Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2022.112311.2439 Volume 30, Issue 7, Oct. 2024
Manuscript ID: ZUMJ-2112-2439 (R1)
DOI 10.21608/ZUMJ.2022.112311.2439

ORIGINAL ARTICLE

Assessment of Volume Displacement as an Oncoplastic Technique in the Management of Early Breast Cancer

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Submit Date: 22-12-2021
Revise Date: 30-01-2022
Accept Date 01-02-2022

ABSTRACT

Background*:* Breast cancer is the most frequently diagnosed type of cancer among women and an important cause of premature death among women. The goal of oncoplastic surgery in women with early-stage breast cancer is to remove breast cancer with negative histological margins and preserve the breast contour. We aimed in our study to assess the oncologic and cosmetic outcomes of applying different types of volume displacement techniques of oncoplastic surgery in the early stages of breast cancer. Methods: This study included (30) patients who had undergone various types of volume displacement techniques of breast oncoplastic surgery in the early stages of breast cancer. This study was conducted at Zagazig University Hospitals, Nasser's Institute Hospital for Research and Treatment, And the National Cancer Institute in Cairo. Patients were evaluated for oncologic and cosmetic outcomes. **Results**: In our study, the pathologist in our multidisciplinary team affirmed that none of the patients had any tumor recurrence demonstrating that we had performed a safe oncoplastic technique from the oncological perspective. None of our cases have had a poor or ugly score in our study. We achieved an excellent cosmetic outcome for relatively large mass excisions with 90% of the cases in excellent and very good score groups with a mean cosmetic outcome score of 4.53. **Conclusions**: Breast oncoplastic surgical techniques were as safe as modified radical mastectomy in oncologic control but with more adequate cosmetic outcomes.**keywords:** Breast-Conserving Surgery, Oncoplastic Surgery, Volume Displacement Techniques.

INTRODUCTION

Breast cancer is the most detected cancer in females and is a significant reason for early death. It is thought it be a big health issue [1]**.**
In Egypt, it is about 30% of women's cancer detected cases, and more than 22,000 new cases are detected every year [2]**.** Breast-conserving surgery (BCS) accompanied by adjuvant radiotherapy, was recorded to be as safe as mastectomy concerning oncological consequences [3]. The purpose of oncoplastic measures in females with early-stage breast cancer is to resect the breast cancer with negative histologic margins and to reserve the accepted shape of the breast. The general principles of the oncoplastic techniques include resecting a skin island with the fibroglandular tissue and advancing the deep fibroglandular tissues over the chest wall to obliterate a large resection defect [4]**.**
Oncoplastic breast surgery has created great hope in previous years and has turned out to be

an incorporated element of the surgical management of breast cancer. The passion for these techniques happens from reported information that seems to suggest equal oncological safety and better cosmetic effectiveness, Oncoplastic breast surgery is coupled with low levels of local recurrence and superior cosmetic outcomes [5]. There are two different approaches. volume replacement procedures, which join resection with immediate reconstruction of the defect by utilizing autologous tissue flaps, and volume displacement procedures, which join resection with a wide range of different breast reduction and reshaping procedures, according to the area of the tumor [6].

The work aimed to assess the oncologic and cosmetic outcomes of Volume Displacement oncoplastic techniques in the early stages of breast cancer.

METHODS

Study type

This was a prospective cohort study that involved thirty patients.

Study Setting

The study was conducted from May 2019 to May 2021 at Zagazig University Hospitals, Nasser's Institute Hospital for Research and Treatment, And National Cancer Institute in Cairo. Approval was obtained from the ethical committee in Zagazig University Hospitals (Approved by IRB), Nasser's Institute Hospital for Research and Treatment, And the National Cancer Institute in Cairo. Written informed consent was obtained from all participants, the study was approved by the research ethical committee of the Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans. Removal of cancer with a broad safety margin was achieved for all 30 patients, with axillary lymph node clearance. Immediate reforming of the breast was done by applying the most appropriate of different volume displacement techniques. All 30 patients underwent follow-up for cosmetic and oncologic results and were directed to get proper post-operative therapy corresponding to the final pathology report.

Patient selection

Patient selection was done by numerous inclusion and exclusion principles.

*Inclusion criteria***:** Females from thirty to sixty years old and stage I –IIa breast cancer patients.

Exclusion criteria: Patients refusing the recommended dose of postoperative radiotherapy and absolute contra-indication to standard BCS such as: **d**iffuse widespread micro-calcifications, extensive in situ component (>25%), recurrent malignancy following conservative breast surgery, multicentric breast cancer in more than one quadrant, inflammatory breast cancer, and absolute contra-indication to radiation therapy such as previous breast irradiation and pregnancy.

Multidisciplinary Team (MDT)

The multidisciplinary team involves various medical and associated experts from several specialties, who come at the same time to discuss a list of patients and make an agreeable diagnosis and treatment strategy.

Diagnosis and Pre-operative preparation

All patients were submitted to the following: history taking, clinical examination, and preoperative investigations such as *ordinary laboratory tests*, r*adiological examination*, bilateral breast ultrasound and bilateral digital mammography (in patients aged 35 or older), and m*etastatic workup* such as: chest CT, pelvi-abdominal sonography, and bone scan if indicated or if the patient complained of bone pain. Also, *ECG* and *Echocardiography* were made if indicated. *Lastly histopathological confirmation* (by tissue biopsy using image-guided true-cut needle core biopsy) was done.

Patient counseling and consent

After MDT approval, admission, and completion of history and assessment, each patient had a full clarification of her illness and kind of surgery using photos of comparable cases to assist to imagine the result. Risks and gains of the recommended technique along with

its potential intra and post-operative complications plus medical photography have also consented. Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Markup and medical photography

On the morning of the surgery, markup and pattern of proposed incision were made in the holding area of the operating theater in the attendance of the surgical team.

Operative techniques and intra-operative details

All the thirty cases underwent oncoplastic breast procedures that included 2 chief technical steps: *Resection* of the mass with safety margins with intraoperative histopathological examination of the margins utilizing frozen section or touch imprint cytology with axillary dissection.

Then *immediate reconstruction* is applied to one of the oncoplastic procedures: Local glandular flaps, Reduction mammoplasty designs (which include Superior pedicle technique and Inferior pedicle technique), Batwing Technique, and Grisotti flap.

Selected procedure according to tumor location

Upper outer: local glandular flap | batwing | inferior pedicle mammoplasty

Upper inner: local glandular flap| Batwing.

Central zone: Grisotti | Batwing

Lower outer: Local glandular flap |superior pedicle mammoplasty.

Lower inner: Local glandular flap| superior pedicle mammoplasty.

Local glandular Flaps

Concept

This procedure moves tissue from inside the breast through a similar little incision utilized for a lumpectomy.

Steps: Fig S1

Preoperative marking, Deepithelialization for NAC reposition., Wide local excision with elevation of tissue flap to fill the cavity, then Closure of the defect.

Reduction mammoplasty designs:

Reduction mammoplasties were performed in patients having big breasts and were created applying a nipple-areolar pedicle based either superiorly or inferiorly depending on the location of the mass.

Superior Pedicle Reduction Mammoplasty.

Concept

This technique was used for the wide excision of tumors in the lower pole of a relatively big or ptotic breast.

Steps: Fig S2

The markup was done using a keyhole pattern and the tumor was placed within the area to be resected with the design to place the new NAC at a mid-humeral position, Intraoperative: the blue arrow points to the de-epithelialized area and the black arrow shows the site of the resected tumor, then Closure.

Inferior Pedicle Mammoplasty

Concept

Like the superior pedicle but the mass of tumors in the upper pole of a relatively big or ptotic breast.

Steps: Fig S3

Preoperative marking and the black arrow illustrating the location of the tumor. Intraoperative: the blue arrow points to the de-epithelialized area, then Closure.

Batwing Technique

Concept

This procedure was applied for masses in the upper zone of a medium to big-sized breast.

Steps: Fig S4

The markup was done as the shape of the wings of a bat including the tumor, Excision of the tumor, Excision till pectoralis fascia, The tumor excised with safety margins, The tumor bed after excision, and then Closure.

Grisotti Technique for Central Breast Defects

Concept

This technique was used for reconstruction of the breasts with centrally located tumors that required excision of the NAC to ensure tumor-free margins and so resulting in big central defects.

Steps: Fig S5

Preoperative markings were done to outline an inferiorly based glandular-cutaneous flap along with the outline of the new NAC lying adjacent to the native NAC (to be removed), then the tumor was excised with safety margins till pectoralis fascia. Deepithelialized area around the new NAC was done.

Assessment of cosmetic outcome

Cosmetic results and patient satisfaction were assessed by the patient, the surgeon, and the breast MDT during the first days postoperative and during follow-up at two weeks then one month.

A graded scoring system was applied from zero to five.

The postoperative cosmetic scoring system

Score 5 means Excellent
Score 4 means Very good
Score 3 means Good
Score 2 means Fair
Score 1 means Poor
Score 0 means Ugly

Pre- and post-operative photos were taken to show the difference in terms of breast size, shape, and contour, ptosis, NAC position, and symmetry.

Assessment of oncologic outcome

Oncologic outcome is assessed by: Intraoperative histopathological examination utilizing frozen section or touch imprint cytology, then Pathologic postoperative histopathological examination, then follow-up for recurrence or distant metastasis.

In *oncoplastic surgery* maximum oncological safety should be achieved if we could succeed in getting: Free margins and Optimum postoperative radiotherapy dose without delay.

RESULTS

Patient characteristics and demographics

The age of the patients started from 31 to 56 with a mean age of 42.70 years.

- The weight started from 59 to 133 with a mean weight of 84.97 kg.
- The height started from 159 to 178 with a mean height of 166.50 cm.
- BMI ranged from 23-42 with a mean BMI of 30.46.
- HTN (16.7%) and DM (13.3%) of patients' co-morbidities.

Tumor characteristics

1. Tumor location was in any quadrant of the breast with distribution as follows:

Tumor location	Number of the patient (%)
Upper outer	13 (43.33)
Lower outer	3 (10)
Upper inner	4 (13.33)
Lower inner	2 (6.67)
Central portion	8 (26.67)

2. Tumor size

The mass size was pre-operatively assessed by sonography.

Table (1) **Mean tumor size in the study**

3. Pathological types

Table (2) **Postoperative pathological type of tumor among the patient population**

Techniques of oncoplastic surgery

All thirty cases submitted to breast immediate reconstruction utilizing one of the following **Volume displacement** oncoplastic methods:

Figure (1): Different kinds of oncoplastic procedures in the study.

Operative evaluation

Operation time

The mean surgery period was 106 minutes, the shortest operation ended in 93 minutes while the longest required 128 minutes.

Postoperative hospital stay

In this study, cases were admitted to the inpatient unit one day preoperatively and discharged on the morning of day one after surgery.

Postoperative complications

Early complications included nipple-areola complex necrosis, skin necrosis, seroma, wound infection, and wound dehiscence.

Delayed complications included fat necrosis, flap failure, post-radiotherapy complications (edema and skin ulceration), and tumor recurrence.

(a) Early complications

(b) Delayed complications

Figure (2): Pie chart showing: (a) Early complications (b) Delayed complications.

Evaluation of cosmetic outcome

Aesthetic result was assessed by a scoring system scored from 1 to 5 as the following:

Postoperative cosmetic scoring system

- 5 Excellent
- 4 Very good
- 3 Good
- 2 Fair
- 1 Poor
- 0 Ugly

The study mean score was 4.53 that was among excellent and very good.

Distribution of cases for every score according to patient satisfaction score (n=30)

Figure (3): Pie chart distribution of cases corresponding to patient satisfaction score.

Table (3)**: Distribution of cases according to their surgeons' score regarding the cosmetic outcome.**

The study showed that the mean cosmetic score was 5 and 4.5 for Conventional local glandular flaps and inferior pedicle technique respectively.

However, the mean cosmetic score was 4.42 for the superior pedicle method.

While the mean cosmetic score was 4.63 for the Batwing technique.

At last, the mean score was 4.5 for the Grisotti procedure.

Evaluation of oncologic outcome

Negative safety margins ranged from 1 to 4 cm. with a mean safety margin of 3.3 cm.

Oncologic results

At the time of the study, no recorded local recurrence in the thirty patients.

No distant metastatic spread of the disease was reported.

Table 1: Mean tumor size in the study

Mean±SD	Min	Max
1.96±0.4 cm	1.2cm	2.8cm

Table 2: Postoperative pathological type of tumor among the patient population

Tumor pathological types	n (%)
IDC	25 (83.3)
ILC	4 (13.3)
Mucinous carcinoma	1 (3.3)

IDC, invasive ductal carcinoma; ILC, invasive lobular carcinoma**.**

Table 3: Distribution of cases according to their surgeons' score regarding the cosmetic outcome.

Surgeons' score on cosmetic outcome		**No.**	**%**
Surgeons' score on cosmetic outcome	Fair	1	3.3%
	Good	12	40.0%
	Excellent	17	56.7%
Total		30	100.0%

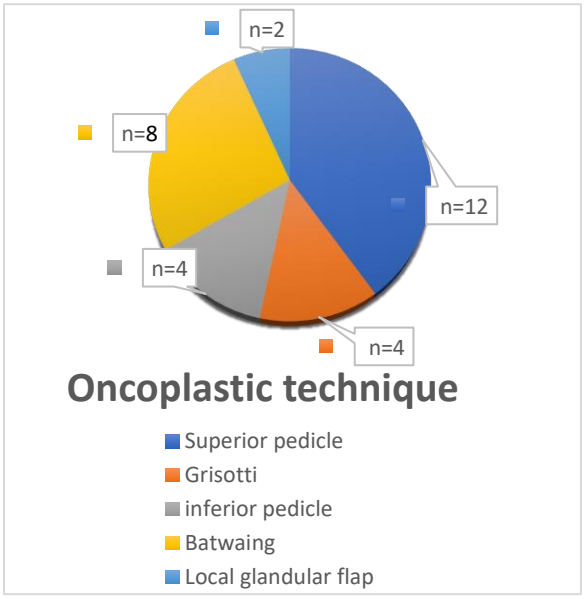

Figure 1: Different kinds of oncoplastic procedures in the study.

(a) Early complications ***(b) Delayed complications***

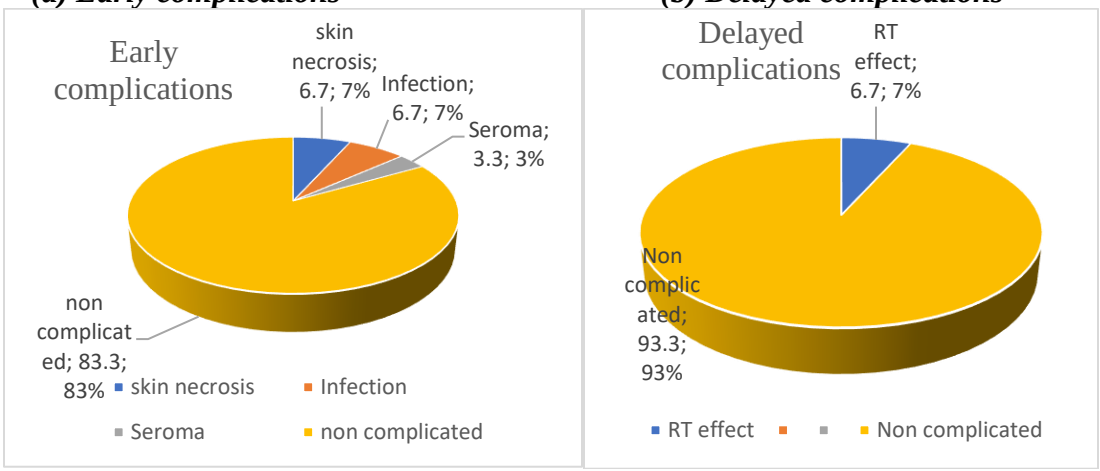

Figure 2: Pie chart showing: (a) Early complications (b) Delayed complications.

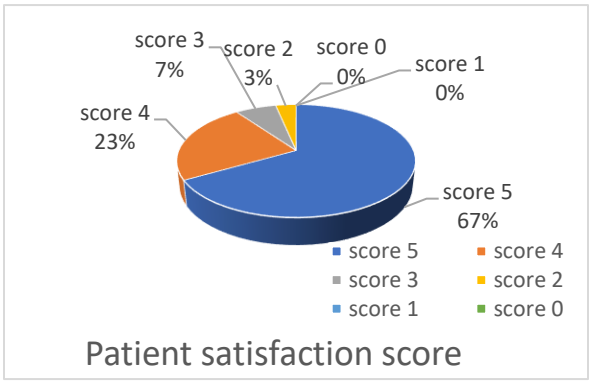

Figure 3: Pie chart distribution of cases corresponding to patient satisfaction score.

DISCUSSION

Our results regarding the mean age of patients were (42.70±7.11) which matches with ***Mahmoud and Amin Saleh*** [7]; the mean age of patients was 45.7 years, half the patients were between 45 to 55 years and this matches with the demographic records announced by the National Cancer Institute in 2013 by ***Zeeneldin et al.*** [8] who declared that the highest incidence of breast malignancy between 40 and 59 years old.

According to our study, most of the cancer masses (43.3%) were in the upper outer zone of the breast, this was in harmony with the national and international records and matched with site distribution published in (Topographic Pathology of Cancer) by ***El Bolkainy et al.*** [9] who stated that breast cancer most common in the UOQ.

In our study postoperative pathological results showed that 83% of patients had invasive duct carcinoma, 13% of patients had invasive lobular carcinoma, and 3% had mucinous carcinoma that matched with the published statistics by Goldvaser et al. [10] that declared that the most common tumor pathology was invasive ductal carcinoma (80.8%), followed by invasive lobular carcinoma (12.4%). Also, Farouk et al. [11] reported that the majority (93.3%) of the tumors were confirmed as invasive ductal carcinoma, followed by invasive lobular carcinoma (3.3%) and medullary carcinoma (3.3%).

In agreement with our results; ***Erić et al*** [12] found that invasive ductal carcinoma was the most common histological sort of tumor.

In this study, sixteen patients were submitted to superior pedicle mammoplasty and inferior pedicle mammoplasty due to big breast volume. This is like what was published by ***Fitzal*** [13], ***Bertozzi et al*** [14]**,** and ***Urban et al.*** [15] who said that the breast volume is often reduced after oncoplastic breast surgery (OBS); therefore, it has a positive effect by lowering the radiotherapy dose needed.

Grisotti technique was done in cases with central masses. The cosmetic outcomes were excellent like the study made by ***Betal et al.*** [16] announced in 2011 who applied the Grisotti flap reconstruction procedure for retro-areolar breast tumors.

According to ***Urban et al.*** [15], Complications related to breast reconstruction of any kind can be classified as early (until 2 months after the surgery) or delayed (after that period).

As regards early postoperative complications, the present study results showed that skin necrosis appeared in (6.7%) of patients. No patients had NAC necrosis. The infection appeared in (6.7%) and seroma appeared in (3.3%) of patients.

Additionally, comparable outcomes were gotten by ***van Paridon et al.,*** [17] recorded complexities included seroma in (4.3%), hematoma in (2.1%), and limited fat gangrene in (2.1%). While ***Farouk et al.,*** [11] reported wound gapping in (13.3 %); seroma in (13.3 %), and surgical site contamination in (3.3 %) of patients.

During the study, only 5 (17%) patients had early complications, 2 of them caught infection, both had diabetes mellitus (DM) displaying the immuno-suppression with (DM). Statistically, DM has raised the possibility of postoperative wound infection 3 times, that is like what was recorded by ***Hart et AL.*** [18] and ***Urban et al.*** [15] showing the complication of DM in oncoplastic surgery.

In this study, two patients (6.7%) had delayed complications in the form of post-radiotherapy skin edema and none of the patients had any malignant recurrence.

In this study, results of wound infection (6.7%%) was less than recorded by ***Vilar-Compte et al.,*** [19] (18.9%) and higher than recorded by ***Olsen et al.,*** [20] (4.7%) and ***Palubicka et al.,*** [21] (6.2%).

In this study, we could reach an excellent cosmetic result for quite bulky tumor resections with 90% of the patients (27 patients) in excellent or very good score groups with a score of 4.53 for mean cosmetic results. The left 10% (3 patients) lie in fair and good score groups as

they observed asymmetry of 2 breasts in opposite of the mirror. None of the patients gave an ugly or poor score.

In this study, none of the patients had any recurrence as proved by the pathologist in our MDT confirming that we achieved an oncologically safe oncoplastic procedure.

CONCLUSION

Breast oncoplastic surgical techniques are effective and result in improved patient satisfaction. Oncoplastic techniques offer the surgeon novel means for breast cancer therapy. These methods are safe regarding oncologic control with more adequate cosmetic outcomes.

FINANCIAL DISCLOSURE

Nil.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

All authors have approved the final article

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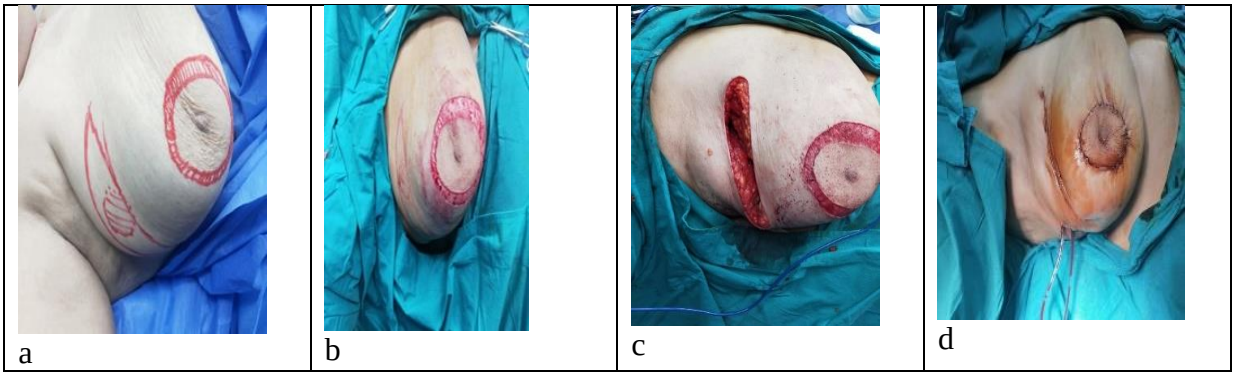

Fig S1: Local glandular Flaps

a) Preoperative marking.
b) Deepithelialization for NAC repositioning.
c) Wide local excision with elevation of tissue flap to fill the cavity.
d) Closure of the defect.

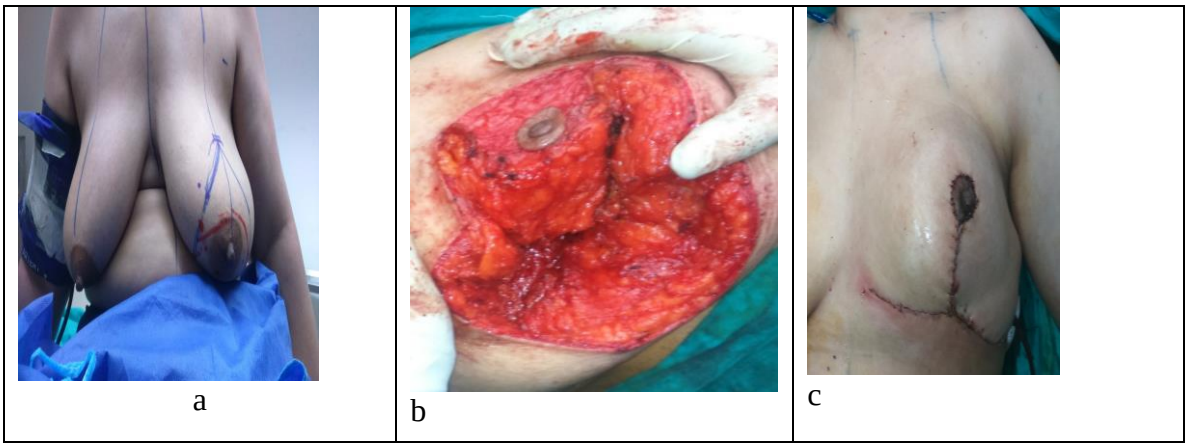

Fig S2: Superior pedicle reduction mammoplasty.

a) Markup was done using a keyhole pattern and the tumor was placed within the area to be resected with the design to place the new NAC at a mid-humeral position.
b) Intraoperative: the blue arrow points to the de-epithelialized area and the black arrow shows the site of the resected tumor
C) Closure

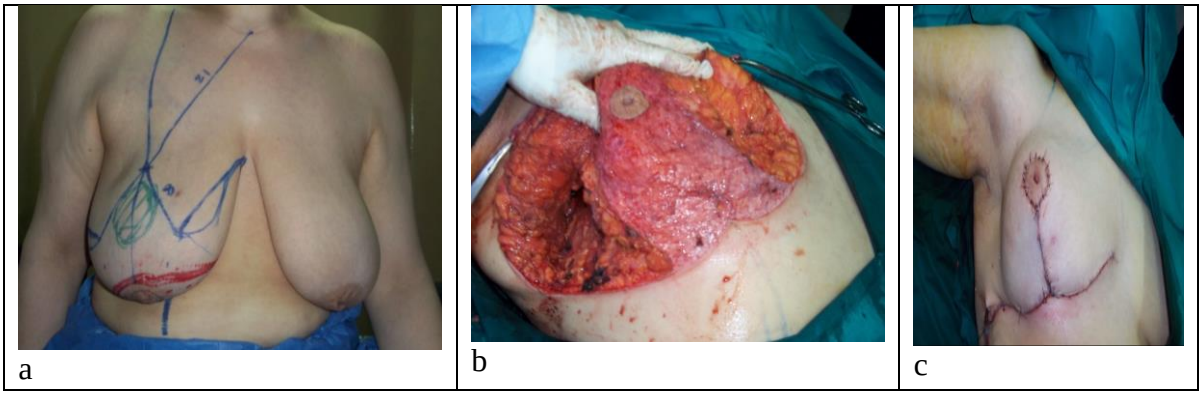

Fig S3: Inferior pedicle reduction mammoplasty.

a) Preoperative marking and the black arrow illustrating the location of the tumor
b) Intraoperative: the blue arrow points to the de-epithelialized area
c) Closure.

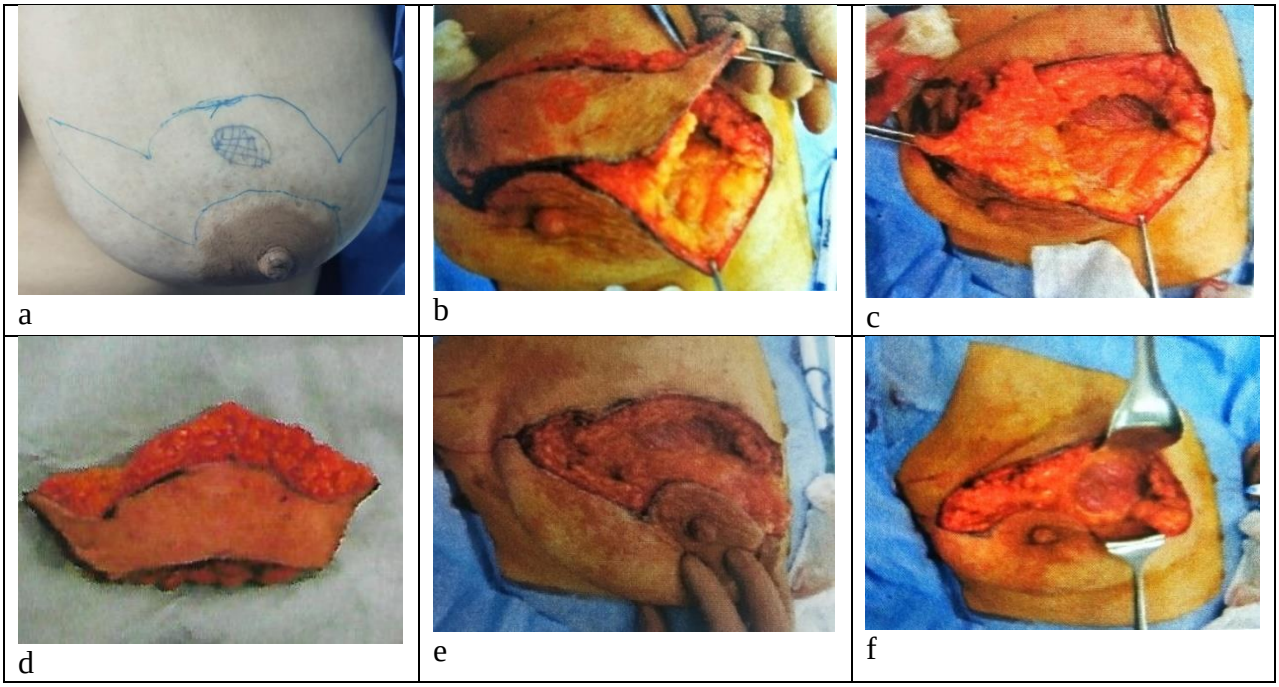

Fig S4: Batwing technique

a) The markup was done as a shape as the wings of a bat including the tumor.
b) Excision of the tumor.
c) Excision till pectoralis fascia (the black arrow)
d) The tumor excised with safety margins., f) The tumor bed after excision.

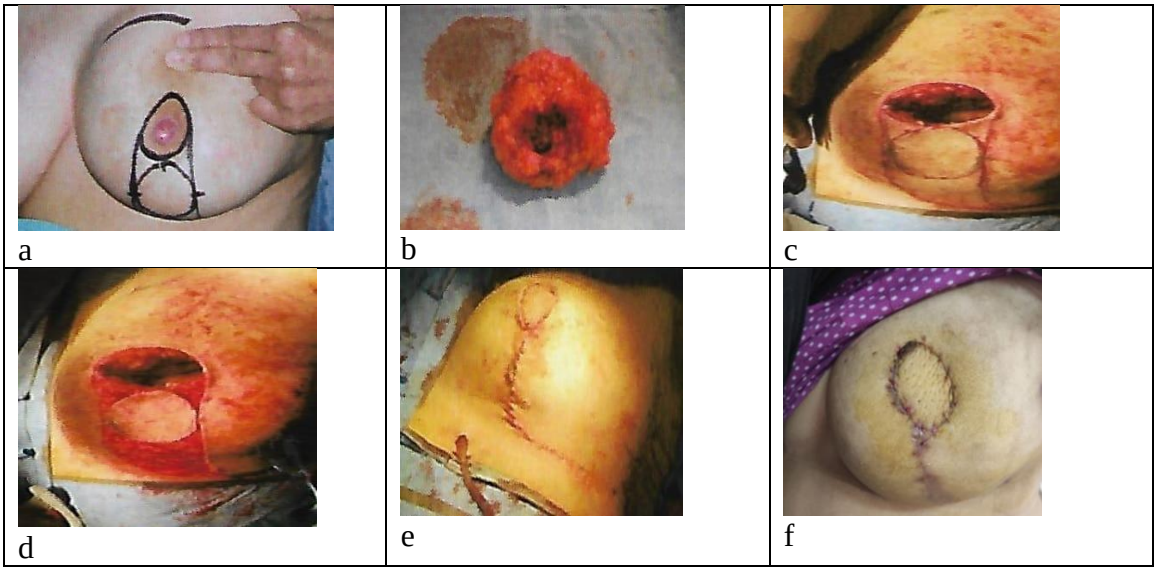

Fig S5: Grisotti technique

a) Preoperative markings were done to outline an inferiorly based glandular-cutaneous flap along with the outline of the new NAC lying adjacent to the native NAC (to be removed) Excised tumor with safety margins.

b) Excision till pectoralis fascia

d) DE epithelialized area around the new NAC.

e) Immediate postoperative.

f) 2 weeks postoperative.

Citation

Gendy, A., Gamal, E. E., Abd El Latif, H., Fared, M. Assessment of Volume Displacement as an Oncoplastic Technique in Management of Early Breast Cancer. *Zagazig University Medical Journal*, 2024; (3656-3666): -. doi: 10.21608/zumj.2022.112311.2439