

Modified anterior intercostal artery perforator rotational flap in lower pole breast cancers: a new technique

Paula S.N. Sadary, Mohamed A.M. Khalaf Allah, Dina H. Ahmed Abdelaziz, Mahmoud T.R. Emam, Ahmed G. Eldin Othman Farag

Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Correspondence to Paula S.N. Sadary, MSc, Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo 111722, Egypt. Tel: +20 106 588 1130; e-mail: paulasamir@gmail.com

Received: 12 August 2022

Revised: 24 October 2022

Accepted: 27 October 2022

Published: 28 April 2023

The Egyptian Journal of Surgery 2023, 41:1454–1461

Background

Breast cancer, according to the National Cancer Institute, is the most common cancer in women in Egypt, as it accounts for ~38.8% of total malignancies among Egyptian women. It is an important cause of mortality among women.

Aim

To evaluate the postoperative cosmetic outcome of a new surgical technique, that is, modified anterior intercostal artery perforator flap, in lower pole breast cancers at 4 and 5 o'clock positions and at 7 and 8 o'clock positions of right or left breast.

Patients and methods

This was a prospective descriptive study conducted on patients having breast masses at the lower pole at 4 and 5 o'clock positions and at 7 and 8 o'clock positions.

Results

In this study, 10 (66.7%) patients gave excellent degree of satisfaction to the postoperative cosmetic outcome of our surgical procedure, four (26.7%) patients gave good degree, and one (6.7%) patient gave fair degree of satisfaction.

Conclusion

'Modified anterior intercostal artery perforator flap' is a new, easy, and feasible technique that shows satisfactory results in patients having breast masses at the lower pole at 4 and 5 o'clock positions and at 7 and 8 o'clock positions of either breast having a cup size of A or B and tumor size of T1 or T2 according to TNM staging.

We recommend to perform this new technique on a larger scale of patients and for a longer period of follow-up so as to get more information on advantages and drawbacks of this technique.

Keywords:

anterior intercostal artery, breast cancer, lower pole breast cancer

Egyptian J Surgery 41:1454–1461

© 2023 The Egyptian Journal of Surgery
1110-1121

Introduction

The breast is the true mirror of femininity, and it remains in the mind of every one of us as the heart of womanhood, with its role as nourisher and comforter. These roles evoke the idea of the importance and the affection of this delicate organ has in the minds of women [1].

Breast cancer, according to the National Cancer Institute, is the most common cancer in women in Egypt, as it accounts for ~38.8% of total malignancies among Egyptian women; it is an important cause of mortality among women [2].

Breast reconstruction is becoming increasingly important owing to changes in patient expectations and demand. There is growing recognition that immediate reconstruction through combining an oncological and esthetic procedure in one operation in appropriately selected women can give excellent

results. As most breast surgery is performed by general surgeons, most reconstructions are performed as delayed procedures by plastic surgeons. Increasingly, breast surgery is being performed by breast surgeons trained in oncoplastic techniques who can offer immediate reconstruction with therapeutic and economic options [3].

Surgical management of malignant diseases represents an exemplary model of multidisciplinary management. The combined modality approach to the treatment of patients with breast cancer including primary surgical treatment, radiation therapy, and chemotherapy needs careful integration of these modalities with the new methods of reconstructive breast cancer surgery [1].

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Lower pole breast cancers present particular challenges to obtaining satisfactory cosmetic results because resection can result in a concavity in the inferior aspect of the breast or a 'bird's beak' appearance [4].

A number of flaps have been described in breast reconstruction, and these include latissimus dorsi, deep inferior epigastric perforator, transverse myocutaneous gracilis, transverse upper gracilis, and intercostal artery perforator flaps [5].

Local flaps are useful owing to the simplicity of the surgical procedure in addition to skin color and texture matching [6].

Aim

In this study, we aimed to evaluate the postoperative cosmetic outcome of a new surgical technique as modified anterior intercostal artery perforator flap in lower pole breast cancers at 4 and 5 o'clock positions and at 7 and 8 o'clock positions of right or left breast.

Patients and methods

Study population

Type of study: this is a prospective descriptive study that was conducted on patients having breast masses at the lower pole at 4 and 5 o'clock positions and at 7 and 8 o'clock positions. This research was performed at the Department of General Surgery, Ain Shams University Hospitals. Ethical Committee approval and written, informed consent were obtained from all participants.

- (1) Study setting: this study was conducted at the breast cancer unit of Ain Shams University Hospitals.
- (2) Study period: it was performed from January 2021 to January 2022.

Study population

Inclusion criteria

The following were the inclusion criteria:

- (1) Patients having breast mass at 4 and 5 o'clock positions or 7 and 8 o'clock positions of either breast.
- (2) Patients having breast with cup size A or B.
- (3) Patients having breast mass staged as T1 or T2.

Exclusion criteria

The following were the exclusion criteria:

- (1) Candidates with age below 18 years old.
- (2) Patients having multicentric breast cancer.

- (3) Patient refusal.
- (4) Not fit for radiotherapy.

Sample size: the required sample size was estimated to be 15 patients.

Ethical considerations

- (1) An approval was taken from all patients to perform this new technique.
- (2) All data have been kept confidential and patients have not been mentioned by name in any published paper.
- (3) Patients had the right to refuse to participate in the research or could withdraw at any time without affecting their chance to receive the traditional therapy at any time.
- (4) Approval of the ethical committee and participants was obtained.

Study procedures

All patients included in the study were candidates for the following.

Clinical assessment

- (1) Detailed medical, surgical, and family history.
- (2) General examination.
- (3) Local breast examination.

Investigations

- (1) Routine laboratory investigations.
- (2) Sonomammography.
- (3) Presentation of patients to a multidisciplinary team.

Intervention

Patients were subjected to inframammary incision to remove the mass, which was sent frozen sectioning. When margin results were free of malignancy, dissection between subcutaneous tissue and anterior abdominal wall fat through the same inframammary incision was done without de-epithelialization of skin or distortion of inframammary fold, followed by freeing of the flap depending on its vascularity from anterior intercostal artery marked preoperatively by Doppler ultrasonography and rotating it to fill the defect.

Regarding axillary lymph nodes, either we did sentinel lymph node biopsy or axillary dissection from separate axillary incision.

While in original anterior intercostal artery perforator flap, the patient was marked in the standing position to

allow for more accurate evaluation and marking of anatomical landmarks. The inframammary fold was marked as the upper border of the flap. Flap width was determined with a pinch test, and the lower border was marked accordingly. The medial border of the flap was extended to the medial end of the inframammary fold adjacent to the xiphoid. The lateral border was marked between the anterior and posterior axillary lines where the upper and lower markings tapered toward each other to enable closure without 'dog-ears.'

Figure 1



Site of tumor localized with a wire on a clip after finishing her neo-adjuvant chemotherapy and the incision to be done.

Figure 2



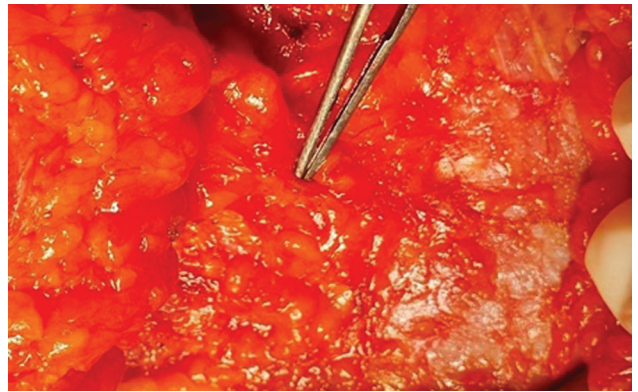
Freeing of flap to fill the defect.

After full-thickness skin incisions along the markings were made, elevation of the flap was advanced from lateral to medial in a subfascial plane. The flap was finally de-epithelialized so that the entire bulk of tissue was suitable for inset. Then, the flap was mobilized superiorly into the defect, and then both lateral and medial arms of the flap were first rotated toward each other and secured together superiorly with 2.0 vicryl sutures. Donor site was closed primarily and in layered fashion [7].

Follow-up

All patients were followed up for cosmetic satisfaction and symmetry with other breast and oncological safety (early recurrence) for 6 months.

Figure 3



Anterior intercostal artery after dissection and preoperative identification by Doppler ultrasonography.

Figure 4



Insertion of drain after filling the defect.

Figures 1–10 show localization of tumor with a wire on a clip after finishing neoadjuvant chemotherapy, freeing of the flap to fill the defect, anterior intercostal artery after dissection, preoperative identification by Doppler ultrasonography, postoperative inframammary scar, and the mass after being excised.

Results

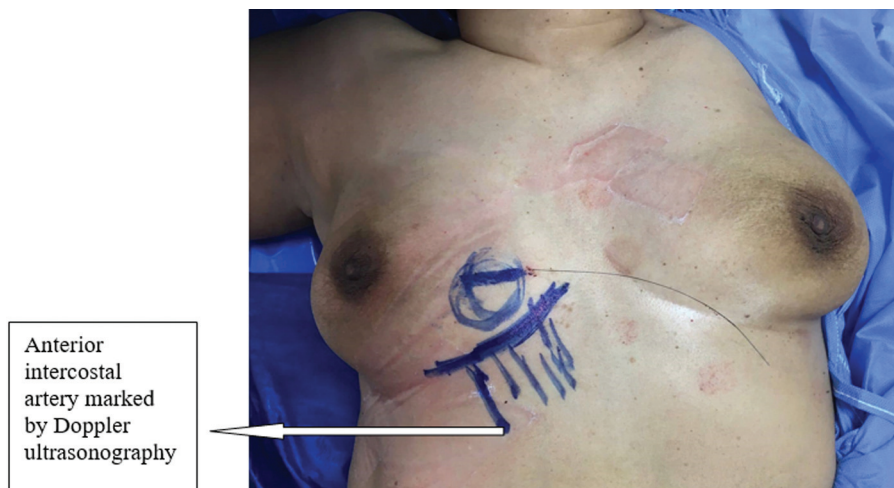
We identified 15 female patients with diagnosis of breast cancers at 4 and 5 o'clock positions and at 7 and 8 o'clock positions of right or left breast.

Figure 5



Postoperative inframammary scar.

Figure 6



Site of tumor localized with a wire on a clip after finishing her neoadjuvant chemotherapy and the incision to be done.

Table 1 shows that the mean age was 48.2 years (range, 38–60 years).

Table 2 shows that three (20%) of our patients were diabetic, four (26.7%) patients were hypertensive, and one (6.7%) patient had ischemic heart disease.

Table 3 shows that nine (60%) patients had tumor located in the lower inner quadrant, whereas six (40%) patients had tumor located in the lower outer quadrant.

According to TNM staging, seven (46.7%) patients had tumor size classified as T1 and eight (53.3%) patients had tumor size classified as T2.

As shown in Table 4, lymph nodes by pathology were classified as N0 and N1, and pathology of tumor was invasive duct carcinoma grade 2 in all of our patients.

In this study, nine (60%) patients had lymph node by pathology as N0 and six (40%) patients had lymph node by pathology as N1.

Table 5 shows that nine (60%) patients had sentinel lymph node biopsy and six (40%) patients had axillary clearance.

A total of seven (46.7%) patients were luminal A, five (33.3%) patients were luminal B, two (13.3%) patients were Her2-neu, and one (6.7%) patient was triple negative.

Table 6 shows that six (40%) patients had neoadjuvant chemotherapy according to MDT. Those patients were N1 by pathology and radiologically.

Figure 7



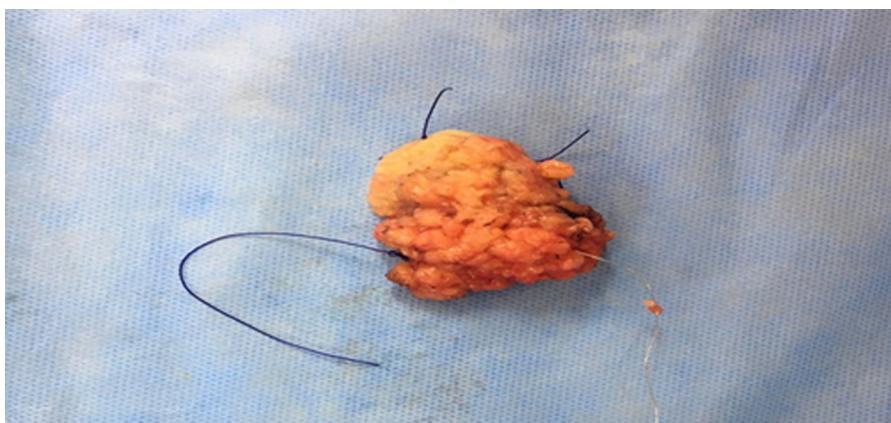
Freeing of flap to fill the defect.

Figure 8



The flap after dissection to fill the defect.

Figure 10

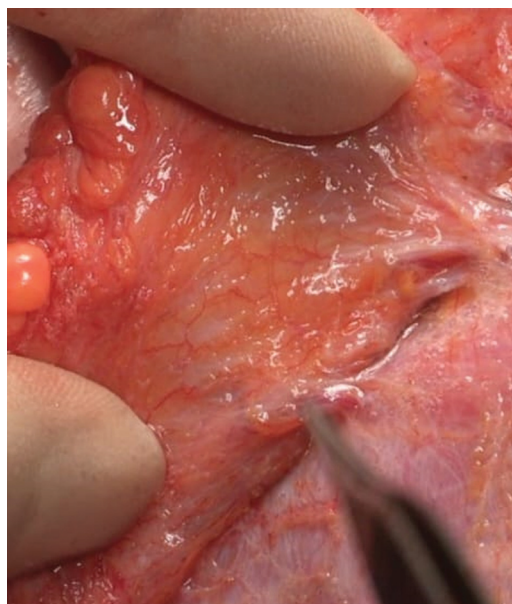


The mass after being excised.

Overall, two (13.3%) patients had wound infection, two (13.3%) patients had seroma, one (6.7%) patient had fat necrosis, and one (6.7%) patient had hematoma. Wound infection was managed conservatively by intravenous antibiotics in the same hospital stay for 4 days in one patient and 5 days for other patient. Seroma was treated by aspiration smoothly with no further interventions (<50 ml), and hematoma and fat necrosis were managed conservatively.

In this study, the cosmetic outcome score was based on multiple items that made up a checklist to be evaluated by our team and the MDT of the breast for every single case. This checklist included the following:

Figure 9



Anterior intercostal artery after dissection and preoperative identification by Doppler ultrasonography.

Table 1 Age and sex of patients

	N=15
Age	
Mean±SD	48.20±6.96
Range	38–60
Sex [n (%)]	
Female	15 (100.0)

Table 2 Medical history of patients

	n (%)
Diabetic	
No	12 (80.0)
Yes	3 (20.0)
Hypertensive	
No	11 (73.3)
Yes	4 (26.7)
IHD	
No	14 (93.3)
Yes	1 (6.7)

Table 3 Location and size of tumor classified according to TNM staging as T1 and T2

	n (%)
Location of tumor	
LIQ	9 (60.0)
LOQ	6 (40.0)
Tumor size (TNM)	
T1	7 (46.7)
T2	8 (53.3)

Table 4 Lymph node by pathology and pathology of the tumor

	n (%)
Lymph node by pathology	
N0	9 (60.0)
N1	6 (40.0)
Pathology of tumor	
IDC grade2	15 (100.0)

- (1) The overall shape of the breast.
- (2) Symmetry of both breasts.
- (3) Site and direction of the nipple.
- (4) Volume of the breast.
- (5) Skin incision shape.

These elements were discussed for every single case and analyzed to give a scoring system graded from 1 to 5 as follows:

5=excellent.

4=very good.

Table 5 Patients who had axillary clearance or sentinel lymph node biopsy and molecular subtype of breast cancer

	n (%)
Axillary clearance	
No	9 (60.0)
Yes	6 (40.0)
SLN	
No	6 (40.0)
Yes	9 (60.0)
Molecular	
Luminal A	7 (46.7)
Luminal B	5 (33.3)
Her2-neu	2 (13.3)
Triple -ve	1 (6.7)

Table 6 Patients who had neoadjuvant chemotherapy and analysis of postoperative complications of patients

	n (%)
Neoadjuvant	
No	9 (60.0)
Yes	6 (40.0)
Infection	
No	13 (86.7)
Yes	2 (13.3)
Seroma	
No	13 (86.7)
Yes	2 (13.3)
Fat necrosis	
No	14 (93.3)
Yes	1 (6.7)
Hematoma	
No	14 (93.3)
Yes	1 (6.7)

Table 7 Patient satisfaction with the cosmetic outcome, postoperative pain analysis, and local recurrence

	N=15 [n (%)]
Satisfaction	
Fair	1 (6.7)
Good	4 (26.7)
Excellent	10 (66.7)
Postoperative pain	
Median (IQR)	7 (6–7)
Range	6–8
Local recurrence	
No	15 (100.0)

3=good.

2=fair.

1=poor.

Postoperative pain was assessed using visual analog scale pain score from 0 to 10, where 0 represented

Table 8 Relation between diabetes mellitus and wound infection

	Infection [n (%)]		Test value*	P value	Significance
	No	Yes			
Non-diabetic	12 (92.3)	0	9.231	0.002	HS
Diabetic	1 (7.7)	2 (100.0)			

P value more than 0.05: nonsignificant (NS); P value less than 0.05: significant (S); P value less than 0.01: highly significant (HS). * χ^2 test.

least pain and 10 the most. Table 7 shows that the median postoperative pain was 7 and ranged from 6 to 8. No patient had local recurrence.

Satisfaction was ranged from good to excellent regarding cosmetic outcome in 1-week follow-up postoperatively and 6-month follow-up postoperatively (on a scale ranging from poor to excellent).

In this study, 10 (66.7%) patients showed excellent degree of satisfaction regarding the postoperative cosmetic outcome of our surgical procedure, four (26.7%) patients showed good degree, and one (6.7%) patient showed fair degree of satisfaction owing to wound infection and hematoma that occurred in this patient.

Table 8 shows that two of three diabetic patients had wound infection, having a P value of 0.002, which was highly significant.

Discussion

Breast cancer surgery is considered a safe option for most patients with early breast cancer. The 5-year survival rate of patients undergoing breast cancer surgery with radiation is statistically similar to those with stage I or II breast cancer undergoing mastectomy alone [8].

Immediate reconstruction after breast cancer surgery has several advantages. First, it allows for better restoration of the original shape of the breast, an outcome that is arguably more difficult to achieve when reconstruction is delayed and certainly more difficult when postoperative radiation has taken place. Another advantage of immediate reconstruction is that it allows for wider local tumor excision, potentially reducing the incidence of margin involvement [7].

In this study, the mean age was 48.2 years, nine (60%) patients had tumor located in the lower inner quadrant, whereas six (40%) patients had tumor located in the lower outer quadrant. Overall, seven (46.7%) patients

had tumor size classified as T1 and eight (53.3%) patients had tumor size classified as T2.

However, in a study done by Orabi *et al.* [8], the total number of patients was 26, with a mean age of 41.12 years, whereas the mean of T stage was 3.7±0.8 and ranged from 2 to 4.5 cm. Nodal status was N1 in 20 (77%) patients and N2 in two (7.7%) patients. In N2 patients, neoadjuvant chemotherapy was recommended by the MDT to downstage the tumor. A total of 22 (84.6%) patients underwent axillary clearance, whereas four (15.4%) patients underwent sentinel lymph node biopsy.

In this study, nine (60%) patients had sentinel lymph node biopsy and six (40%) patients had axillary clearance.

Overall, six patients had neoadjuvant chemotherapy; these patients had lymph node N1 by pathology.

There are many surgical wound complications, especially with oncoplastic techniques such as surgical site infection, ecchymosis, wound dehiscence, seroma, hematoma, partial flap loss, and complete loss of flap [9].

In a study performed on 20 patients, 10 of them underwent conservative breast surgery and 10 underwent oncoplastic surgery by LD flap. There were three (as 9%) cases of postoperative complication in the oncoplastic surgery group by LD flap. Among them, there was only one incidence for hematoma, surgical site infection, and also partial necrosis of nipple areolar complex. All of these were treated by conservative management. In CBS, perioperative complication was reported in five (11%) patients. Among these, two cases had surgical site infection, infection of seroma cavity in two cases, and one case had skin flap necrosis [10].

In our study, two (13.3%) patients had wound infection, two (13.3%) patients had seroma, one (6.7%) patient had fat necrosis, and one (6.7%) patient had hematoma. Wound infection was managed conservatively by intravenous antibiotics in

the same hospital stay for 4 days in one patient and 5 days for other patient. Seroma was treated by aspiration smoothly with no further interventions (<50 ml), and hematoma and fat necrosis were managed conservatively.

In this study, we recommend modified anterior intercostal artery perforator flap in patients having breast cup size A or B and tumor size according to TNM staging up to T2 because there is no de-epithelialization of skin or distortion of inframammary fold, unlike anterior intercostal artery perforator flap, especially in patients with small breast sizes who are not ideal candidates for more extensive breast reduction techniques. The flap is relatively easy and quick to raise, and it does not require extensive microsurgical skills. Moreover, a laterally pedicled flap is typically harder to mobilize over the entire breast imprint than an anteriorly pedicled flap; more anterior pedicles (i.e. pedicle closer to the center of the breast imprint) allow for better flap mobilization over the entire breast [7].

AICAP flaps provide benefits compared with myocutaneous flaps. There is no need to reposition the patient as is required in latissimus dorsi flaps. Moreover, the operative time is shorter when performing AICAP flaps compared with free flaps as microsurgical anastomoses are not required [11].

In this study, 10 (66.7%) patients showed excellent degree of satisfaction regarding the postoperative cosmetic outcome of our surgical procedure, four (26.7%) patients showed good degree, and one (6.7%) patient showed fair degree of satisfaction due to wound infection and hematoma that occurred in this patient.

It is not necessary to sacrifice the underlying muscle when harvesting AICAP flaps, leading to reduced morbidity compared with myocutaneous flaps [6].

In this study, we recommend to perform this new technique on a larger scale of patients and for a longer period of follow-up so as to get more information on advantages and drawbacks of this technique.

Conclusion

Modified anterior intercostal artery perforator flap is a new, easy, and feasible technique that showed satisfactory results in patients having breast masses at the lower pole at 4 and 5 o'clock positions and at 7 and 8 o'clock positions of either breast having cup size of A or B and tumor size of T1 or T2 according to TNM staging.

We recommend to perform this new technique on a larger scale of patients and for a longer period of follow-up so as to get more information on advantages and drawbacks of this technique.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Urban C, Rietjens M. *Oncoplastic and reconstructive breast surgery*. 1st ed. Italia. E-book Springer-Verlag; 2013. pp. 13–20.
- Ibrahim AS, Khaled HM, Mikhail NN, Baraka H, Kamel H. Cancer incidence in Egypt: results of the national population-based cancer registry program. *J Cancer Epidemiol* 2014; 18:437971.
- Schrenk F. *Oncoplastic breast surgery*. In: Fitzel S, editor. *Oncoplastic breast surgery: a guide to clinical practice*. 2nd ed. Austria: Springer Wein; 2010; pp. 165–173.
- Clough KB, Kaufman GJ, Nos C, Buccimazza I, Sarfati IM. Improving breast cancer surgery: a classification and quadrant per quadrant atlas for oncoplastic surgery. *Ann Surg Oncol* 2010; 17:1375–1391.
- Tondu T, Tjalma WAA, Thiessen FEF. Breast reconstruction after mastectomy. *Eur J Obstet Gynecol Reprod Biol* 2018; 230:228–232.
- Carrasco-López C, Julian Ibañez JF, Vilà J. Anterior intercostal artery perforator flap in immediate breast reconstruction: anatomical study and clinical application. *Microsurgery* 2017; 37:603–610.
- Adler N, Carmon E, Chapchay K, Billig A. Anterior intercostal artery perforator flap for immediate reconstruction following breast conservationsurgery. *Microsurgery* 2022; 21:1–7.
- Orabi A, Youssef MMG, Manie TM, Shaalan M, Hashem T. Lateral chest wall perforator flaps in partial breast reconstruction. *J Egypt Natl Canc Inst* 2022; 34:2.
- Crown A, Scovel LG, Rocha FG, Scott EJ, Wechter DG, Grumley JW. Oncoplastic breast conserving surgery is associated with a lower rate of surgical site complications compared to standard breast conserving surgery. *Am J Surg* 2019; 217:138–141.
- Chauhan A, Sharma MM. Evaluation of surgical outcomes following oncoplastic breast surgery in early breast cancer and comparison with conventional breast conservation surgery. *Med J Armed Forces India* 2016; 72:12–18.
- Denning M, Hayes P, Tsang F, Leff D, Thiruchelvam P, Hadjiminias D. The modified crescentic anterior intercostal perforator flap. *Plast Reconstr Surg Glob Open* 2020; 8:e2785.