Original Article

Evaluation of the Intercostal Artery Perforator (ICAP) Flaps versus Lateral Thoracic Artery Perforator (LTAP) Flap in Partial Breast Reconstruction Following Breast Conservative Surgery

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ABSTRACT

Introduction: The introduction of pedicled chest wall perforator flaps (CWPF) in breast surgery, increased the options for oncoplastic volume replacement procedures, however, the literature is scarce on nonblind nonrandomized interventional studies comparing intercostal artery perforator (ICAP) flaps versus lateral thoracic artery perforator (LTAP) flaps in Partial breast reconstruction. This research was designed to assess the ICAP flaps versus the LTAP flaps in partial breast reconstruction in small and medium-sized breast women, in terms of aesthetic outcomes, patient satisfaction, and perioperative complications.

Patients and Methods: This study was a nonblind nonrandomized interventional study, conducted on 34 female cases with early breast cancer, who underwent conservative breast surgery and partial reconstruction, either by the ICAP flaps or the LTAP flap.

Results: In this study, 34 cases were allocated to 20 patients in the ICAP flaps group, and 14 cases in the LTAP flaps group. The mean total follow-up period was 33.10±11.96 versus 12.15±10.92, *P* less than 0.001*. The average age was 40.60±8.62 versus 43.07±8.01, and the average BMI was 32.19±6.80 versus 33.74±4.60 for the ICAPs versus LTAP groups, respectively. The most common complications encountered were marked seroma, experienced by 5 cases in the two groups without statistically significant difference. Overall, the aesthetic outcomes were good to excellent in over 90% of the cases in the two groups without statistically significant difference, *P=0.608*. Most of the cases were very satisfied with the aesthetic outcomes (n=19, 95.0%) versus (n=12, 85.7%) for the ICAP versus the LTAP flaps, respectively without statistically significant differences, *P=0.455*.

Conclusion: The ICAP and the LTAP flaps are both versatile, risk-free surgical techniques, associated with low complications rate, very good to excellent aesthetic outcomes, and a high patient satisfaction rate.

Key Words: Chest wall perforator flaps, intercostal artery perforator flaps, lateral thoracic artery perforator.

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INTRODUCTION

Breast Cancer is a commonly diagnosed cancer globally, the most frequent cancer affecting females in Egypt, and the primary reason for cancer-related death between females[1]. The breast is considered a symbol of motherhood, femininity, and sexuality, and nutrition, as well as an aesthetic and functional organ, therefore it is an organ of unity in diversity in a family and hence attracts the central focus of a female's anatomy[2,3].

Surgical management of breast cancer dates back to the era of Edwin Smith Papyrus, who treated a case by cauterization with a fire drill, thereafter, surgical management, witnessed a steady and profound evolvement, from the era of the heroic radicality of William S. Halsted, through the era of conservatism of Umberto Veronisi and Bernard Fisher, to the current stage of art in the breast surgery; the Oncoplastic Breast Procedures[4-7].

Despite the consensus that both techniques of Oncoplastic Breast Techniques; volume displacement and volume replacement, improve post-CBS deformities, and result in better aesthetic outcomes, and quality of life, however, regardless of whatever volume displacement technique is used, the latter causes diminished ipsilateral breast volume which may need a contralateral breast symmetrization technique[5-7]. Volume replacement oncoplastic techniques provide a significant benefit over breast displacement procedures to overcome these inherent challenges. The addition of pedicled chest wall perforator flaps (CWPF) in breast surgery further increased the options for oncoplastic volume replacement procedures[5,6,8]. Several CWPFs have been described

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for partial reconstruction of CBS-inherent deformities, including but not limited to Thoracodorsal Artery Perforator (TDAP), Intercostal Artery Perforator (ICAP), Lateral Thoracic Artery Perforator (LTAP) flaps,…etc[9].

The concept of perforator flaps was developed as a tool for reducing donor-site morbidity via harvesting only the adipo-cutaneous portion of the flap while sparing the muscle in its natural position[10].

There is increasing evidence that the utilization of the ICAP or the LTAP flaps is a more favorable default option than the TDAP flap in the immediate reconstruction setting. Nonetheless, the Literature is scarce on non-blind non-randomized interventional studies comparing ICAPs versus LTAP flaps[9,11–13].

The current study was designed to assess the feasibility, safety, and efficacy of the ICAP flaps versus LTAP flaps in partial breast reconstruction in terms of aesthetic outcomes and patient satisfaction as the primary outcome measures, and perioperative complications as the secondary outcome measures[14].

PATIENTS AND METHODS:

This study was a prospective comparative nonblind nonrandomized interventional study, conducted on 34 female cases with early breast cancer, who underwent the CBS, followed by partial breast reconstruction, either by the ICAP (anterior or lateral intercostal perforators, AICAP, or the LICAP) flaps on one arm, versus the LTAP flaps on another arm, from August 2019 to February/2024, after the approval of the institutional Research Board-IRB, under the proposal code (MD.19.08.209.R1-2019/09/2) of Faculty of Medicine, Mansoura University.

Inclusion criteria

Patients were selected from attendants to Oncology Center, Mansoura University who fulfilled the following criteria: Small to medium-sized breasts, T1-T3, N0-N2, M0 primary breast cancer, lateral, central, and medial quadrants, patients either received neoadjuvant therapy or underwent upfront surgery. Careful history was taken from the patient including age, gender, residency, occupation, special habits, comorbidities, and presentation including onset, course, and duration of symptoms, medical, family, and family history, and a thorough patient examination.

Investigations

Preoperative investigations included breast Sono mammography or MRI as indicated. Histopathological confirmation of malignancy was performed in a preoperative setting by tru-cut biopsy and molecular subtyping by hormonal profile analysis including ER, PR, Her2 Neu, and KI67 were done). Treatment decisions were made by a multidisciplinary team (MDT). The patients who needed neoadjuvant therapies were referred to the medical oncology department to receive treatment and re-transferred back to the surgical oncology department after finishing their courses. Patients were reviewed by surgeons in the wards a day before the operation and in operation theatres.

Surgical intervention

All patients underwent Wide local excision of the primary tumor accompanied by a frozen section for confirming the presence of free margins, coupled with axillary dissection or sentinel lymph node biopsy (as indicated), followed by partial breast reconstruction either by the ICAP flaps or the LTAP flaps.

Intercostal artery perforator (ICAP) flaps

Anterior intercostal artery perforator (AICAP)

The possible perforators were detected on the day of the operation in the operating room through the utilization of handheld Doppler ultrasound. The flap was then raised while the patient was in the supine position, with the arm extended to facilitate lymph node dissection and/or sentinel lymph node biopsy (SLNB). When Doppler failed to detect perforators, donor site was explored because in most cases, additional perforators were observed during the operation in addition to the one detected by Doppler (Fig. 1).

By employing the most nearby and well-dissected perforator, it was possible to harvest all flaps into the breast. Neither a dog ear nor any modification to the donor site was noted using this approach. A pre-intervention anesthesia was administered to the patient. A lateral incision or an inframammary fold incision was the conventional approach for tumor resection.

The perforators were identified following resection through examination of the identical incision used for resection and verification of the perforator's viability. As is normal, we dissected two of them and then determined which one caused the membrane to irrigate. Once the optimal perforator had been identified, dissected, and chosen, a long inframammary fold was utilized to construct the final flap in accordance with the location of the perforator and the extent of the resected breast. Additionally, a pinch test was conducted at the donor site to acquire the maximum amount of tissue possible.

Flap elevation proceeded from the distal to the proximal direction with caution to the superficial perforator. A thorough dissection of the perforator enabled the complete positioning of the flap within the breast, avoiding any tension or kinking of the pedicle. In this situation, the surgeon could modify the inframammary tissue more effectively.

Typically, the perforator closest to the defect was selected. Perforators in the lateral third were therefore chosen because the defects we reconstructed by AICAP were located at LOQ. To prevent scar migration, the incision was closed with stitches that delineated at inframammary fold. In this way, we avoided IMF distortion (Fig. 1).

Fig. 1: Illustrate Marking of AICAP flap, A=marked two lesions, white arrow=with wire in the lesion, black arrows=superficial marking of lesions, B=showing handheld doppler U/S.

Post-neoadjuvant identification of clips

In most cases who received Neoadjuvant chemotherapy plus clipping, especially those who gave radiological Complete Response (rCR), routinely we marked the clips and the tumor bed preoperatively by either a hook wire localization under ultrasound guidance (Fig. 1), or by charcoal localization. However, in minor cases that gave a Partial Response, we used an intra-operative C- Arm Machine for the identification of metallic clips in 2 cases (Fig. 2) and sent the tumor specimen to the radiology department for identification in one case (Fig. 2), and to the pathology department for frozen section thereafter.

A

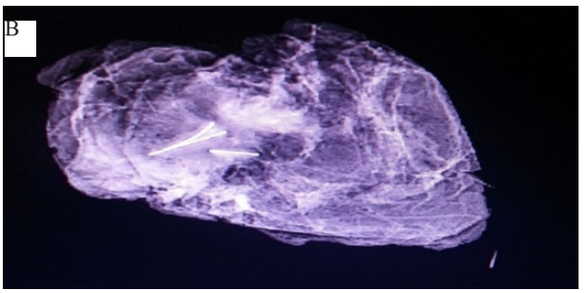


Fig. 2: Illustrates C-Arm machine and Clips in tumor specimen. A=C- Arm, B=Clips in tumor Specimen.

Lateral intercostal artery perforator (LICAP)

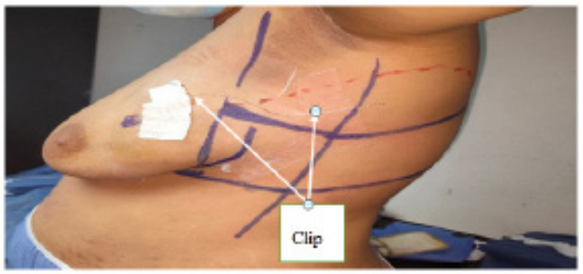
The predetermined location of the dominant perforator was verified through its relation to the latissimus dorsi. A unidirectional Doppler probe was used to reassess the perforator at this specific location, and the skin was designated for utilization in the design phase. For breast-conserving surgery, the incision was strategically designed to optimize the aesthetic outcomes of the access. Following the creation of an incision along the predetermined line, the dissection was meticulously continued to locate the subfascia perforator that had been previously marked. A reliable perforator was identified by its observable pulsations. Choke vessels will be utilized to establish the perforator circulation between the intercostal segmental perforating branches that comprise the subcutaneous arcades.

Skin incisions

In the beginning, we used traditional Transverse Back incisions, described by Hamdi *et al*., but as skills refined, and the learning curve improved, we used several modified skin incisions including; Lazy S Inferolateral, Curvilinear inferolateral, C-shape Inferolateral incision, as well as C-shape plus Batwing incisions.

Transverse back incision

In traditional transverse back incision, we used an Inferolateral(Lateral breast mammary Sulcus) curvilinear incision to dissect the tumor mass and manage the axilla, plus transverse back an elliptical skin incision with skin paddle around the future flap over latissimus dorsi Muscle, this later incision meets the former at right angle fashion, forming sorrow triangle which is associates with increased risk of wound necrosis and delay wound healing (Fig. 3).



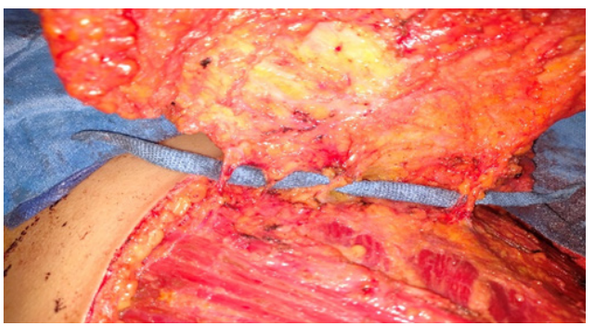


Fig. 3: Illustrating Transverse back incision.

Lazy S inferolateral incision

We used Lazy S Inferolateral, without skin paddle to dissect a tumor, manage the Axillary lymph nodes, and raise the flap without overlying skin, however, this incision was associated with redundant skin, which required trimming the edges of the skin to suit breast shape and projection (Fig. 4).

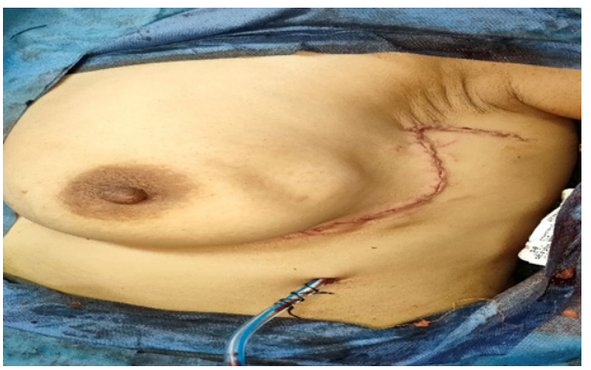


Fig. 4: Illustrate lazy S Incision.

C-shape inferolateral incision

A c-shaped flap with a skin paddle was used over the future flap at the lateral mammary sulcus. The final scar was hidden by the arm behind the breast without any visible extension (Fig. 5).

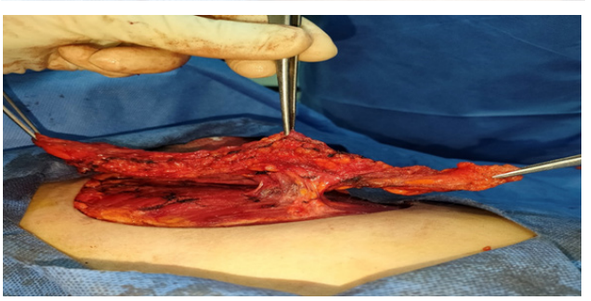


Fig. 5: Illustrating C- shape inferolateral Incision.

Curvilinear inferolateral incision

This is the same as a Lazy S Inferolateral incision where the skin paddle is not involved in the flap. Just subcutaneous tissue with the dermis and its vessels. Is also associated with redundant skin, which requires trimming the edges of the skin to suit breast shape and projection.

Shape inferolateral plus batwing incisions

In some situations where the tumor is closed or infiltrating skin, such as the case we used a Batwing incision and removed a tumor mass together with involved skin, while accessing the axilla for axillary lymph nodes management and raised perforator flap through c- shape skin paddle inferolateral incision (Fig. 6).

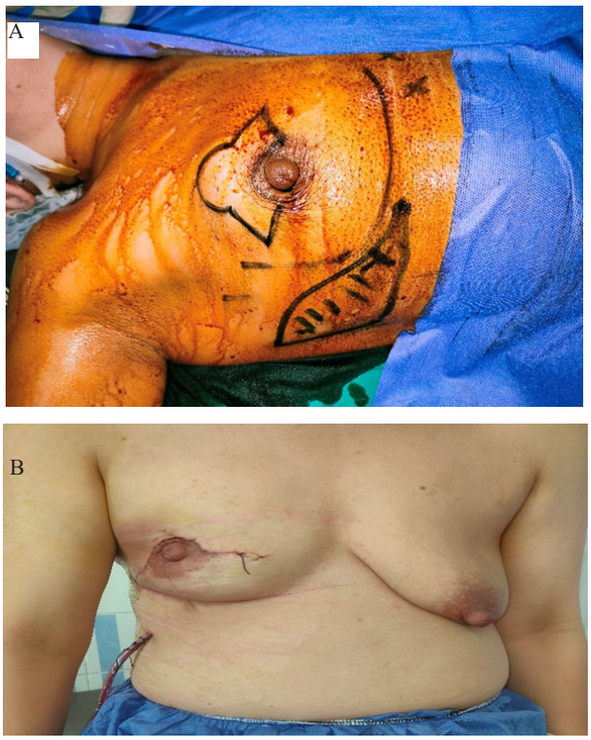


Fig. 6: Illustrate C-shape plus Bat wing Incision, A=marking of Wat wing and C-shape incisions, B=After closure of the wounds.

Lateral thoracic artery perforator (LTAP) flap

The lateral thoracic artery perforator was identified intra-operatively by handheld Doppler ultrasound, the perforator position was marked by a dye or sharp point of a needle. The skin was incised through the curvilinear incision, with an ellipse of the skin left over the future flap and de-epithelization thereafter. In some cases, the skin is left intact while the flap is raised underneath, however, the latter procedure causes minor redundant skin which necessitates trimming of skin edges during wound closure (Fig. 7).

A case was positioned in the supine position with the shoulder abducted or in the supine position throughout dissection. Position selection is contingent on the opening size. Closing larger flaps was more manageable when performed in the fully lateral position. Flap dissection was initiated laterally and progressed medially. However, meticulous dissection was maintained at the cephalad border so as not to injure the lateral thoracic pedicle at its origin from the second part of the axillary artery.

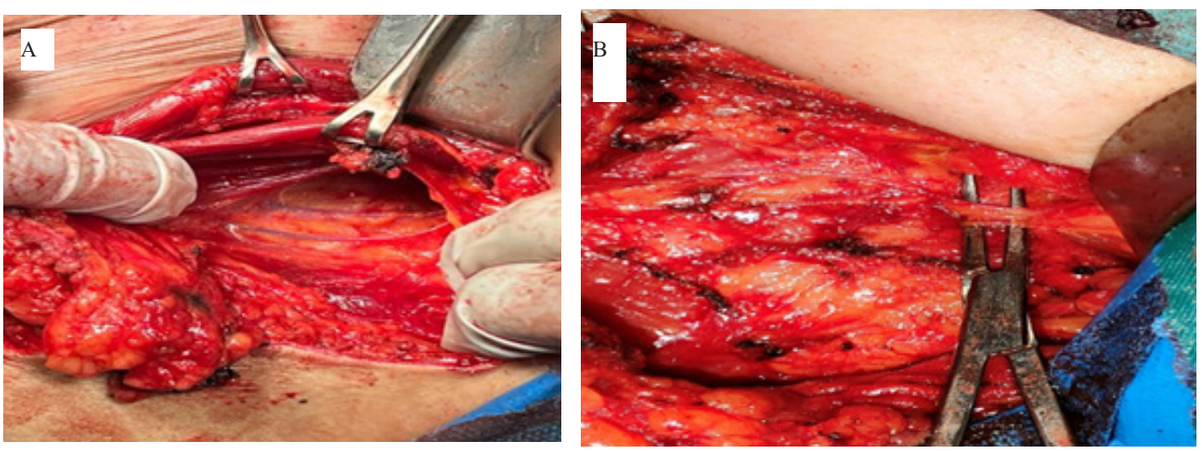


Fig. 7: Illustrates variation of Lateral Thoracic Artery perforators, A=flap based on two perforator vessels with two arrows pointing to the perforator vessels. B=flap based on one perforator vessel with artery forceps and arrow marking the perforator vessel.

Aesthetic outcome and patient satisfaction assessment

Objective evaluation of aesthetic outcomes

Preoperative, Intraoperative, and postoperative photographs were taken and recorded. Objective evaluation of aesthetic outcomes was assessed by 3 observers: a consultant surgeon (observer 1), an independent breast surgeon (observer 2), and independent specialist nurse (observer 3) using five-point scale (5=excellent, 4=good, 3=fair, 2=poor, 1=bad) evaluated breast volume symmetry, the shape of the breast mound, and Nipple Areola symmetry and position of Nipple areola complex at 3months, 6 months, 1 year, and 2 years postoperative intervals (Tomita *et al*.).

Subjective evaluation of aesthetic satisfaction

Aesthetic satisfaction was assessed by distributing breast questionnaires to the cases to rate their aesthetic satisfaction with surgery, using a five-point scale (5=very Satisfied, 4=Satisfied, 3=Neutral, 2=Dissatisfied, 1=Very Dissatisfied), evaluated volume symmetry, shape of the breast mound, and Nipple Areola symmetry and position of Nipple areola complex, at 3 months, 6 months, 1 year, and 2 years postoperative intervals (Dikmans *et al*.).

Follow-up

Any perioperative complication including wound infection, wound dehiscent, seroma, hematoma, flap necrosis, flap loss, local or distant tumor recurrence occurring after surgery was documented and reported.

Statistical analysis

The data were gathered, organized in a table, and assessed utilizing version 25 of the Statistical Product and Service Solutions Program (SPSS). When continuous data were normally distributed, they were presented as mean SD; otherwise, they were expressed as median (IQR). For comparing the two groups, a nominal unpaired test or Mann–Whitney was utilized; qualitative data were presented as percentages and numbers; the χ^2 test was employed to compare the two groups. The statistical distinctions among the categories were examined by employing suitable statistical tests. *P values* below 0.05 were deemed to be statistically significant.

RESULTS:

Results

This research included 34 cases, distributed into 20 cases in the ICAP flaps, and 14 cases in the LTAP flaps. Mean total and mean follow-up period was higher among the ICAPs group versus LTAP, respectively, *P<0.001**, summarized in (Table 1). The average age was 40.60±8.62 versus 43.07±8.01, the average BMI was 32.19±6.80 versus 33.74±4.60, and performance status was good among the majority of patients in both groups (ASA-I) was 20 (100%) versus13 (92.9%), there was a low incidence of associated comorbidities, MD was present only in two cases among the ICAP group. HTN was present only in three cases in both studied groups. Other comorbidities occurred among 4 cases in both groups without statistically significant difference, all cases were nonsmokers (Table 2).

Tumor location: Most of the tumors were located at the UOQ in both groups, representing(n=14, 70%) versus (n=9, 63.4%) for the ICAP versus the LTAP, however, the lesions at the LOQ were present exclusively on the ICAP group, meanwhile, the lesions in the UIQ were present exclusively on the LTAP group, without statistically significant difference. We used modified skin incisions in the majority of the cases in the two studied groups more than traditional Transverse Back Incisions described by Hamdi *et al*. (Table 1)[15].

As regards postoperative tumor characteristics, the most common pathological tumor sizes ranged from PT1 to PT2 in two groups without statistically significant difference, meanwhile, the most common pathological lymph nodes were pN0 in both studied groups without significant difference.

90% of the cases were diagnosed at stage I and stage II in the two studied groups without statistically significant differences. The majority of the cases received neoadjuvant therapies, (55%) cases versus (63.4%) cases among the ICAP versus the LTAP without statistically significant difference *P=0.588*. There was no statistically significant difference among the studied groups as regards margins assessment, and involved margins: However, there was a statistically significant difference among the studied groups as regards the number of perforator vessels included in a flap, where 3 perforator vessels (85.0%) were used in the ICAPs group, in contrast, to 1 perforator vessel was used predominantly in the LTAP group, *P=0.001** (Fig. 8, Table 1)

Table 1: Breast characteristics and tumor location

	ICAPs *N*=20 (%)	LTAP *N*=14 (%)	Test of significance
Breast Size			
Cup: A	3 (15)	4 (28.6)	χ^2=0.985
Cup: B	11 (55)	6 (42.9)	*P*=0.611
Cup: C	6 (30)	4 (28.6)	
Ptosis grade			
Grade: I	4 (20)	3 (21.4)	χ^2MC=4.90
Grade: II	16 (80)	8 (57.1)	*P*=0.086
Grade:III	0	3 (21.4)	
Side			
Right	5 (25)	6 (42.9)	χ^2=1.20
Left	15 (75)	8 (57.1)	*P*=0.273
Multiplicity			
Single	13 (65)	13 (92.9)	χ^2MC=7.16
Two	7 (35)	0	*P*=0.03*
Three	0	1 (7.1%)	

Tumor Location			
▓LOQ	4 (20)	1 (7.1)	χ^2MC=4.98
▓NAC	1 (5)	1 (7.1)	*P*=0.289
▓UIQ	1 (5)	3 (21.4)	
▓UOQ	14 (70)	9 (64.3)	
Zone			
▓I	2 (10)	3 (21.4)	FET=0.858, *P*=0.627
▓2	16 (80)	10 (71.4)	FET=0.336, *P*=0.689
▓3	5 (25)	4 (28.6)	χ^2=0.054, *P*=0.816

*Statistically significant.
χ2, Chi-Square test; FET, Fisher exact test; LOQ, lower outer quadrant; MC, Monte Carlo test; NAC, nipple areolar complex; UIQ, upper inner quadrant; UOQ, upper outer quadrant.

Table 2: Surgical procedures

	ICAPs *N*=20 (%)	LTAP *N*=14 (%)	Test of significance
Type of skin incision			
▓*Transverse Back*	2 (10)	1 (7.1)	χ^2MC=8.22
▓*Lazy S Inferolateral I*	5 (25)	5 (35.7)	*P*=0.144
▓*Infra-mammary fold*	3 (15)	0	
▓*Curvilinear inferolateral*	4 (20)	0	
▓*C-shape Inferolateral*	5 (25)	8 (57.1)	
▓*C- shape plus Batwing*	1 (5)	0	
No of perforators			
▓*1*	0	11 (78.6)	χ^2MC=27.81
▓*2*	3 (15)	3 (21.4)	*P*=0.001*
▓*3*	17 (85)	0	
Margins Assessment			
▓*Infiltrated margin*	3 (15)	2 (14.3)	χ^2=0.003
▓*Free all margin*	17 (85)	12 (85.7)	*P*=0.954

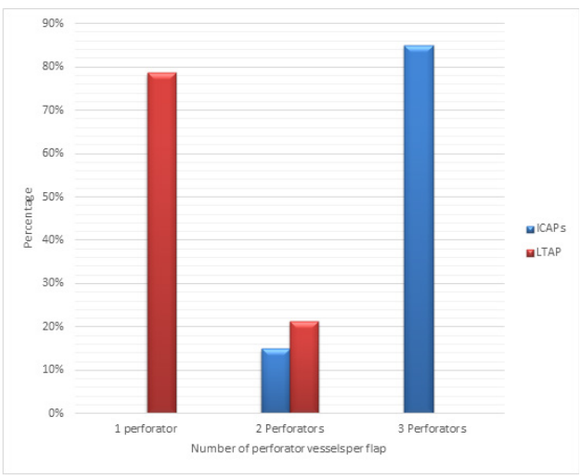


Fig. 8: Illustrate number of perforator vessels used in flap.

Complications

There was a low incidence of complications, the most common complications encountered were marked seroma, experienced by 5 cases in the two groups without a statistically significant difference, followed by wound dehiscence which developed in 5 cases in both groups without a statistically significant difference between studied groups. Similarly, traumatic fat necrosis occurred in 4 cases in the two studied groups without statistically significant variance, flaps retraction, partial flap necrosis, and hematoma were encountered each in a patient (Fig. 9).

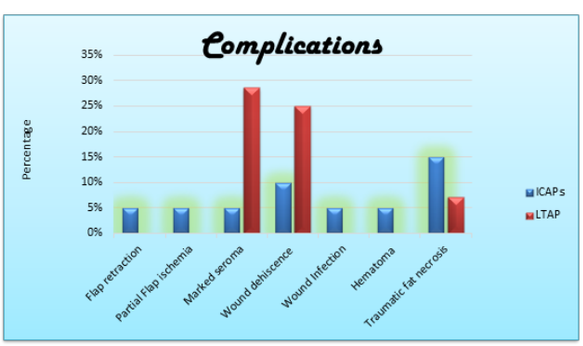


Fig. 9: Illustrating complications in ICAPs and LTAP flaps.

Objective Evaluation of Aesthetic Outcome

Overall aesthetic outcomes were good to excellent in over 90% of the cases in the two studied groups without statistically significant difference, *P=0.608* (Table 3, Figs 10–13).

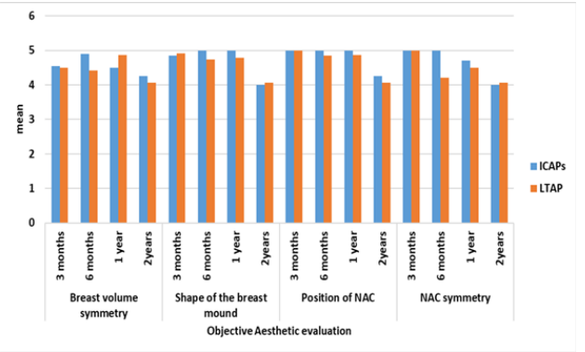


Fig. 10: Illustrating Objective Aesthetic Evaluation between studied groups at 3 months, 6 months, 1 year, 2 years postoperative Intervals, 5=excellent, 4=good, 3=fair , 2=poor, 1=bad,.

Table 3: Overall objective aesthetic outcome

Objective aesthetic evaluation	ICAPs *n*=20 (%)	LTAPs *n*=14 (%)	Test of significance
Excellent	18 (90)	11 (78.6)	χ^{2MC}=0.995
Good	1 (5)	2 (14.3)	*P*=0.608
Fair	1 (5)	1 (7.1)	
Poor	0	0	
Bad	0	0	

Aesthetic evaluation at 3 months, 6 months, 1 year, 2 years, postoperative Intervals (5=excellent, 4=good, 3=fair , 2=poor, 1=bad).

Aesthetic satisfaction

Most of the cases were very satisfied in (n=19, 95.0%) versus (n=12, 85.7%) for the ICAP versus the LTAP flaps respectively without statistically significant differences, *P=0.455* (Tables 4 and 5).

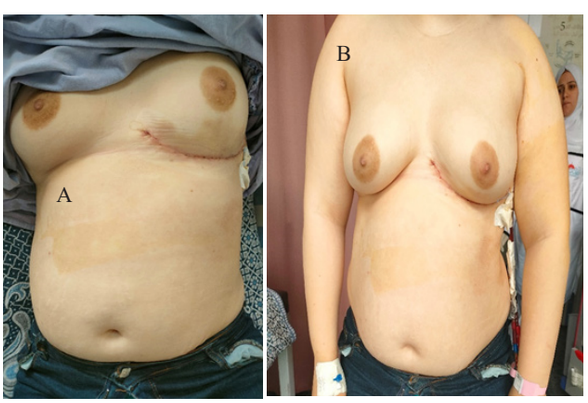
Table 4: Patient aesthetic satisfaction

Subjective patient satisfaction	ICAPs *n*=20 (%)	LTAP *n*=14 (%)	Test of significance
Very Satisfied	19 (95)	12 (85.7)	χ^{2MC}=1.57
Satisfied	1 (5)	1 (7.1)	*P*=0.455
Neutral	0	1 (7.1)	
Dissatisfied	0	0	
Very Dissatisfied	0	0	

Patient satisfaction in 3, 6months, 1 year, 2 years, (5=very satisfied, 4=satisfied, 3=neutral, 2=dissatisfied, 1=very dissatisfied).

Table 5: Comparison between ICAPs and LTAP flaps

	ICAP	LTAP
Source of the origin	Originate from intercostal arcades formed between the internal mammary artery and thoracic aorta	Originates from the second part of the axillary artery
Variation of the origin	Constant origin	May originate from thoracodorsal or subscapular arteries
Absence	Always present	Maybe absent in 15% of cases
Relation of the origin to lymphatic levels	Not related to the lymphatic level	Related to level II ALNs
Relation to SLNs	Not related to SLNS	Related to SLNs
Arc of axis and mobility	Short arc and mobility, not suitable for UIQ lesions	Long arc and can be mobilized to UIQ
Adequate quadrants for use	UOQ, LOQ, LIQ, and retroareolar defect	UOQ, UIQ, retroareolar defect
Injury during ALNs management	Not at risk of injury	At risk of injury during SLNB or ALND
Number of perforator vessels	3 or more perforator vessels	Mostly one and occasionally two perforator vessels



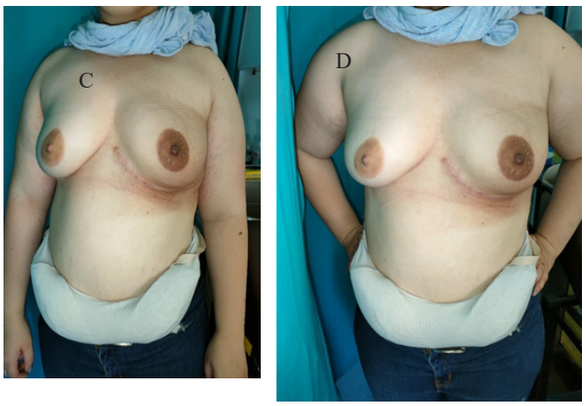


Fig. 11: Illustrating Aesthetic Outcome following Partial Breast Reconstruction By ICAP (AICAP), A and B=second P O. C and D=4 months P O.

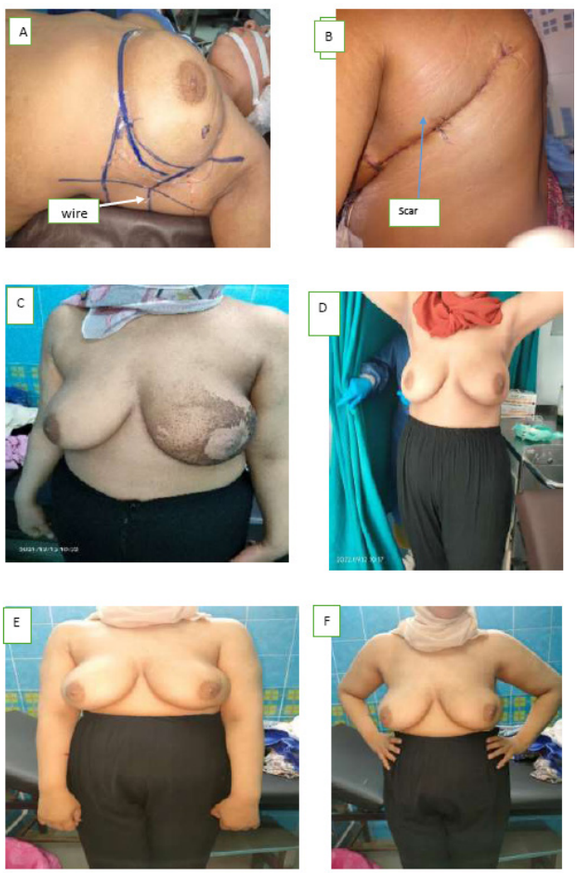


Fig. 12: Illustrates Aesthetic outcome following partial Breast Reconstruction By ICAPs(LICAP) flap, A=IO, B=second day PO, C=6 months PO, showing desquamation effect of PORT, D=15 months PO, E & F = 2 years PO, IO=intraoperative, PO=postoperative.

Fig. 13: Illustrating Aesthetic outcome in partial Breast Reconstruction By LTAP flap, A=Intraoperative, B=second postoperative day, C=3 months postoperative, D=1 year postoperative, E and F=2 years.

DISCUSSION

Despite the consensus that both volume displacement and volume replacement of oncoplastic procedures improve post-CBS deformities, reduce re-excision rate, better aesthetic outcomes, and quality of life, however, volume displacement techniques associated with diminished ipsilateral breast volume regardless of whatever technique was used, which occasionally may need contralateral breast symmetrization[5-7]. These inherent challenges are overcome by volume replacement oncoplastic techniques[9].

The addition of CWPF in breast surgery expanded the oncoplastic volume replacement procedures[5,6,8]. A number of the CWPFs were described for partial reconstruction of breast deformity following CBS, including TDAP, ICAPs, LTAP, SAAP, and SEAP flaps[9].

Our study included 34 cases, 20 (58.8%) cases underwent partial breast reconstruction by ICAP

(17=the LICAPs, 3 =the AICAP) flaps, meanwhile, 14 (41.2%) cases had the LTAP flaps. The mean total follow-up was higher in the ICAPs group than the LTAP group, represented as 33.10±11.96 months versus 12.15±10.92 months for the ICAP versus the LTAP groups respectively. This statistically significant difference highlights the challenges faced during recruitment of cases for the LTAP group, due to risks associated with the location of perforator vessels near the sentinel lymph node, the origin of lateral thoracic artery from the second part of the axillary artery near the level II ALNs. Furthermore, the LTAP was more complex in dissection, flimsy narrow vessel at high risk of damage, as well as at raised risk during axillary node clearance, similar concerns reported by Agrawal[16].

All the cases in the two studied groups had small to medium-breast sizes (cup A to Cup C), the majority of cases in both groups had either cup A or cup B (n=24, 70.6%) without statistically significant difference, *P=0.611*. The outcome of this study is comparable to the studies of Agrawal A, Mc Culley *et al*., and Shetty G, Hamdi, who demonstrated that the ICAP and the LTAP are useful for small and Medium-sized breast women[1618]. However, in a series of Dube and colleagues they used the ICAP and the LTAP flaps for partial breast reconstruction in all breast sizes, including large and ptotic breasts, ranging from Cup A to Cup F[19].

Both the ICAPs (LICAP) and the LTAP flaps were used equally in more than 60% of cases to reconstruct post-lumpectomy defects for tumor lesions located at UOQ. However, ICAPs (AICAP and LICAP) were used more frequently for the lesions located in LOQ (20.0%). On the other hand, the LTAP flap was used frequently for the lesions located at UIQ (21.4%), this finding emphasizes the feasibility of mobilizing the LTAP to the upper inner quadrant due to the long axis of its arc, the findings in this study is comparable to the study of Zeeshan and colleagues who conducted a study on 25 patients, and used the LICAP in eight patients for the tumors located at the UOQ and the LOQ, while the LTAP in 10 patients for 7 tumors in UOQ 3 at 12 O clock[20].

These findings support the early findings of Noguchi *et al*. who demonstrated that each flap has a favorable arc of rotation necessary to reach the defect and emphasized the need for surgeons to consider the excised volume and tumor location before planning surgical procedures[5]. However other studies in the literature demonstrate equal usefulness of both the ICAPs and the LTAPs for different breast quadrants[8,9,12,16,18,21].

Number of perforator vessels in flap

The number of perforator vessels used in a flap was higher among the ICAPs groups than the LTAP group, with the majority of flaps in the ICAPs group were raised based on three perforator vessels (85%), conversely, most of the flaps in the LTAP group were raised based on one perforator vessel (78.60%), with statistically significant difference between them (*P=0.001*), This finding is equivalent to the report of Zeeshan and colleagues who identified and used two to three perforator vessels in the LICAP, while identified 1-2 perforator vessels in LTAP flaps[20].

Skin incision

Hamdi *et al*. described intercostal perforator flaps based on transverse back an elliptical skin paddle incision over a future flap, in this study we used traditional Transverse Back incision in (n=5, 25.0%) versus (n=5, 35.7%) for the ICAP versus the LTAP, without significant variance between the two studied groups, the rest of the cases (n=24, 70.6%) were raised on different modified skin incisions including; Lazy S Inferolateral, Infra-mammary fold, Curvilinear inferolateral, C-shape inferolateral, C-shape inferolateral plus Bat wing Incisions, without statistically significant difference.

These findings are comparable to the study conducted by Korayem *et al*. on 36 patients, which evaluated the feasibility and early cosmetic outcomes of a modified LICAP flap after BCS. They concluded that it is possible technically to perform the entire modified LICAP flap reconstruction procedure with the patient in the supine position and without repositioning, adding that, the approach is associated best cosmetic outcomes (Korayem *et al*., 2024). The important point to be stressed is that the more skills are refined, the use of traditional transverse back incisions described by Hamdi *et al*. 2006 is deserted, by using different modified skin incisions, intraoperative changing the positions is avoided, as well as formation of sorrow triangle and its associated delayed wound healing are minimized. Overall, modified different skin incisions were frequently used rather than traditional back incisions described by Hamdi *et al*. and Soumian *et al*.[15,22].

Complications

Postoperative complications were low in this study, the most common complication experienced by patients in the two groups was seroma (n=5, 14.8%), and managed by serial drainages, without statistically significant difference, our finding of seroma was less than seroma developed in the study conducted by

Korayem and colleagues on 36 patients underwent partial breast reconstruction by LICAP flaps, where they developed (n=6,16.7%)[6], the minor different in the rate of the seroma in favor of our study may be attributed to refining the skills of surgeons and minimal use of diathermy in hemostasis.

Other (n=5; 14.8%) cases developed wound dehiscence, managed by daily repeated dressing under the coverage of topical and oral systemic antibiotics. Our finding was higher than the study of Korayem *et al*., where they had reported only 2 (5.6%) cases developed wound dehiscence, the higher incidence occurred in our study because we used transverse back incisions in early cases which were associated with increased incidence of wound dehiscence at sorrow triangle, whereas Korayem *et al*. used exclusively C-shape inferolateral (they termed Modified lateral intercostal perforator flap). Traumatic fat necrosis occurred in 4 (11.8%) cases in the two groups.

Three cases developed flap retraction, hematoma, and wound infection, the latter three complications were managed by refashioning, warm fomentation, and systemic and topical creams, respectively, without statistically significant difference among the two studied groups. The complication rate in this study is higher than the outcomes of the systematic review by Pujji and colleagues which involved 432 cases of partial breast reconstruction by CWPs. They reported the incidence of complications as; seroma (n=9, 2.1%), fat necrosis (n=9, 2.4%), haematoma (n=8, 1.9%), infection (n=9, 2.1%), and flap necrosis (n=9, 2.1%). And concluded that CWPFs are a safe method of partial breast reconstruction following BCS[23].

Aesthetic outcome; objective

Aesthetic outcomes were excellent in 90% versus 78.6%, good outcome in 5% versus 14.3%, for the ICAPS versus the LTAP, respectively without statistically significant difference, *P=0.608*. The Findings in this study are superior to the findings of Orabi *et al*., on 26 patients, with early breast cancer who underwent BCS and immediate partial reconstruction with lateral chest wall perforator flaps, and reported aesthetic outcome assessed by surgeons as the excellent outcome in (65.4%), good in (30.8%), and fair in (3.8%)[11]. Furthermore, the findings of this study are also superior to the study of Korayem *et al*., who evaluated the feasibility and the early cosmetic outcome of modified lateral intercostal artery perforator flap following breast conservative operation on 36 patients and reported general aesthetic outcomes as excellent outcome in 66.7%, good outcome in 22.2%, and fair outcome 11.1%[6].

Patient satisfaction

Moreover, overall aesthetic satisfaction in the two studied groups, was Very Satisfied in 95% versus 85.7%, and Satisfied in 5% versus 7.1% for the ICAPs versus the LTAP, respectively, without statistically significant variance among studied groups, *P=0.455*. These findings are equivalent to reports of multiple studies in the literature, including Korayem and colleagues who reported general satisfactory aesthetic outcomes, excellent satisfaction in 83.3%, good satisfaction in 5.6%, and fair outcome in 11.1%[6]. Furthermore, Lipman and colleagues augmented the breasts of 12 cases through the performance of 16 LICAP procedures, they showed favorable results for every case, with no concerns expressed about the flap scar[24]. Additionally, 40 cases who underwent flap reconstruction with satisfactory cosmetic outcomes (outstanding and good) were included in the study by Kim *et al*.[25]. However patient aesthetic satisfaction in our series is superior than the study of Orabi and colleagues on 26 patients, who reported excellent Aesthetic satisfaction in 65.4% of cases, and good aesthetic satisfaction in 23.1% of cases[11].

CONCLUSION

Both the ICAP and the LTAP are safe, versatile surgical techniques for partial breast reconstruction following conservative breast operation in small to medium-sized breast women. They are good and reliable options, associated with low complications rate, yield very good to excellent aesthetic outcomes and high patient satisfaction rate, the two flaps are equally useful for partial reconstruction of defects in UOQ of the breasts, however, the ICAP flaps were used exclusively for the tumors in the Lower quadrants whereas the LTAP flap for the lesions in UIQ.

Limitations

The number of cases is not equal in the two groups, as well as the cases were not recruited at one time, hence some cases did not reach 2 years follow-up while others exceeded the estimated time. We recommend conducting a similar comparative study involving a large sample size.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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