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Research Article

Breast Reconstruction Using the Lateral Intercostal Artery Perforator (LICAP) Flap: A Single-Institution Experience

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Abstract

Background: Breast Conservation Surgery (BCS) has become the standard of care in the management of early-stage breast cancer, offering outcomes comparable to mastectomy when combined with radiotherapy. In cases with a high tumor-to-breast volume ratio, achieving oncologic safety while preserving cosmesis can be challenging. The Lateral Intercostal Artery Perforator (LICAP) flap is a reliable volume replacement technique in such settings.

Objective: To evaluate the outcomes of partial breast reconstruction using the LICAP flap, focusing on operative details, postoperative complications and patient satisfaction.

Methods: A retrospective review was conducted at Liaquat National Hospital and Medical College, Karachi, from March 2020 to December 2024. Thirty-three patients undergoing BCS with immediate LICAP flap reconstruction were included. Patient demographics, tumor characteristics, operative time, postoperative morbidities and aesthetic outcomes were recorded. Patient satisfaction was assessed using the SDC1 PROM (Patient-Reported Outcome Measure) scale.

Results: The mean patient age was 45.8 years. Most tumors (36.4%) were in the upper outer quadrant. Twelve patients (36.4%) received neoadjuvant chemotherapy and 36.4% underwent axillary dissection. Mean tumor size was 4.6 ± 1.8 cm. The median operative time was 145 minutes. Postoperative complications occurred in 3 patients (9%), including wound dehiscence, hematoma and minor erythema. All patients reported high satisfaction scores with favorable cosmetic outcomes.

Conclusion: The LICAP flap is a safe and effective technique for partial breast reconstruction, providing adequate volume replacement and excellent aesthetic outcomes with minimal donor site morbidity.

Keywords: Lateral Intercostal Artery Perforator Flap; Breast Conservation Surgery; Oncoplastic Breast Surgery; Volume Replacement; Patient Satisfaction

Introduction

Breast cancer remains the leading cause of cancer-related mortality among women worldwide, with an increasing incidence in low- and middle-income countries, including Pakistan where breast cancer is the commonest cancer accounting for 31.3% of all cancer in women [1,2]. The introduction of Breast Conservation Surgery (BCS) has significantly transformed the management of early-stage breast cancer by offering oncologic outcomes equivalent to mastectomy when combined with adjuvant radiotherapy [3].

Breast-Conserving Surgery (BCS) aims to achieve complete tumor excision with negative margins while preserving breast shape and symmetry. However, in patients with larger tumors relative to breast volume, attaining oncologic clearance can necessitate removal of a substantial amount of tissue. This often compromises cosmetic outcomes and may lead to breast deformity. In such

cases, advanced oncoplastic techniques are essential to balance oncologic safety with optimal aesthetic results, allowing wider excisions without compromising breast appearance [4,5]. Volume replacement strategies, such as flap-based reconstructions, have become increasingly important in this regard [6].

Among the various autologous flap techniques, the Lateral Intercostal Artery Perforator (LICAP) flap has emerged as a reliable option. This flap utilizes excess lateral chest wall tissue, sparing the underlying muscle and thereby minimizing donor site morbidity [7,8]. The LICAP flap is particularly suited for tumors located in the outer quadrants of the breast, where volume loss is more visually apparent post-resection [9,10].

Given the limited data available from Pakistan and other South Asian countries regarding LICAP flap utilization, this study aims to present our institutional experience with LICAP flap-based partial breast reconstruction. We report on surgical technique, postoperative outcomes and patient-reported satisfaction using a structured PROM tool.

Ethical Statement

The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore, was exempt.

Materials and Methods

Study Design and Setting

This was a retrospective observational study conducted at Liaquat National Hospital and Medical College, Karachi, Pakistan, from March 2020 to December 2024. The study was approved by the institutional ethics review board. Informed consent was obtained from all patients for data collection and photographic documentation.

Patient Selection

Patients who underwent breast conservation surgery with immediate volume replacement using a Lateral Intercostal Artery Perforator (LICAP) flap were included. Inclusion criteria were:

- Histologically confirmed non-metastatic breast cancer
- Tumors located predominantly in the lateral quadrants
- Sufficient lateral chest wall tissue for flap harvest
- Willingness for oncoplastic reconstruction

Exclusion criteria included multicentric tumors, contraindications to breast conservation or previous chest wall radiation. A total of 33 patients were identified. Data were retrieved from operative logs and medical records.

Data Collection

Demographic and clinical variables included age, BMI, smoking status, comorbidities, tumor location, tumor size (clinical and pathological), type of axillary surgery and neoadjuvant therapy status. Operative details, duration of hospital stay, drain duration and postoperative complications were recorded.

Cosmetic outcomes and patient satisfaction were assessed using the SDC1 Patient-Reported Outcome Measure (PROM) scale [11]. A validated tool for evaluating subjective perceptions of physical and psychosocial outcomes after breast surgery.

Surgical Technique

Patients were placed in the supine position with the ipsilateral arm abducted. Flap markings were performed preoperatively, guided by the inframammary fold and lateral chest contour. A handheld Doppler was used to identify intercostal perforators along the lateral chest wall.

Tumor excision and axillary staging (when indicated) were performed through separate incisions. Following lumpectomy, the defect was assessed and the LICAP flap was designed accordingly. The flap consisted of an adipo-fascio-cutaneous paddle based on lateral intercostal perforators, typically not requiring intramuscular dissection.

The flap was elevated in a subfascial plane, de-epithelialized except for the distal tip (when skin replacement was required) and

rotated into the breast defect. Flap viability was confirmed by bleeding at the cut edges. Tacking sutures (2-0 Vicryl) were used to anchor the flap to residual breast tissue, followed by standard layered closure with subcuticular sutures. Average operating time was 145 minutes. In patients requiring skin replacement, a skin paddle was included in the flap. The donor site was closed primarily with hidden scars within the bra line.

Postoperative Management

Patients were instructed to wear a supportive bra continuously for 4-6 weeks postoperatively and to avoid strenuous upper limb activity. Drains were placed only in cases with axillary dissection and removed when output was <30 ml/day. First follow-up occurred at 7-10 days postoperatively. Patient satisfaction was assessed at a minimum of 3 months post-surgery using the SDC1 PROM questionnaire. The questionnaire was administered in-person or via telephone and supplemented with photographic documentation (with consent), maintaining patient anonymity.

Statistical Analysis

Data were analyzed using SPSS version 24.0. Descriptive statistics were applied. Continuous variables (age, BMI, tumor size and operative duration) were presented as mean ± standard deviation or median with range, while categorical variables (tumor location, laterality, NACT, axillary clearance) were expressed as frequencies and percentages.

Results

Between March 2020 and December 2024, a total of 33 female patients underwent breast conservation surgery with immediate LICAP flap reconstruction at our institution.

Patient Characteristics

The mean age at surgery was 45.8 years (range: 35-59 years), with a mean BMI of 30.0 kg/m² (range: 22.5-37). All patients were non-smokers and non-metastatic at presentation. Tumors were right-sided in 18 patients (54.5%) and left-sided in 15 patients (45.5%). The majority of tumors (36.4%) were located in the upper outer quadrant. Twelve patients (36.4%) received neoadjuvant chemotherapy and 12 (36.4%) underwent axillary lymph node dissection. The mean clinical tumor size was 4.6 ± 1.8 cm (range: 2.7-8.0 cm). Table 1 summarizes demographic data, while Table 2 provides tumor characteristics.

Operative Details

The median operative time (skin-to-skin) was 145 minutes (range: 80-200 minutes), including both tumor excision and flap reconstruction. A single vacuum drain was placed in patients undergoing axillary clearance and was typically removed between postoperative days 6 and 14. All patients were discharged within 72 hours post-surgery. These details are presented in Table 1.

Postoperative Morbidity

Three patients (9%) experienced complications categorized as per Clavien-Dindo classification:[12]

- One patient developed a surgical site infection with flap dehiscence requiring re-suturing under general anesthesia (Clavien-Dindo Grade III)
- One patient developed a localized hematoma, managed conservatively
- One patient experienced mild erythema at the donor site, managed with oral antibiotics
- There were no cases of flap necrosis, seroma or reoperation for flap failure. Table 2 categorizes complications using the Clavien-Dindo classification

Cosmetic Outcomes and Patient Satisfaction

All patients were assessed using the SDC1 PROM tool at a minimum of 3 months postoperatively. The scores ranged from 39 to 46, indicating high levels of satisfaction in both physical and psychosocial domains. No patient reported dissatisfaction with the procedure. Photographic documentation (Fig. 1-3) demonstrated satisfactory aesthetic outcomes in terms of breast symmetry, contour and scar placement. Two patients experienced minor delays in initiating adjuvant radiotherapy due to wound healing concerns.

Characteristic	Value
Mean Age (years)	45.8
Mean BMI (kg/m²)	30.0
Diabetes	5 (15.1%)
Hypertension	11 (33.3%)
Smoking Status	0 (0%)
Neoadjuvant Chemotherapy	12 (36.4%)
Radiotherapy	33 (100%)
Axillary Clearance	12 (36.4%)
Breast Laterality - Right	18 (54.5%)
Breast Laterality - Left	15 (45.5%)
Tumor Location - UOQ	12 (36.4%)
Tumor Location - LOQ	18 (54.5%)
Tumor Location - 12 o'clock	3 (9.1%)
Histology - Invasive Ductal Carcinoma	26 (78.8%)
Histology - Poorly Differentiated Carcinoma	1 (4.8%)
Histology - Phyllodes Tumor	4 (12.1%)
Histology - Invasive Mucinous Carcinoma	2 (6.1%)
Tumor Grade I	2 (6.1%)
Tumor Grade II	21 (63.6%)
Tumor Grade III	10 (30.3%)
Clinical Tumor Size (mean ± SD, cm)	4.6 ± 1.8
Pathological Tumor Size (mean ± SD, cm)	2.9 ± 2.1

Table 1: Patient and tumor characteristics.

Variable	Value
Median Operative Time (minutes)	145
Operative Time Range (minutes)	80 - 200
Hospital Stay Duration (hours)	72
Drain Duration Range (days)	6 - 14
Number of Drains (in axillary clearance cases)	One
Clavien-Dindo Grade I Morbidity	2 patients (erythema, hematoma)
Clavien-Dindo Grade III Morbidity	1 patient (SSI, re-suturing)
Total Postoperative Complications	3 (9%)
Flap Failure	0
Patient Satisfaction (SDC1 PROM range)	39 - 46
Delay in Radiotherapy Initiation	2 patients

Table 2: Operative and postoperative outcomes.

Figure 1: Preoperative marking and perforator identification. Representative images demonstrating anatomical landmarks and preoperative marking for licap flap planning. identification of lateral intercostal artery perforators is aided by doppler mapping along the lateral chest wall.

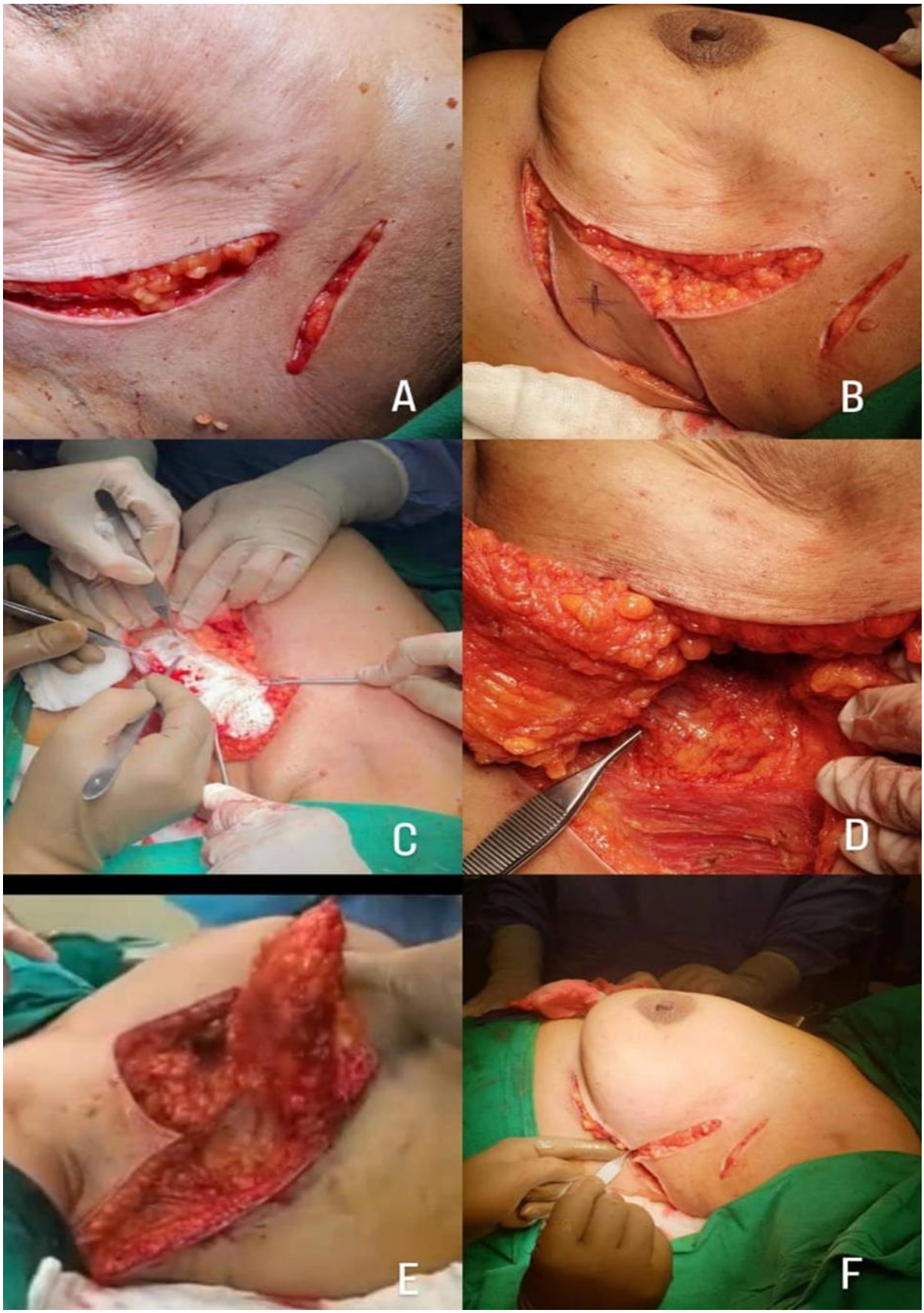

Figure 2: Intraoperative steps of LICAP flap harvest and inset. a. tumor excision with axillary staging. b. marking and incision of the lateral chest wall flap. c. de-epithelialization of flap surface. d. identification of intercostal perforators. e. elevation of the adipo-fascial flap. f. flap in setting into the breast defect and donor site closure.

Figure 3: Postoperative cosmetic outcomes. Postoperative images of patients at follow-up visits, demonstrating restored breast volume, symmetric contour and concealed donor site scars along the bra line. These results highlight the effectiveness and aesthetic benefit of the LICAP flap.

Discussion

Breast Conservation Therapy (BCT) has become the cornerstone in the management of early-stage breast cancer, demonstrating survival outcomes equivalent to mastectomy when combined with adjuvant radiotherapy [13]. The quality of life after BCT depends largely on aesthetic results, which may be affected if a large volume is removed compared to breast size [14]. Oncoplastic techniques, especially volume replacement methods, are now essential for balancing cancer control with cosmetic outcomes [15]. The Lateral Intercostal Artery Perforator (LICAP) flap, first described by Hamdi, et al., in 2004, has proven to be a reliable and safe option for partial breast reconstruction, especially in tumors located in the upper outer and lateral quadrants [16]. Our findings support these observations, with 95.2% of tumors in our cohort located in lateral quadrants and all patients reporting satisfactory cosmetic results. Unlike traditional muscle-based flaps, perforator-based flaps like LICAP preserve the underlying muscle, thereby minimizing donor site morbidity. This is particularly advantageous in patients requiring rapid postoperative recovery and early return to daily activities [17,18]. In our series, the donor site was well tolerated, with only one instance of superficial wound infection requiring surgical revision. No cases of flap loss or major seroma formation were reported.

Patient satisfaction was uniformly high in our cohort, as assessed by the SDC1 PROM tool. While this specific tool has not been extensively validated in breast reconstruction literature, it allowed a structured assessment of both physical and psychosocial

domains. The consistent high scores (range: 39-46) reflect a positive patient-reported outcome, further supporting the utility of this technique. Our findings are in line with other regional studies. Zeeshan, et al., reported favorable outcomes using a range of local perforator flaps (including LICAP) with similarly low complication rates and high patient satisfaction [19]. In contrast to implant-based reconstructions, LICAP flaps avoid issues such as capsular contracture, implant replacement, foreign body sensation and interference with oncologic imaging [20,21]. Moreover, scars are well concealed within the bra line, adding to aesthetic acceptability.

Nevertheless, the choice of reconstruction technique must be individualized. Factors including surgeon expertise, patient preference, tumor-to-breast size ratio and lateral chest wall tissue redundancy must be considered. In our experience, the LICAP flap provided a dependable solution for volume replacement in patients with moderate to large defects, offering excellent aesthetic outcomes with minimal morbidity.

Limitations

- Retrospective design - inherent risk of selection and information bias
- Small sample size - limits statistical power and generalizability
- No comparator group - such as traditional breast-conserving surgery without reconstruction or other flap types, reducing the ability to contextualize outcomes
- Short follow-up duration - may not adequately assess long-term flap durability or oncologic outcomes
- Lack of standardized PROMs - limits consistency and comparability of patient-reported outcomes across studies
- Future research needed - prospective studies with larger cohorts, standardized PROM tools and extended follow-up are warranted

Strengths of Study

- Contributes to the limited literature from South Asia on immediate volume replacement using the LICAP flap
- Presents real-world data from a consecutive series of patients from a Single-institute experience with consistent surgical techniques
- High patient satisfaction evaluated through a validated tool (SDC1 PROM)
- Photographic documentation supports objective assessment

Conclusion

The LICAP flap is a safe, effective and cosmetically favorable option for partial breast reconstruction in patients undergoing breast conservation surgery, particularly for tumors in the lateral breast quadrants. It offers excellent volume replacement with minimal donor site morbidity and high patient satisfaction. This technique represents a valuable addition to the armamentarium of oncoplastic breast surgery, particularly in resource-limited setting.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Consent for Publication

Written informed consent was obtained from the patient for publication of this paper. No identifiable data were included.

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Author's Contribution

All authors have contributed equally to this work and have reviewed and approved the final manuscript for publication.

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