Feasibility and safety of oncoplastic breast-conserving surgery through an inframammary incision

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Background
Breast-conserving therapy became the treatment of choice for early breast cancer due to a better understanding of the disease's biological activity and natural history. With the addition of oncoplastic breast surgery, conservation could be conducted in relatively large tumors with the best possible cosmetic results and without jeopardizing oncological safety. Oncoplastic breast surgery procedures are done by incising the skin envelope of the breast and then dissection of the dermoglandular breast tissue. An inframammary crease incision is a suitable choice as a hidden scar in the breast envelope because one of the primary considerations for good oncoplastic methods is the cosmetic outcome. It also provides easy access to the retromammary region. This study aims to assess the feasibility of adopting the retroglandular approach for breast-conserving surgery by making a skin incision in the inframammary fold.
Patients and methods
This study involved 67 female patients with breast cancer who were candidates for BCS and had tumors deeply seated between January 2019 and July 2021. An incision is made in the inframammary fold, its length depends on the tumor site, and the tumor was excised after retroglandular exploration. Reapproximation of the glandular pillars was done and the wound was closed after a closed suction drain was inserted. SPSS software package, version 20.0, was used for statistical analysis.
Results
All patients were presented with mass, most of them (53.7%) had breast cup size B. Of the cases, 55.3% had their tumor in the lower half of the breast. The median operative time was 125 min (110–140 min). Seroma was the most common complication (8.9% of cases). Of the cases, 62.7% had excellent results as judged by breast surgeons other than the operating surgeon and 82.1% of patients were satisfied with the esthetic results.
Conclusion The inframammary approach for breast-conserving surgery is feasible and safe for surgical treatment of patients presented with deeply seated breast cancer.

Keywords:
breast-conserving surgery, oncoplastic surgery, inframammary incision, breast cancer

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Introduction

Breast carcinoma is considered the most common site-specific cancer among women, and it is the first cause of cancer-related deaths among them. It accounts for 29% of all newly diagnosed female cancers and is responsible for 14% of the cancer-related deaths among them [1]. Breast-conserving therapy has become the treatment of choice for early breast cancer due to a better understanding of the disease's biological activity and natural history [2,3]. The primary goal of BCS is to achieve a tumor excision with satisfactory cosmetic outcome. This, however, is only achieved in 60–80% of patients [4]. The efforts that have been made to improve the esthetic outcome after BCS led to the emergence of oncoplastic breast surgery that was created by merging standard breast surgery procedures with novel oncological principles to treat breast cancer with improved esthetic outcomes [5,6]. Oncoplastic breast surgery aims to treat breast cancer without deviating from oncological principles while also making the patient feel better by improving their appearance [7]. The inframammary approach for BCS was first described by Gerbasi [8], who presented a case study of early breast cancer treated by BCS through an inframammary incision. An inframammary incision allows good access to breast tissue for the excision of tumor with an adequate

safety margin, leaving a cosmetically accepted scar located in a hidden area.

This study aims to assess the feasibility of adopting the retroglandular approach for breast-conserving surgery by making a skin incision in the inframammary fold (IMF), combined with a retroglandular exploration in a cohort group of patients in a single-center experience.

Patients and methods

All methods were performed in accordance with the Declaration of Helsinki guidelines and regulations. This study involved 67 female patients with breast cancer who were candidates for BCS and had tumors deeply seated. A study was done between January 2019 and July 2021 at the Surgical Oncology Unit of Alexandria Main University Hospital. All patients fulfilling the inclusion and exclusion criteria gave their informed written agreement and undertook the necessary preoperative examinations, investigations, and preparation.

Inclusion criteria included: patients with unifocal deeply seated breast carcinoma of up to 3 cm in size. We had no constraints regarding the breast cup size.

We defined deeply seated breast lesions as tumors with a distance from the skin more than 2 cm as measured by ultrasound.

Exclusion criteria included: previous mastopexy or reduction breast surgery, multifocal/multicentric lesions, and cases with recurrent breast cancer. Patients with fatty breasts are not candidates for this technique as it depends on mobilization of the glandular tissue, which might implicate an increased risk of fat necrosis in this category of patients. Indeed, a relatively larger tumor size in relation to the breast cup size was another exclusion criterion. The technique is considered a level I oncoplastic technique with no secondary pedicle to fill the defect. Thus, it is unfit for patients with large tumor/breast ratio and for patients with contraindications to postoperative radiotherapy.

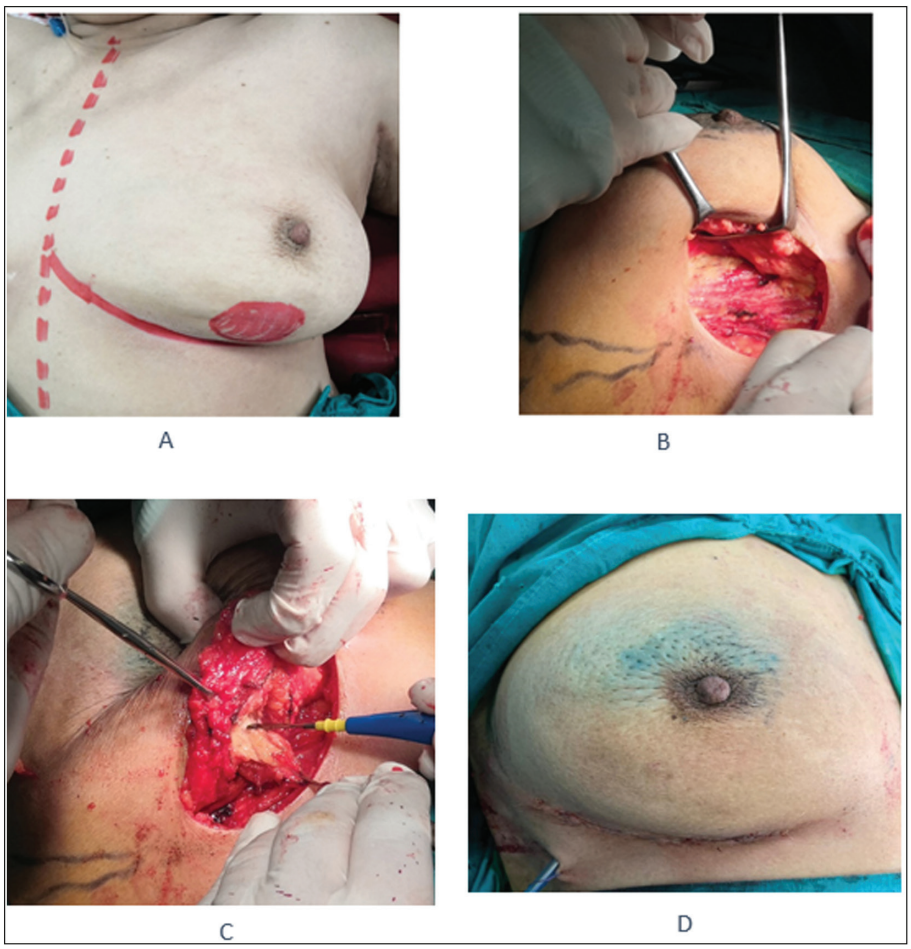
Surgical steps

Preoperative drawings: in the standing position, the tumor location and the IMF were marked by a water-resistant marker pen. The incision line was marked within the IMF line according to the tumor location (Fig. 1a) (the further the tumor from the IMF the wider should be the incision). Yet, the incision line was not allowed to exceed the junction of the IMF with the anterior axillary line to keep the scar in the most hidden part of the breast.

Operative technique

(1) Patient positioning and anesthesia: under general anesthesia, patients were placed in the supine position with the arms abducted at 90° or less to avoid over traction of the brachial plexus.
(2) After sterilization and draping, the skin was sharply incised by a scalpel (15 blades) along the previously marked incision line. The incision line was deepened by cutting mode of electrocautery till reaching the pectoral fascia. The breast mammary tissue is elevated by both assistant hands using sharp rake retractors or Babcock forceps. This retraction helps the surgeon to invade the prepectoral (retromammary) nearly avascular plane.
(3) Dissection in this plane should extend cranially till reaching proximal to the tumor location previously marked (Fig. 1b).
(4) The tumor (palpated and/or guided by a wire) is excised with at least 1 cm all around in the three-dimensional plane (Fig. 1c). The specimen was oriented by stitches to help the pathological assessment of the different margins. Orientation should take into consideration the inverted position of the specimen as it had been dissected through a posterior-retromammary approach. The intraoperative pathological assessment was performed by a frozen section examination. Free margins were defined as no ink on the tumor in all directions. In the case of positive or undetermined margin, re-excision was performed in the same setting.
(5) Axillary staging (either SLNB with blue dye or axillary clearance, if necessary) was done through the same skin incision in laterally located breast tumors or a separate axillary incision. The created defect from the tumor excision is closed by mobilization of the glandular tissue all around. Then, approximation sutures are taken along the edges of the defect's pillars as well as the edges of the retromammary plane. All sutures are done using 3/0 Polyglactin absorbable sutures.
(6) It is worth mentioning that dissection of the superficial plane should not extend much in the superficial plane to avoid unsightly redundancy of the overlying skin envelope as well as avoiding iatrogenic injury of the overlying skin. Also, this helped in avoidance of thermal skin injury (by the diathermy), which might be at risk through this inverted plane.
(7) The tumor bed was marked by titanium surgical clips as usual. A closed system suction drain 14 Fr is attached to the retromammary space. Then

Figure 1



(a) Marker pen was used to delineate the tumor and the proposed incision; (b) dissection in the plane between the breast parenchyma and the pectoralis major muscle; (c) specimen dissected from the surrounding parenchyma; and (d) final incision after closure.

subcutaneous tissue and skin were closed in layers (Fig. 1d).

(8) All patients were subjected to adjuvant radiotherapy with a boost to the tumor bed.

Methods of assessment of the results

Surgeon esthetic assessment

Patients were examined regularly every 2 weeks after discharge and then the cosmetic outcome was assessed by breast surgeons who were not involved in the operation after 2, 4, and 6 months postoperatively using the Harvard scale (four-point Likert scale) [9].

Excellent: breasts that have been treated are nearly identical to breasts that have not been treated.

Good: breasts that have been treated differ slightly from breasts that have not been treated.

Patient satisfaction

Patient satisfaction was assessed as regards cosmetic outcome according to size, shape, the appearance of scar, symmetry, cleavage, the appearance of the nipple/areola complex, body wholeness/harmony, proportionate. and feels to touch. They were categorized as satisfied or not satisfied [10].

All patients were followed up for a mean of 6 months (range, 3–9 months) for the possible complications and esthetic outcome.

All patients who underwent retroglandular exploration approach were statistically assessed as regards the following data:

(1) Demographic data and patient history.
(2) Clinical presentation and tumor criteria.
(3) Distance of the tumor from the skin.
(4) Operative time, frozen time.
(5) Postoperative complications.
(6) Postoperative pathology and hormonal profile.
(7) Cosmetic outcome assessment, this was done both by surgeons and patients.
(8) Oncologic outcome was assessed based on the occurrence of local recurrence or distant metastasis during the follow-up period.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package, version 20.0. (IBM Corp., Armonk, New York, USA). Qualitative data were described using numbers and percentages. The Kolmogorov–Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, SD, and median. The significance of the obtained results was judged at the 5% level.

Informed consent was taken from all patients involved in the study. The study was approved by the local ethics committee of Alexandria University.

Results

Table 1 shows the demographic data and the medical history of the studied patients. Table 2 shows the presenting symptoms and the clinicopathological data of the patients. All patients were presented with mass, most of them (53.7%) had breast cup size B. Of the cases, 55.3% had their tumor in the lower half of the breast. Luminal types were the most common biological subtypes (79.2%) among our patients. The distance of the tumor from the skin, total operative time, and complications are shown in Table 3. A free resection margin was achieved from the first attempt of resection in 59 (88%) patients, while nine patients required reresection in the same surgery to achieve a negative margin; none of our cases proceeded to mastectomy.

Of cases, 62.7% had excellent results as judged by breast surgeons other than the operating surgeon and 82.1% of patients were satisfied with the esthetic results. Examples of cases operated through inframammary incision are shown in Figs 2 and 3.

Table 1 Demographic data and medical history (*N*=67)

Demographic and medical history	*n* (%)
Age (years)	
Median (minimum–maximum)	52 (31–63)
Mean±SD	48.3±8.6
Marital status [*n* (%)]	
Unmarried	8 (11.9)
Married	59 (88.1)
Number of children	
Median (minimum–maximum)	2 (0–4)
Mean±SD	2.3±1.4
Lactation [*n* (%)]	55 (82.1)
Use of OCPs [*n* (%)]	6 (9)
BMI (kg/m^2)	
Median (minimum–maximum)	33 (28–41)
Mean±SD	33.4±3.4
Family history [*n* (%)]	12 (17.9)
HTN [*n* (%)]	7 (10.4)
DM [*n* (%)]	18 (26.9)

DM, diabetes mellitus; HTN, hypertension.

Table 2 Distribution of the studied cases according to preoperative assessment (*N*=67)

Preoperative assessment	*n* (%)
Complaint (mass)	67 (100)
Neoadjuvant chemotherapy	14 (20.9)
Breast size	
A	10 (14.9)
B	36 (53.7)
C	21 (31.3)
Tumor size (cm)	
Median (minimum–maximum)	1.8 (1.2–3.5)
Mean±SD	2±0.7
Axillary LNs	
Clinical	10 (14.9)
Mammogram	31 (46.3)
Side	
RT	30 (44.8)
LT	37 (55.2)
Site	
UOQ	14 (20.9)
LOQ	33 (49.3)
UIQ	2 (3)
LIQ	4 (6)
Central	14 (20.9)
Microcalcification	4 (6)
Hormonal profile (ER–PR_KI 67)	
A	33 (49.3)
B	20 (29.9)
Triple negative	6 (9)
Her2 enriched	8 (11.9)
Type of the tumor by core	
ILC	16 (23.9)
IDC	51 (76.1)

LN, lymph node; LT, left; RT, right.

Discussion

Surgery is the main line of treatment for nonmetastasizing breast cancer either breast-conserving surgery or modified radical mastectomy [11].

Post-BCS cosmetic results are inversely proportional to specimen weight and scar length and are adversely affected by smaller breast cup size, medial tumor localization, and inappropriately located incision [12,13].

Despite the good outcome of oncoplastic techniques, most of the techniques are accompanied by lengthy apparent scars in the breast skin envelope. This can be noticed in oncoplastic procedures like lateral mammaplasty, V-mammaplasty, Grisotti technique, Le jour technique, etc. [14–16].

Table 3 Distribution of the studied cases according to postoperative assessment (*N*=67)

Postoperative assessment	*n* (%)
Stage	
I A	30 (44.8)
II A	16 (23.9)
II B	21 (31.3)
Grade	
II	44 (65.7)
III	23 (34.3)
Operative time in min	
Frozen	
Median (minimum–maximum)	45 (35–55)
Mean±SD	45.2±5.5
Total	
Median (minimum–maximum)	125 (110–140)
Mean±SD	126.4±7.1
Complications	10 (14.9)
Seroma	6 (8.9)
Hematoma	0
Wound dehiscence and infection	4 (6)
Distance of the tumor from skin (cm)	
Median (minimum–maximum)	2.5 (2–4)
Mean±SD	2.7±0.7
Postoperative pathology (paraffin)	
IDC	47 (70.1)
ILC	16 (23.9)
IDC+DCIS	4 (6)
Axillary management	
Sentinel LN biopsy	36 (53.7)
Axillary clearance	31 (46.3)
Cosmetic result	
Surgeon assessment	
Fair	14 (20.9)
Good	11 (16.4)
Excellent	42 (62.7)
Patient satisfaction	
Not satisfied	12 (17.9)
Satisfied	55 (82.1)

Thus, there is a need to look for hidden sites to place the scar. Round block technique is an example of an oncoplastic procedure that successfully achieved a scar that is placed in a hidden area. Yet, the procedure is accompanied by variable degrees of mastopexy that might need a symmetrizing procedure to get ideal results.

In this article, we studied the inframammary crease-retroglandular approach as an alternative access for the required breast surgery as a level I oncoplastic surgery. The site of the scar is relatively hidden. Also, the retroglandular plane of dissection allows for good mobilization of the glandular parenchyma to overcome the created defect after lumpectomy. Furthermore, this dissection in the retroglandular plane resulted in a good cosmetic outcome as it avoids deformity in the anterior breast contour.

Unlike many other techniques, the inframammary crease-retroglandular approach is suitable for nearly any quadrant in the breast. However, in the upper half of the breast, there is a need for more dissection as expected. This entails a wider incision to get access for a safe lumpectomy as well as good tissue mobilization for defect closure. The surgeon must be oriented with the difference in orientation when dealing with the tumor from a posterior approach.

The availability of intraoperative pathological assessment in the current study allowed the surgeons to detect positive or narrow margins in the same surgery. Hence, there was no need for a second visit to achieve safe margins. On the contrary, this was at the expense of a longer procedure time (110–140 min) when compared with other similar data in the literature [10].

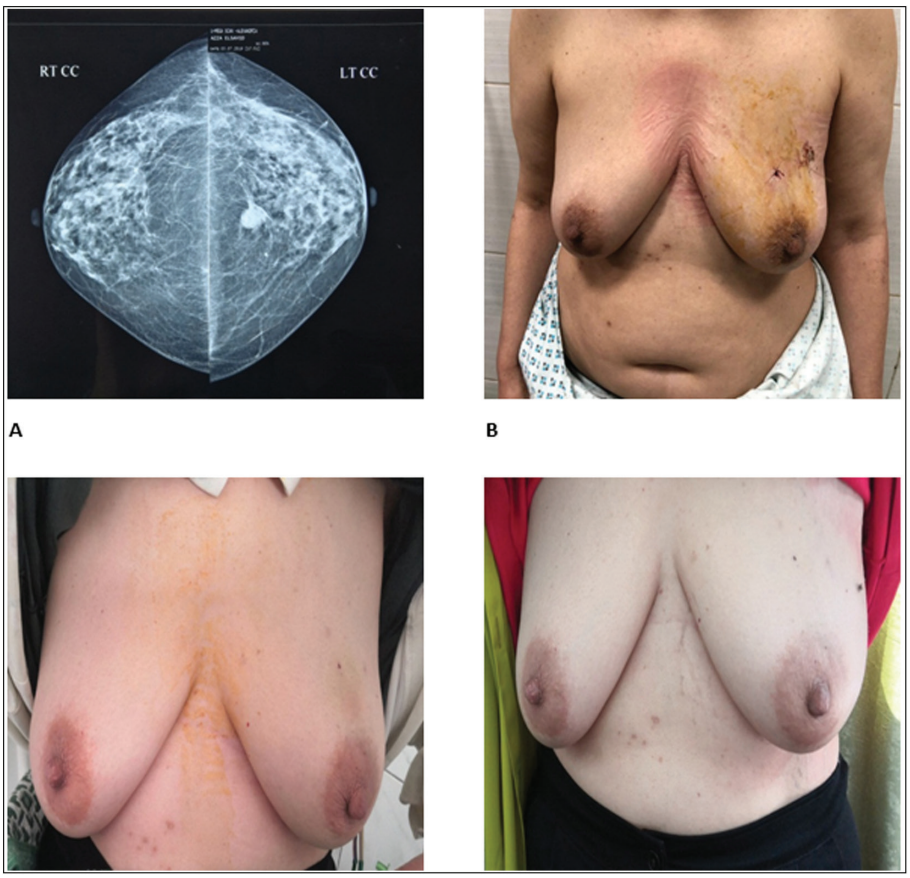
In our study, 59 (88%) patients had a negative margin on frozen section from the first attempt, while nine (12%) patients needed re-excision to achieve negative margins. None of our patients proceeded to mastectomy. Yet, if modified radical mastectomy had been done, we believe this will be due to tumor factors, not technique failure, that is, it would have occurred with any frontal approaches. Skin-sparing or nipple-sparing mastectomy can be done through the same incision.

The technique showed very good cosmetic results with small tumors (an average of 1.5 cm in the Zoltan Matrai study and 1.9 cm in the current study). We believe larger tumor sizes in small breast cup sizes would necessitate some sort of level II oncoplastic procedure. In such conditions, we suggest partial volume replacement by some sort of perforator flaps. LICAP may be ideal with the extension of the scar into the lateral sulcus.

Seroma formation was the most common complication in the Mátrai and colleagues study seen in 25 (24.5%) patients. Limited fat necrosis was found in three (2.9%) patients. Wound dehiscence was seen in two (1.9%) patients. Fat necrosis was seen in four (3.9%) patients in the follow-up.

The incidence of complications in our study occurred in 14.9% of cases. Clinically detected seroma was the most common complication and was seen in six (8.9%) patients. Ultrasound was not performed routinely to detect subclinical seromas. "Clinically significant seroma" was defined by Ten Wolde *et al.* [17] as seroma detected by aspiration and not by symptoms or by the use of ultrasound. In our patients, seroma was managed by aspiration only [17,18].

Figure 2



(a) Preoperative mammogram craniocaudal view; (b) preoperative wire localization; (c) immediately postoperative; and (d) 1-month postoperatively.

Wound infection and dehiscence were seen in four (6%) patients. It was treated by frequent dressing and systemic antibiotics after culture and sensitivity.

Ullmark *et al.* [4] reported complications in 11% of their patients, also in the form of seroma and wound infection.

In the Mátrai and colleagues study, the median follow-up time of the patients was about 11 months with no evidence of locoregional or distant recurrence. In our study, the follow-up period was shorter ranging from 3 to 9 months with no signs of recurrent disease. In fact, in both studies, the follow-up period is not sufficient to judge the rate of recurrence. However, it is worth mentioning here that the recurrence rate is related to the ability to achieve safe margins rather than the technique. Ullmark *et al.* [4] reported that after a median follow-up of 35 months (29–40 months), all patients were alive and free of disease.

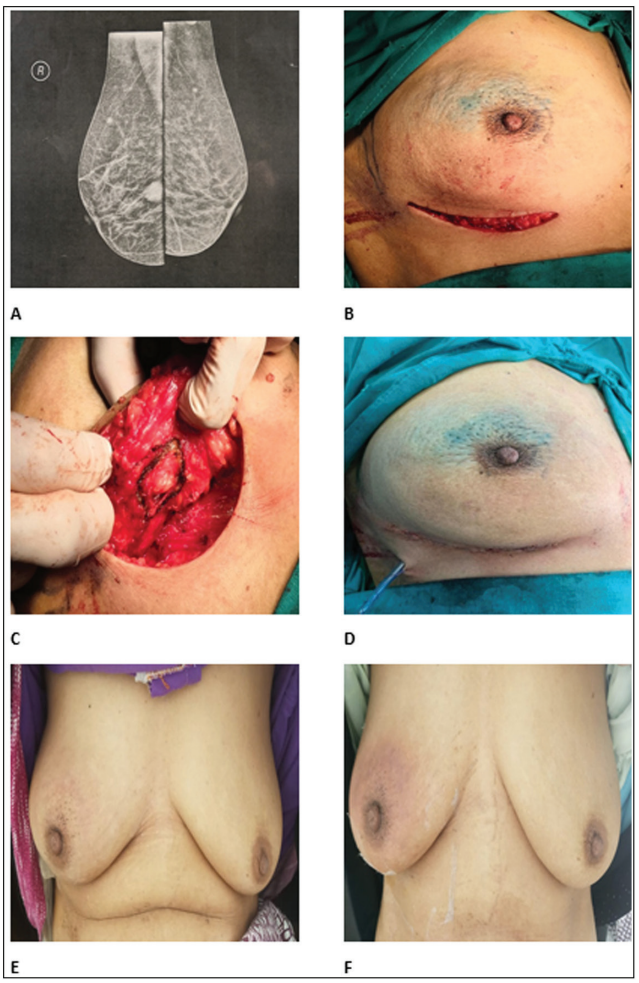
Cosmetic outcome after BCS is influenced negatively by increased specimen weight, inappropriate incisions, and increased scar length. Inframammary incision allowed resection of the tumor while preserving the skin envelope of the breast giving better cosmetic results.

In the Mátrai and colleagues study, according to the results of the four-point Likert score and the BCCT score points out that most of the patients had an excellent or good esthetic outcome. Thus, retroglandular oncoplastic breast surgery was able to fully preserve the initial natural appearance and shape of the breast while accomplishing radical tumor resection.

In our study, cosmetic outcome was assessed by both surgeon esthetic assessment four-point Likert scale and patient satisfaction. According to surgeon assessment, 62.7% of patients showed excellent results, while 16.4% showed good results and 20.9% had fair results. Of our patients, 82.1% were satisfied with their results and only 12 (17.9%) patients were not satisfied with their results. Unsatisfactory results occurred in patients who needed reresection that resulted in skin or nipple retraction. In Ullmark *et al.* [4], postoperative patient satisfaction was assessed using the validated BREAST-QTM questionnaire, breast-conserving therapy module. The item 'breast satisfaction' had a mean RASCH score of 72.5, with a range of 18–100.

However, the lack of long-term follow-up might be a relative limitation of the current study.

Figure 3



(a) Preoperative mammogram mediolateral view; (b) inframammary crease incision; (c) marking of resection margins; (d) immediately postoperatively; (e) 2 weeks postoperatively; and (f) 3 months postoperatively (postradiotherapy).

Conclusion

Inframammary incision for retroglandular tumor excision is an acceptable and feasible oncoplastic technique that permits the excision of deeply seated breast cancer without violation of the skin envelope of the breast. A longer follow-up period is required to assess the oncological safety of the procedure. Acceptable cosmetic results were achieved in 82.1% of cases.

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Author contributions: Haytham Fayed designed the work, performed the surgical procedures, collected the data, and helped in data analysis, article drafting, and critical revision of the article. Joseph Yousry helped in work design, data collection and analysis, article drafting, and final revision. Tarek El-Fayomi helped in the work design collection of the data, performed surgical procedures, and helped in data analysis, drafting, and final revision of the article. Mahmoud Al-Husseini shared in work design, performed surgical procedures, shared in data collection and analysis, and revised the article's final draft.

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Conflicts of interest

There are no conflicts of interest.

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