant worry for patients having LICAP flap surgery. Though LICAP flap offers excellent aesthetic outcomes, the resulting scars can be prominent, particularly when extensive tissue is removed or when the flap extends from the lateral mammary fold to areas near the axilla.<sup>16,17</sup>

A review of 39 flaps performed in an outpatient setting reported a low complication rate, with only 2.5% experiencing major complications. This aligns with the findings of current study, reinforcing the notion that LICAP flap is a reliable option for breast reconstruction without significant morbidity.<sup>17</sup>

The strength of this study lie in its use of standardized cosmetic scoring systems, ensuring objective evaluation of outcomes, and its multidisciplinary approach, integrating oncological and plastic surgery expertise. However, limitations include the small sample size, and the short follow-up period, which limits the applicability of findings and assessment of long-term outcomes like tumor recurrence and flap durability.

## Conclusion:

This study underscores the efficacy of the Lateral Intercostal Artery Perforator (LICAP) flap as a pivotal tool in oncoplastic breast surgery. The high levels of patient satisfaction and favourable aesthetic outcomes affirm



its role in improving both the cosmetic and functional aspects of breast reconstruction post-breast conservation surgery. The low complication rates further emphasize its safety and practicality in clinical settings. Future research should focus on larger, multicentric studies with extended follow-up periods to validate these findings.

## References:

1. Breast cancer [Internet]. [cited 2024 Dec 30]. Available from: <https://www.who.int/news-room/fact-sheets/detail/breast-cancer>
2. Breast cancer statistics [Internet]. World Cancer Research Fund. [cited 2024 Dec 30]. Available from: <https://www.wcrf.org/preventing-cancer/cancer-statistics/breast-cancer-statistics/>
3. Treatment for breast cancer [Internet]. [cited 2024 Dec 30]. Available from: <https://www.cancerresearchuk.org/about-cancer/breast-cancer/treatment>
4. Jordan RM, Oxenberg J. Breast Cancer Conservation Therapy. In: StatPearls [Internet] [Internet]. StatPearls Publishing; 2022 [cited 2024 Dec 30]. Available from: <https://www.ncbi.nlm.nih.gov/sites/books/NBK547708/>
5. Breast-Conserving Surgery (Lumpectomy) [Internet]. 2024 [cited 2024 Dec 30]. Available from: <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/breast-conserving-surgery>
6. Jain U, Kothari A, Joshi S, Masannat YA. Breast conserving surgery revisited: a narrative review. *Annals of Breast Surgery* [Internet]. 2022 Dec 30 [cited 2024 Dec 30];6(0). Available from: <https://abs.amegroups.org/article/view/7368>
7. Shen YF, Huang J, Zhou WB, Li JH, Xiao Z, Huang AJ, *et al.* Breast-conserving in centrally located breast cancer patients confirmed safe by SEER based study. *Gland Surg.* 2022 Jan;11(1):226–35.
8. Pillarisetti RR, Querci della Rovere G. Oncoplastic Breast Surgery. *Indian J Surg.* 2012 Jun;74(3):255–63.
9. Macmillan RD, McCulley SJ. Oncoplastic Breast Surgery: What, When and for Whom? *Curr Breast Cancer Rep.* 2016;8:112–7.
10. Arisoy H, Sabaratnam R, Boland M. 583 Use of LICAP Flap Reconstruction in a Breast Cancer Patient with Cosmetic Implants Undergoing Breast Conserving Surgery. *British Journal of Surgery.* 2024 Jul 1;111(Supplement\_6):znae163.351.
11. Lipman K, Graw G, Nguyen D. Lateral intercostal artery perforator (LICAP) flap for breast volume augmentation: Applications for oncoplastic and massive weight loss surgery. *JPRAS Open.* 2021 May 21;29:123–34.
12. Agrawal\* SK, Mahajan\* S, Ahmed R, Shruti N, Sharma A. Chest wall perforator flap partial breast reconstruction: a retrospective analysis of surgical, cosmetic and survival outcome [Internet]. 2024 [cited 2024 Dec 31]. Available from: <http://ecancer.org/en/journal/article/1681-chest-wall-perforator-flap-partial-breast-reconstruction-a-retrospective-analysis-of-surgical-cosmetic-and-survival-outcome>
13. Kim JB, Kim DK, Lee JW, Choi KY, Chung HY, Cho BC, *et al.* The usefulness of pedicled perforator flap in partial breast reconstruction after breast conserving surgery in Korean women. *Arch Plast Surg.* 2018 Jan;45(1):29–36.
14. Regan JP, Casaubon JT. Breast Reconstruction. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 Dec 31]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK470317/>
15. Merh R, Devalia H, Dani M. 12. Pedicled perforator flaps (LICAP, MICAP) are safe and economical alternatives to mastectomy and complex reconstruction in a select group of patients. *European Journal of Surgical Oncology.* 2019 May 1;45(5):880.
16. Jacobs JED, Al Shaer S, Schmidbauer U, de Leeuw DM, Rakhorst HA, Zöphel OT. The anterior LICAP flap: a design option for oncoplastic breast reconstruction. *Case Reports Plast Surg Hand Surg.* 8(1):158–63.
17. Hakakian CS, Lockhart RA, Kulber DA, Aronowitz JA. Lateral Intercostal Artery Perforator Flap in Breast Reconstruction: A Simplified Pedicle Permits an Expanded Role. *Ann Plast Surg.* 2016 May;76 Suppl 3:S184-190.