

Modified Lateral Intercostal Artery Perforator Flap in Immediate Partial Breast Reconstruction for Breast Cancer: A Retrospective Cohort Study

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ABSTRACT

Introduction: The primary surgical options for treating breast cancer involve mastectomy or Breast Conservative Surgery (BCS), which may or may not include reconstruction procedures. BCS helps achieve complete tumour excision with an acceptable cosmetic result. Contour deformities and asymmetry are associated with tissue excision in the lateral aspect of the breast. To address this issue, various techniques of volume replacement, such as the modified Lateral Intercostal Artery Perforator (LICAP) flap, can be performed.

Aim: To demonstrate the outcomes of a modified LICAP flap when a muscle flap is not available or desired.

Materials and Methods: A retrospective cohort study was conducted, reviewing all modified LICAP flaps performed for breast tumours in Department of Surgical Oncology, Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India, a tertiary-level cancer centre, from June 2018 to August 2020.

Patient demographics, surgical details, histopathology reports, and postoperative complications were collected.

Results: Ten patients underwent modified LICAP flaps over a two-year period. All patients had pT2 tumours with margin-negative resection, and the mean resection volume of the specimen was 370 cm³. Intraoperative patient repositioning was not necessary during the modified LICAP flap procedure. One patient experienced marginal wound necrosis, which was managed conservatively. No patients had scars extending beyond the posterior axillary line, and axillary dissection was performed without a separate incision.

Conclusion: The present study demonstrates the advantages of using a modified LICAP flap for breast reconstruction. The modified LICAP flap can be considered as an option for tumours located in the outer aspect of the breast, providing good access to the breast as well as the axilla, with an aesthetically acceptable scar.

Keywords: Breast conservation, Carcinoma breast, Mastectomy

INTRODUCTION

Modified radical mastectomy with or without reconstruction or BCS are the main treatment options for breast cancer. With a better understanding and implementation of oncoplastic techniques, the complexity of these BCS and reconstruction procedures is increasing. BCS has comparable survival rates to mastectomy when paired with adjuvant radiotherapy. Tumour factors, patient body habitus, co-morbidities, and patient wishes are taken into consideration when offering BCS as a treatment option [1].

Standard oncoplastic techniques involve volume displacement, resulting in a significant difference in the size of the breast, sometimes requiring contralateral reduction mammoplasty to achieve symmetry. In patients who initially have nearly symmetrical breasts preoperatively, volume replacement techniques can be performed instead of volume displacement techniques to maintain symmetry. The evolution of volume replacement oncoplastic techniques has progressed from musculocutaneous to fasciocutaneous flaps, and currently involves the use of perforator-based flaps composed solely of skin and subcutaneous tissue. The LICAP flap, as described by Hamdi M et al., stands out as an excellent method of volume replacement technique, relying on perforating arteries originating within the costal segment of the intercostal arteries [2].

The original LICAP flap described by Hamdi M et al., had two limitations. There was a need to reposition the patient to harvest the flap, and the scar extended from the lateral mammary fold to a point 5 cm behind the posterior axillary line, making the scar quite

visible [2]. To address these limitations, the LICAP technique was modified, and this article assesses the surgical technique, patient and tumour characteristics, and any postoperative complications of breast reconstruction using a modified LICAP flap.

MATERIALS AND METHODS

A retrospective cohort study was conducted, reviewing all patients who underwent the modified LICAP flap procedure along with BCS from June 2018 to August 2020 at Department of Surgical Oncology, Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India, a tertiary-level cancer centre.

Study Procedure

The patients were identified from a prospectively maintained database. The LICAP flap procedure had been performed on breast tumours in the upper and outer quadrants. Patient demographics, details of surgery, histopathology results, and any postoperative complications following the modified LICAP flap were collected and tabulated.

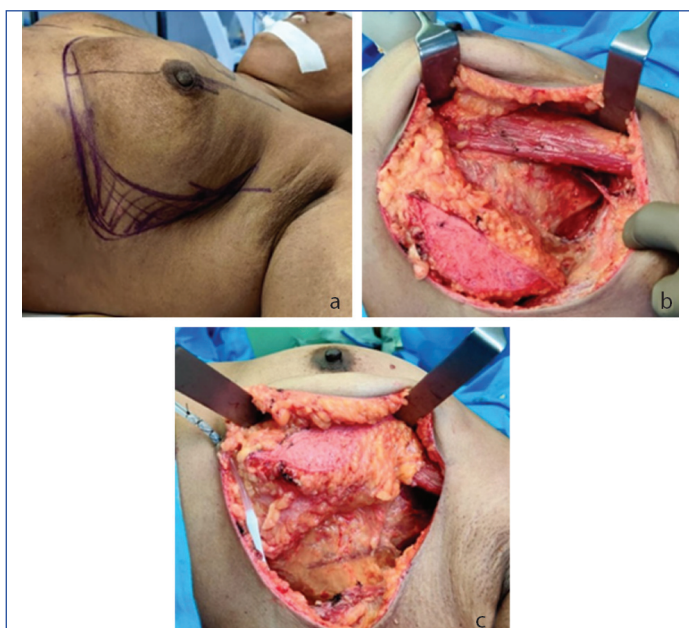
Surgical anatomy: The lateral chest roll, extending laterally from the breast, comprises both the skin and adipose tissue situated alongside the inframammary crease. To reconstruct the breast mound without an implant, a large chest fold can provide adequate tissue. Even when a distinct lateral fold is not clearly defined, it is still possible to harvest the flap since there is some a degree of excess skin in the upper back. The LICAP flap is based on the

skin and subcutaneous pedicle containing analogous perforators, which are present more laterally in the inframammary fold. There are usually 2 to 5 lateral intercostal perforator arteries located within a range of 6 to 8 cm from the midaxillary line, based on the dissection studies conducted by Hamdi M et al., [2-4]. The portion of the fold present within 6 to 8 cm of the midaxillary line represents the flap pedicle, which can be rotated 180°. A single perforator bundle measuring more than 0.5 cm in diameter is sufficient to provide blood supply to the flap, as indicated by Hamdi M et al., based on cadaver dissections. In 90% of the dissections, lateral intercostal perforators were found 2.67 to 3.49 cm from the anterior border of the latissimus dorsi muscle [3,5].

Surgical technique: Prior to surgery, preoperative marking is performed to identify external landmarks, including the mid-axillary line, the lateral edge of the latissimus dorsi muscle, the inframammary fold, and its extension as the lateral chest fold. The anterior part of the incision is a continuation of the inframammary crease along the lateral aspect of the breast. Based on the redundancy of the lateral skin fold, another line is drawn elliptically in a posterior direction along the midaxillary line, completing the outline of the flap. This design ensures that the pedicle consistently includes cutaneous perforators from the intercostal vessels [Table/Fig-1,2] [2-4]. The flap's skin is de-epithelialised.



[Table/Fig-1]: a) Original LICAP flap as described by Hamdi M et al., [2]; b) Modified LICAP flap described by Meybodi F et al., [3]; c) Modified LICAP flap in this study [4].



[Table/Fig-2]: a) Modified LICAP flap marked; b) Modified LICAP flap de-epithelialised and wide excision of breast and axillary dissection completed; c) Modified LICAP flap rotated into the defect.

The skin flap is raised along the anterior border of the flap, and a wide local excision of the breast primary is performed. From the superior border of the flap, axillary dissection is completed, providing excellent access to both the breast and axilla. Clips are placed for marking within the cavity of the wide local excision. Once the dissection is complete, the flap is rotated 180 degrees to fill the defect and concealed within the skin envelope to provide a vascularised volume. The flap is supported with deep dermal and subcuticular sutures in its new location before closing the wound with a suction drain [Table/Fig-2].

RESULTS

Ten patients underwent BCS and modified LICAP flap between June 2018 and August 2020. The patient characteristics are summarised in [Table/Fig-3]. All patients underwent preoperative multidisciplinary tumour board discussions. They all had a biopsy-proven breast carcinoma before surgery and were scheduled for initial surgery.

Variables		Values
No of patients		10
Mean age		47 years (35-56 years)
Tumour site	Upper outer quadrant	7
	Upper quadrants	2
	Lower outer quadrant	1
Laterality	Right	6
	Left	4
Mean tumour size		2.9 cm
Neoadjuvant chemotherapy		None
pT stage		pT2
Mean volume of breast specimen		370 cm ³
Molecular subtype	Luminal B	7
	HER2-enriched	1
	Triple negative	2
Adjuvant chemotherapy		10
Adjuvant radiation		10
Infection		None
Outcome		
Wound necrosis		1
Median follow-up		18 months (6-30 months)
Recurrence		None

[Table/Fig-3]: Patient characteristics.

Out of the 10 patients, seven had tumour located in the upper outer quadrant, two had tumours in the upper quadrants at the 12 o'clock position, and one had a tumour in the lower outer quadrant. Seven patients had luminal B tumour biology, two had basal-like subtype, and one had Her-2 enriched tumour.

All patients had a pathological T stage of pT2, and the size of the excised tumour ranged from 2 cm to 4 cm (median size 2.9 cm), with clear margins. Axillary dissection and modified LICAP flap were performed in the same sitting. Five patients had pN0 nodal status, four had pN1a, and one had pN3a nodal staging. The volume of the breast specimen ranged from 140 cm³ to 600 cm³ (median 370 cm³).

The median postoperative stay was 48 hours, and the average duration of surgery was 120 minutes. None of the patients required perioperative blood transfusion. All patients were taught shoulder exercises and advised to continue them at home.

There were no perioperative mortalities. The drains were removed by the 10th day (range 8-14 days). No postoperative seroma infections were reported. One patient developed wound marginal necrosis and required debridement and resuturing. All patients underwent adjuvant chemotherapy and sequential radiotherapy and are currently on regular follow-up. The median duration of follow-up was 18 months, ranging from 6 to 30 months.

DISCUSSION

The primary goal of BCS is to achieve complete cancer removal with clear margins while also obtaining a favourable aesthetic outcome. Several factors influence the outcome and risk of complications, including the ratio of excised tissue volume to breast volume, tumour location, density of the glandular breast tissue, and the condition of the skin covering the area [1,6,7].

In traditional BCS for a large tumours in the upper outer quadrant, there is a potential risk of the nipple-areola complex experiencing deviation, which becomes more noticeable following radiotherapy, leading to contour deformity or depression in the breast parenchyma. Balancing the oncological requirement for wider excision with the patient's desire for a pleasing aesthetic outcome can pose a significant challenge in standard BCS. These irregularities and imbalances in breast appearance have been documented as contributing factors to negative body image and reduced quality of life [8-10].

Oncoplastic breast surgery integrates the principles of both oncology and reconstructive surgery to achieve optimal results that are both oncologically sound and aesthetically pleasing. Oncoplastic procedures enable the removal of larger tumours relative to breast size, reduce the occurrence of positive margins, and the need for redo surgeries, while maintaining and improving the shape, symmetry, and cosmetic appeal of the breast [11].

To address these aesthetic problems, oncoplastic techniques with or without contralateral reduction procedures have been developed [12]. In a retrospective review by Wijesinghe K et al., oncoplastic breast surgeries were shown to have wider surgical margins, decreased need for re-excision, better aesthetic outcomes, and similar operative times and complication rates [13]. The LICAP flap, a perforator-based flap, has been added to the armamentarium of oncoplastic breast surgeries. The modified LICAP flap, initially described by Meybodi F et al., [3], offers several advantages over the traditional LICAP flap, including the elimination of the need for intraoperative patient repositioning and the achievement of a cosmetically pleasing scar. These perforator flaps do not alter the inframammary fold, and there is no need for skeletonisation of the perforator pedicle. In comparison to Meybodi F et al., the present flap was fashioned close to the anterior axillary line, resulting in a scar hidden by the breast and not extending into the axilla [Table/Fig-4] [3]. Even in patients with tumours close to the upper inner quadrant at the 12 o'clock position, adequate exposure was provided by the incision for wide excision. The de-epithelialised skin placed under the skin flap contributes to the uniformity of the reconstruction, and the resultant scar is along the anterior axillary line. The volume replacement technique also enables BCS in patients with a large tumour volume to breast volume ratio. The modified LICAP technique is particularly suitable for women who

wish to maintain their breast shape and size and who have excess tissue lateral to the breast and skin laxity.

Limitation(s)

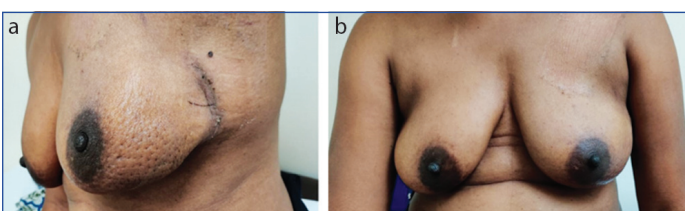
The study has certain limitations, including its small sample size, which necessitates further assessment of patient satisfaction when comparing it with volume displacement oncoplastic techniques.

CONCLUSION(S)

The volume replacement technique, such as the modified LICAP flap, provides immediate reconstruction of defects in the lateral aspect of the breast following BCS. The Modified LICAP flap also allows excellent exposure of the axilla and avoids the need for intraoperative patient repositioning, while also offering an aesthetically acceptable scar.

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[Table/Fig-4]: a) Resultant scar of modified LICAP flap along anterior axillary line; b) Resultant scar well concealed in frontal view.

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PLAGIARISM CHECKING METHODS: [Lain H et al.](#)

- Plagiarism X-checker: Mar 14, 2023
- Manual Googling: May 12, 2023
- iThenticate Software: Sep 20, 2023 (20%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Feb 28, 2023**

Date of Peer Review: **Apr 27, 2023**

Date of Acceptance: **Sep 24, 2023**

Date of Publishing: **Nov 01, 2023**