A guide algorithm for management of central quadrant breast cancer at Cairo University Hospitals

Emad Khallaf, Yehia M. Safwat, Yehya Khodear, Kerolos A. Barsoum, Youmna G. Sabry, Mahmoud A. Ameen

Breast Unit, Department of General Surgery, Faculty of Medicine, Cairo University, Cairo, Egypt

Correspondence to Mahmoud Abdelmonem Ameen, MD, Giza, 11865, Egypt,
Tel: 01002862709;
e-mail: mahmoudmon3m84@yahoo.com

Received: 5 March 2021
Revised: 12 March 2021
Accepted: 12 March 2021
Published: 12 October 2021

The Egyptian Journal of Surgery 2021, 40:727–737

Background
Oncoplastic techniques play an important role in managing centrally located breast cancer, as it gives the opportunity for wider surgical resection, which leads to adequate margins and good oncological outcome while maintaining great cosmetic results and patient satisfaction. The objective of the current study is to assess the short-term oncological and aesthetic outcomes of oncoplastic techniques after centrally located breast tumor resection.

Patients and methods
This study comprised 35 patients with central breast cancer who were treated at Kasr Al Ainy Teaching Hospital, Faculty of Medicine, Cairo University. The decision of surgery was taken by a multidisciplinary team. According to nipple–areola complex (NAC) involvement, we classified the patients into two groups. The first group included patients with evidence of NAC involvement and required resection of the NAC. The second group included patients with no evidence of NAC involvement, and preservation of the NAC was done. In each group, we used the breast size (cup size) and the degree of breast ptosis to guide the selection of the oncoplastic technique.

Results
Our sample had a mean age of 51.2±10 years and ranged from 35 to 74 years. A total of 13 patients had a medium-sized breast with mild ptosis, hence underwent round block technique. Moreover, 11 patients had a medium-sized breast with moderate ptosis and underwent Grisotti mastopexy. In addition, in larger breasts, reduction mammoplasty was the optimal procedure, whereas in tumors that had extended to the upper pole of the breast (segment II), dome-shaped mastopexy was the best option, especially in patients with large areolar discs more than 4 cm in diameter. Regarding postoperative complications, four (11.4%) patients had a seroma formation and three cases developed wound infection, whereas only one case had a postoperative wound dehiscence and were treated conservatively.

Discussion
Preoperative radiological assessment was proved to be a very crucial element in predicting the possibility of NAC involvement, by using both MRI and mammography. The patients who had positive pathological invasion of NAC postoperatively had a smaller distance between the tumor and NAC (<1.58 cm). On the contrary, the patients who had a nipple-tumor distance more than or equal to 2.4 cm had a higher probability of negative invasion of NAC in pathological assessment. Regarding the patients' satisfaction toward the surgical procedure done, 60% had excellent results, and it was mainly related to NAC preservation.

Keywords:
central breast tumors, oncoplastic breast surgery, retroareolar tumors

Egyptian J Surgery 40:727–737

1110-1121

Introduction

Breast conservation surgery (BCS) combined with postoperative radiotherapy has become the preferred locoregional treatment for the majority of patients with early-stage breast cancer, with equivalent survival to that of mastectomy [1]. The success of BCS for breast cancer is based on the belief of complete removal of the cancer with adequate surgical margins, while preserving the natural shape and appearance of the breast. Achieving both goals together in the same operation can be challenging [2]. One of the limiting factors is the central breast tumors, which have been denied the opportunity of breast conservation, given the possibility of multifocality, multicentricity, direct invasion of the nipple–areolar complex (NAC), and aesthetic revulsion arising from the possible removal of the NAC [3]. It is not until later, when

the clinical trials have proved that breast conservative surgery in centrally located tumor is similar to those who undergo mastectomy in terms of local recurrence, disease-free, or overall survival rates [4,5]. However, the conventional conservative treatment or central quadrantectomies, which includes excision of the NAC and the correspondent underlying cylinder of parenchyma down to the pectoralis fascia, may result in local glandular defects and poor esthetic outcome including obvious distortion of breast contour and scar contracture in most cases [6]. The failure of classical BCS techniques to offer solutions for challenging scenarios has stimulated the growth and advancement of new techniques in breast surgery during the past decade. Oncoplastic surgery has emerged as a new approach to allow wide excision for BCS without compromising the natural shape of the breast. It is based upon integration of plastic surgery techniques for immediate breast reshaping after wide excision for breast cancer [7]. Several oncoplastic techniques can be used to reconstruct the breast after central quadrantectomy. The choice of the oncoplastic technique depends on tumor size, NAC involvement, the breast volume, and its ptotic degree [8]. The objective of the current study is to assess the short-term oncological and aesthetic outcomes of oncoplastic techniques after centrally located breast tumor resection.

Patients and methods

This study comprised 35 patients with central breast cancer who were treated at Kasr Al Ainy Teaching Hospital, Faculty of Medicine, Cairo University, between October 2015 and June 2018. All patients with centrally located operable breast cancer were included in the study. Patients with peripheral tumors or eccentric tumors extending more than 2 cm beyond the areolar edge, multicentric tumors, previous breast irradiation, and pregnancy were excluded. Full history taking and thorough physical examination of both breasts and axillae were done, including assessment of the size of the breast (cup size), the shape of the breast, breast ptosis, and previous operations (biopsies and previous surgery). Assessment of breast ptosis was done according to LaTrenta and Hoffman Classification [9], which classifies breast ptosis into 3° [10]. Investigations including routine laboratory tests, bilateral mammography and breast ultrasound, MRI, and metastatic workup were done. Histopathological diagnosis of cancer was made before surgery using core needle biopsy; patients with Paget's disease were subjected to punch/wedge biopsy. An important part of preoperative patient assessment is to determine if the NAC is involved or not. NAC was not preserved if there was clinical evidence of nipple involvement (nipple retraction, nipple discharge, ulceration, and Paget disease) and/or imaging findings suggesting malignant involvement of the nipple and subareolar tissues (lesion to nipple distance <2 cm, best done by MRI).

The decision of surgery was taken by a multidisciplinary team, who are specialized in breast cancer, then it was discussed with the patients, and their approval was documented by an informed consent. This study was approved the Ethical Committee for Researches of General Surgery Department, Cairo University Hospital and the Research committee of Faculty of medicine, Cairo University. According to NAC involvement, we classified the patients into two groups. The first group included patients with evidence of NAC involvement and required resection of the NAC. The second group included patients with no evidence of NAC involvement, and preservation of the NAC was done. In each group, we used the breast size (cup size) and the degree of breast ptosis to guide the selection of the oncoplastic technique.

Oncoplastic surgical techniques

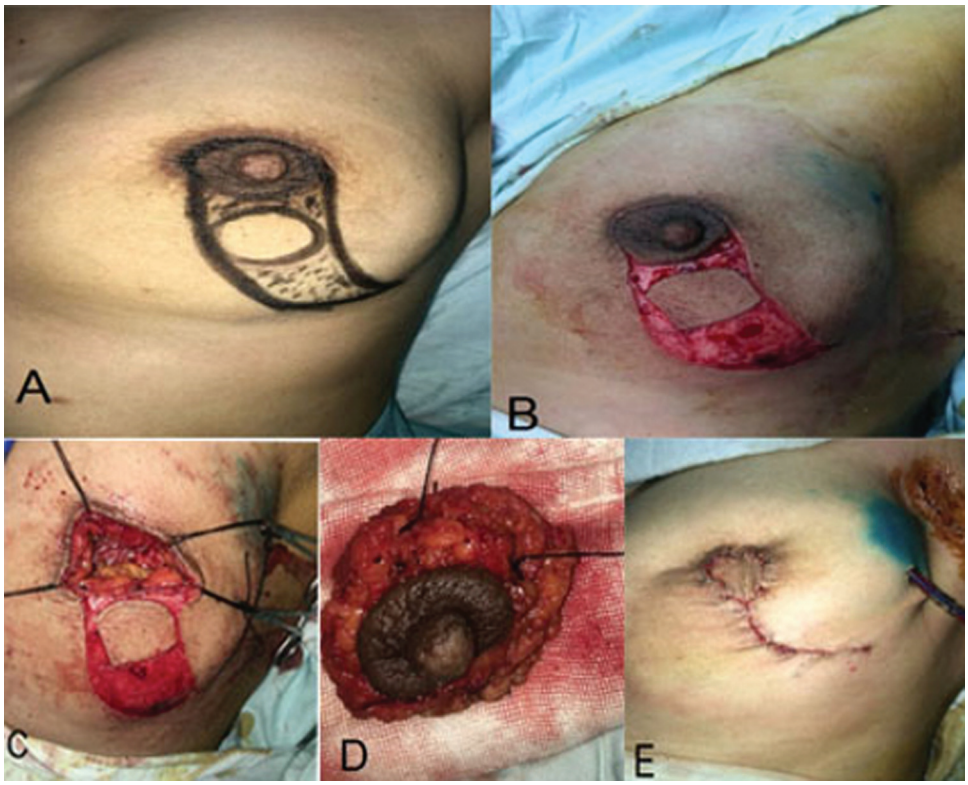
General considerations

The procedure started by preoperative markings before anesthesia and with the patient standing. The operation was done under general anesthesia with the patient in supine position with both arms abducted. Excision of the mass with 1 cm safety margin was done. Following surgical excision, the breast specimen was marked with sutures by the surgeon to retain orientation. Surgical margins were determined by macroscopic and histologic examination of frozen sections of the breast specimens. We used the following techniques for breast reconstruction.

Grisotti mastopexy

This technique was used in 11 patients with moderate-size breasts (B, C) and moderate or severe ptosis and required resection of the NAC. The operation started with marking of the areola outline, another 4-cm circle is drawn just below the NAC, and also the inframammary fold was marked. The medial and lateral borders of the flap were drawn extending from the medial and lateral margins of the areolar down to the inframammary fold and converging distally to give a comma-shaped appearance (Fig. 1a). Then complete de-epithelialization of the flap (except the new areola) was done (Fig. 1b). Central quadrantectomy including NAC and tumor with a column of tissue from the subcutaneous layer down to the pectoral fascia was done (Fig. 1c) with marking the specimen peripheries for intraoperative frozen section analysis. Mobilization

Figure 1



Grisotti technique (a) preoperative mapping. (b) Complete de-epithelialization of the flap (except the new areola). (c) Central quadrantectomy defect. (d) Central quadrantectomy specimen including NAC. (e) Immediate postoperative view. NAC, nipple–areola complex.

of the flap was done using one of the following techniques:

(1) The medial margin of the flap was incised down to the pectoral fascia with wide mobilization of the flap from the pectoral fascia, and then, the flap was advanced and rotated to fill the defect. This technique was used in six cases.
(2) The dermis of the medial and lateral margins of the flap was released to the required extent but keeping its base on the pectoral fascia intact to preserve blood supply. We found that this technique gives better mobility of the flap, and the new areola rests comfortably in its new position without the comma-shaped deformity. We used this technique in five cases.

Breast tissue was approximated using 2/0 or 3/0 vicryl sutures followed by skin closure with subcuticular 4/0 absorbable sutures, and suction drain was used.

Batwing mastopexy

This technique was used in patients with moderate-size breast (B, C), mild ptosis, and requiring resection of NAC. We did a modification in this technique called Batwing (O) modification; the aim of this modification is to replace the resected NAC with a complete circle resembling original NAC instead of half a circle, so giving better cosmetic outcome (Fig. 2). The technique started with marking of the areola outline, and another 4-cm circle is drawn just below the NAC. A horizontal tangent is drawn between both circles. From the center of both circles, two lines measuring (2–4 cm) are drawn medially and laterally creating two triangles (Fig. 3a). The triangles are then de-epithelialized (Fig. 3b). Central quadrantectomy including NAC and tumor

Figure 2

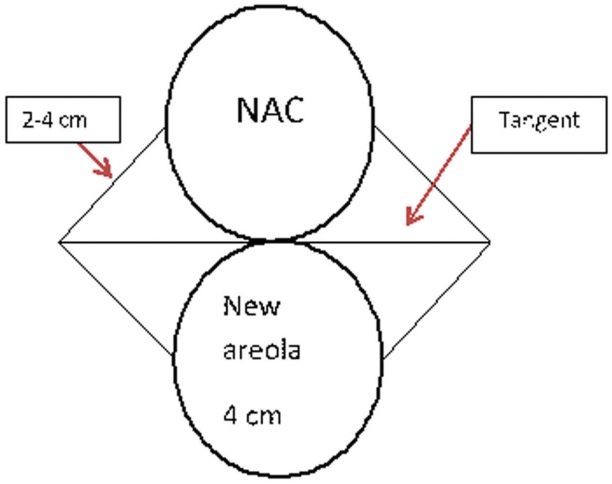
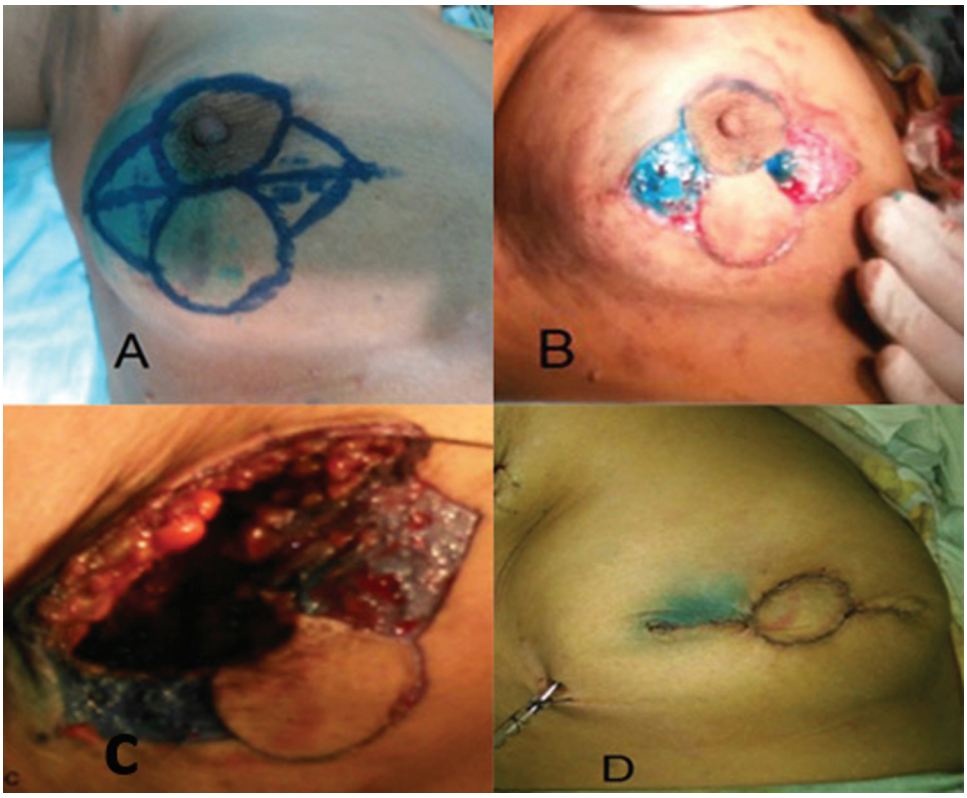


Diagram showing preoperative drawing of Batwing (O) modification.

Figure 3



Batwing mastopexy (a) preoperative mapping. (b) De-epithelialization. (c) Central quadrantectomy defect. (d) Immediate postoperative view.

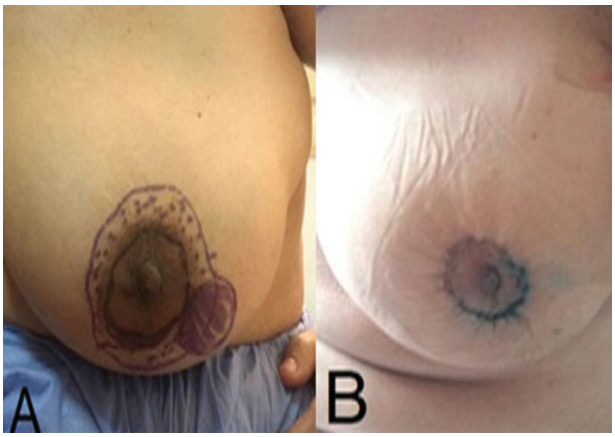
with a column of tissue from the subcutaneous layer down to the pectoral fascia was done (Fig. 3c), with marking the specimen peripheries for intraoperative frozen section analysis.

The upper borders of both triangles were incised, and the resulting de-epithelialized triangles were put underneath the skin laterally from the defect. The defect was then closed by approximating the breast tissue using vicryl 2/0 sutures followed by subcuticular sutures using 4/0 absorbable sutures (Fig. 3d). Suction drain was inserted.

Round block technique

It was used in 13 patients with lesions located within 2 cm of the areolar margin, but not involving the NAC, in small-size to moderate-size breasts. The technique started by drawing two circles, one around areola and the other circle 1–2 cm outside the first one (Fig. 4a). This 1–2 cm can be made more in larger tumors and if there was ptosis that required correction. If the original areola was more than 4 cm, the inner circle was marked as 4 cm using a cookie cutter. De-epithelialization of the skin island between the two circles was done. Cutting through the dermis at the side of tumor location was done. Then, the quadrant of breast tissue containing the target lesion was fully exposed

Figure 4



Round block technique (a) preoperative mapping. (b) Immediate postoperative view.

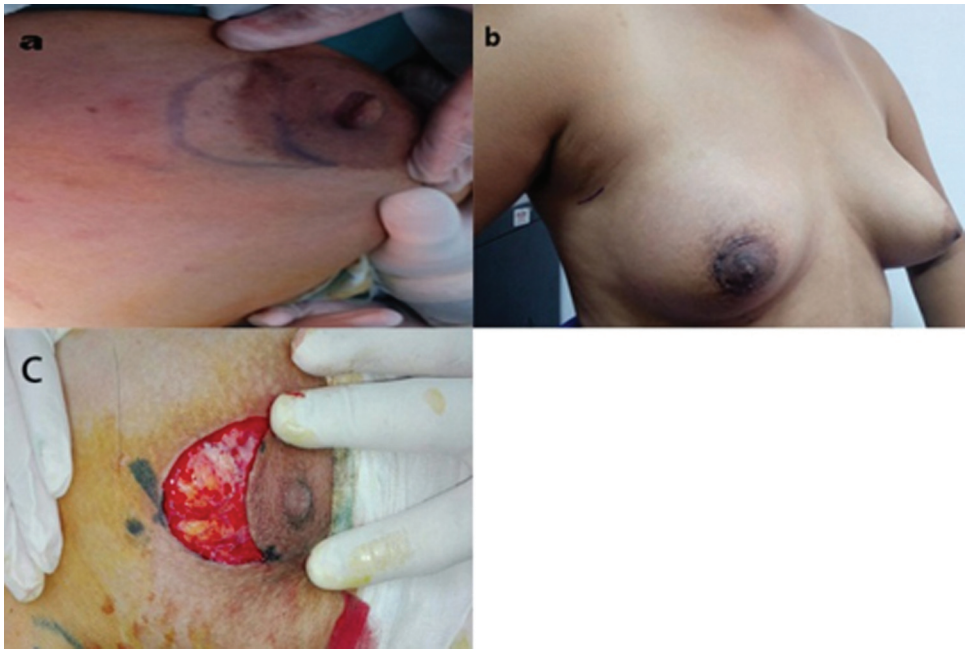
using the same plane for mastectomy. Excision of the mass in a wedge-shaped fashion directed radially toward the NAC, and then mobilization from the pectoralis fascia was done if needed. This was followed by closure of the defect using vicryl 2/0 or 3/0 sutures after adequate hemostasis. A purse string using a 3-0 absorbable suture was placed around the areola opening and was tightened and clamped at a size that approximates the original NAC. Interrupted inverted 3-0 absorbable sutures are

placed subdermally around the NAC, at which time the purse-string suture is tied, and then, 4-0 subcuticular sutures are used to close the wound (Fig. 4b).

Crescent mastopexy resection

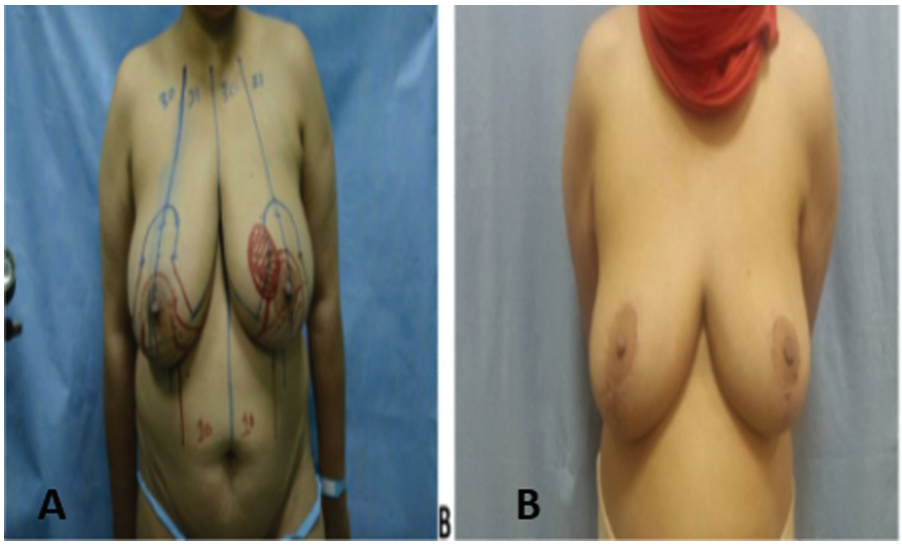
This technique was used in two cases for resection of tumors located in the upper central quadrant between 10 and 2 o'clock positions in patients with small-size to moderate-size breasts. The technique started by drawing two semiparallel 'C-' shaped lines, superior and adjacent to the areola, encompassing the skin immediately overlying a breast malignancy (Figs 5a and 6). Resection of the skin island between the two lines was done. Raising flaps in the same plane as mastectomy was done to facilitate excision of the mass. This was followed by wedge excision of the mass with adequate safety margin. Suction drain was inserted. Closure of the defect was done using 2/0 or 3/0 vicryl sutures followed by 4/0 subcuticular sutures for skin closure (Fig. 5b).

Figure 5



Crescent mastopexy (a) preoperative mapping. (c) Intraoperative picture. (b) Immediate postoperative view.

Figure 6



(a) Preoperative markings for a patient with retroareolar mass extending to the upper inner quadrant underwent reduction mammoplasty (wise pattern technique) with contralateral breast reduction. (b) Postoperative result after 4 weeks.

Patients who were node negative at presentation (N0) were subjected to sentinel lymph node biopsy at the time of planned surgery using patent blue. Combined intradermal, periareolar, and peritumoral injection techniques were used. If the sentinel node were negative, no further axillary dissection was done. However, if the sentinel node was positive, axillary lymph node dissection (ALND) was completed (levels I and II dissection). Patients who had initially node-positive axilla were subjected to ALND. All specimens were oriented and subjected to histopathology and immunohistochemical examination, including ER, PR, and Her-2-neu. Margins were regarded as negative when permanent histological examination found no cancer cells within a distance of 1 mm from excised tissue surface for invasive cancer and 2 mm for duct carcinoma in situ. Postoperative clinical follow-up was done at 3-month intervals and included palpation of the breast and axilla. Mammograms and ultrasound were done if there was any degree of clinical suspicion.

Assessment of the cosmetic outcome

Subjective evaluation

Assessment of the postoperative cosmetic results entails asking patients to rate the postoperative cosmetic result and their degree of satisfaction compared with the preoperative breast using a five-point scale (excellent, 5; good, 4; fair, 3; poor, 2; and bad, 1).

Objective evaluation

Objective assessment of the cosmetic result was done by two surgeons rated on a visual analog scale from 1 (unacceptable result) to 10 (excellent result). Evaluation was based on five criteria, namely, breast symmetry, glandular tissue defects, nipple and areola reconstruction, scar quality and/or retraction, and the resultant breast shape.

Statistical analysis was conducted using STATA 14.2 software (StataCorp LLC 4905 Lakeway Drive College Station, Texas, USA). Continuous variables were presented as mean and SD, and intergroup differences were compared using t test. Skewed numerical data were presented as median and average rank, and between-group differences were compared using the Mann–Whitney U test [11]. Paired numerical data were compared using the paired t test. Categorical variables were presented as number and percentage, and differences between groups were compared using Pearson χ^2 test or Fisher's exact test [12]. Ordinal data were compared using the χ^2 test for trend. Paired binary data were compared using the McNemar test. P values less than 0.05 were considered statistically significant.

Results

A total of 35 patients were eligible for inclusion in our study. All patients were diagnosed with primary breast cancer in the central region. None of them had a multicentric lesion by clinical or radiological assessments. Breast MRI was done for all patients. The patients had a mean age of 51.2±10 years old and ranged from 35 to 74 years. A total of 26 (74.3%) patients were luminal, seven (20%) patients were HER-2 enriched, whereas two patients were triple negative. Only four (11.4%) patients had a positive family history. Multiple variables were studied to predict NAC involvement before surgery (Table 1) (clinically, in the form of retraction / ulceration, and radiologically in the form of suspicious enhancement and/or suspicious findings within 2 cm of the nipple on MRI and/or diagnostic mammography, respectively), as this prediction subsequently affected the decision upon which NAC should be preserved or sacrificed.

A total of 13 patients had a medium-sized breast with mild ptosis, hence underwent round block technique, whereas 11 patients had a medium-sized breast with moderate ptosis and underwent Grisotti mastopexy. However, in larger breasts, reduction mammoplasty was the optimal procedure, and only one case was subjected to this technique. On the contrary, in tumors that had extended to the upper pole of the breast (segment II), Dome-shaped mastopexy was the best option, especially in patients with large areolar discs more than 4 cm in diameter; two cases were done by this technique (Table 2). A total of 20 (57.1%) patients were clinically and radiologically node negative and underwent SLND. However, 15 (42.9%) patients underwent ALND. Overall, 74.3% of cases were invasive duct carcinoma, whereas 14.3, 5.6, and 2.8% of cases were Paget's, invasive lobular carcinoma (ILC), and duct carcinoma in situ (DCIS), respectively

Table 1 Nipple–areola complex involvement in studied cases

Items	*n* (%)
Site of the tumor	
Retroareolar	33 (94.3)
Retroareolar and other quadrants	2 (5.7)
Clinical involvement of NAC	
No	19 (54.3)
Yes	16 (45.7)
Radiological involvement of NAC	
No	25 (71.4)
Yes	10 (28.6)
Pathological involvement of NAC	
No	21 (60)
Yes	14 (40)

NAC, nipple–areola complex.

(Table 2). Patients with highly suspicious NAC involvement preoperatively were mostly subjected to NAC resection after correlation with frozen section results. A total of 17 (48.5%) patients were subjected to NAC resection, where 14 (82.3%) patients were proved to be pathologically involved, whereas just three (17.6%) proved to be free of tumor infiltration.

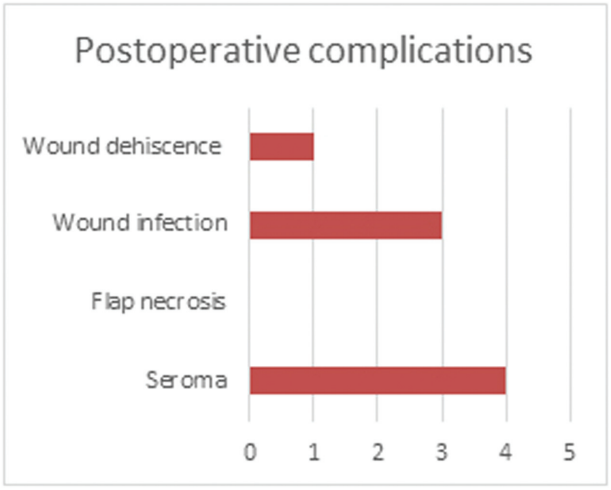
Regarding postoperative complications, four (11.4%) patients had a seroma formation and three cases developed wound infection, whereas only one case had a postoperative wound dehiscence and was treated conservatively. There were no reported cases that had a flap necrosis (Fig. 7).

Regarding cosmetic outcome assessment by patient satisfaction, 21 (60%) patients had an excellent satisfaction, whereas 10 (28.6%) patients gave a good satisfaction. Four patients had a fair satisfaction, and no patients felt bad about the cosmetic outcome. Patients who had been subjected to round block and dome-shaped technique gave higher satisfaction, as the NAC was still preserved with also symmetrical both breasts. In the survey of surgeons (two surgeons) regarding the aesthetic evaluation, the breast shape and symmetry yielded a mean score of 7.8 points, indicating that the overall results were satisfactory, where the highest scores had been attributed mainly to the techniques where the NAC is preserved, like round block technique (RBT) and dome-shaped mastopexy.

Table 2 Percentage of techniques used in central quadrant cancers

Items	*n* (%)
Technique of surgery	
Batwing	2 (5.7)
Bilateral wise pattern	1 (2.8)
Central quadrantectomy	4 (11.5)
Crescent mastopexy	2 (5.7)
Dome shaped	2 (5.7)
Grisotti	11 (31.4)
Round block	13 (37.1)

Figure 7



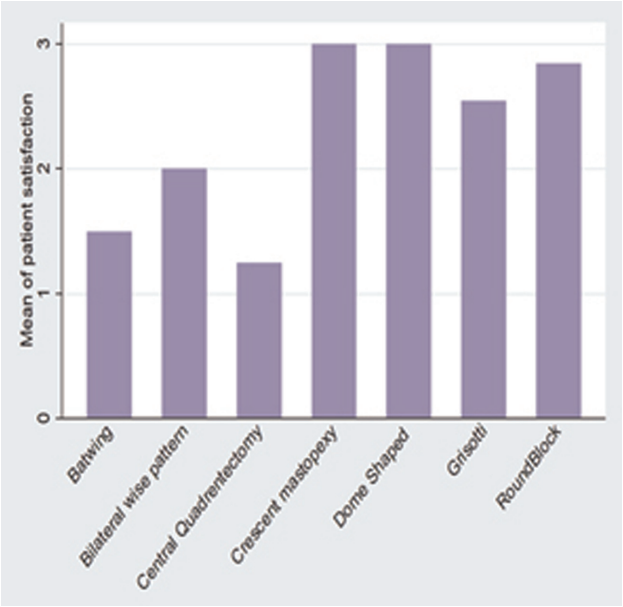
Bar chart showing incidence of postoperative complications.

Tests of correlations

Postoperative complications

Seroma formation had a significant correlation with hypertension, as patients who had hypertension had a higher incidence of postoperative seroma formation, with *P* value of 0.03. Moreover, patients with radiological evidence of NAC involvement had a higher incidence of postoperative seroma formation, with *P* value of 0.03. Patients who underwent central quadrantectomy had the highest incidence of postoperative seroma formation, with *P* value of 0.005. Wound infection has a significant correlation with surgical technique, with *P* value of 0.014. Wound dehiscence correlated to patient satisfaction, with *P* value of 0.02. Patient satisfaction showed a strong correlation with comorbidities such as diabetes mellitus, with *P* value of 0.006. Surgical techniques with lowest satisfaction rates correlated with central quadrantectomy and Batwing approaches, with *P* value of 0.001 (Fig. 8). Wound infection, wound dehiscence, and postoperative seroma significantly affected patient satisfaction, with *P* values of 0.0001, 0.02, and 0.009, respectively. Patients were followed-up for a period

Figure 8



Bar chart showing patient satisfaction based on different surgical techniques.

ranging from 3 to 12 months, with a mean±SD of 6.9 ±4.0 months. None of the patients developed local recurrence or distant metastasis. Clinical and mammographic follow-up were easy in all cases and was not hampered by the reconstruction.

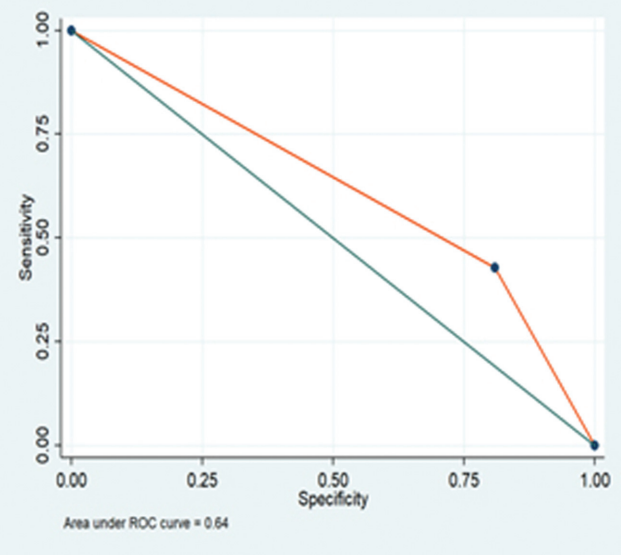
Doctor's opinion correlated with the surgical techniques, with *P* value of 0.005, and wound infection, *P* value of 0.0001. Receiver operating characteristic analysis for sensitivity and specificity of preoperative radiological assessment showed that radiological involvement of NAC preoperatively had an area under the curve of 0.64, sensitivity 42.8%, specificity 81%, and *P* value of 0.12 (Fig. 9).

Using a Student *t* test, patients who had positive pathological invasion of NAC postoperatively had a smaller distance between the tumor and NAC (<1.58 cm). On the contrary, patients who had a nipple-tumor distance more than or equal to 2.4 cm had a higher probability of negative invasion of NAC in pathological assessment, with *P* value of 0.04 (Table 3).

Discussion

Retroareolar breast cancers were conventionally treated via modified radical mastectomy, because of the possibility of multicentricity, which usually accompanies these types of tumors (centrally located tumors), and direct invasion of the NAC, necessitating subsequent resection, which leads to bad cosmetic outcome. However, modified radical mastectomy (MRM) is difficult for patients to accept, for both psychological and aesthetic reasons. Recent studies have reported that there are no significant differences between MRM and BCS with respect to local recurrence, distant metastasis, and survival rate [13].

Figure 9



ROC curve show sensitivity of preoperative radiological assessment of NAC involvement in comparison with pathological NAC involvement. NAC, nipple–areola complex; ROC, receiver operating characteristic.

However, it is worth mentioning in this context that other authors reported in extended series of 298 patients treated with oncoplastic surgery, 5-year recurrence-free and overall survival rates of 93.7 and 94.6%, respectively [4]. Moreover, Simmons *et al.* [14] have reported that the recurrence rate of patients with centrally located breast cancer who underwent BCS was 6.3%, a statistically insignificant rate as compared with the recurrence rate of 4.5% in patients who underwent MRM.

In our study, we did not report any case of local recurrences or distant metastasis, which may be owing to the short time of follow-up, which actually was not one of the main intentions of this effort, as our main focus was to create a guideline for the treatment of retroareolar breast tumors. However, proper assessment of NAC involvement by MRI and intraoperative frozen section is an additional explanation of 0% recurrence in our cases.

There is an increasing interest in the preservation of the nipple and/or areola in hopes of achieving improved cosmetic and functional outcomes; however, the oncologic safety of NAC preservation is a major concern, which is why, the identification of the possible predictive factors for NAC involvement in patients with breast cancer is crucial. Several series confirmed that optimal preoperative patient selection and intraoperative assessment of the NAC can result in low rates of nipple resections with future long-term viability.

In our study, efforts have been done to classify patients who were most likely to have NAC tumor involvement from those who had free NAC, so as to facilitate the decision of NAC preservation or resection. All patients

Table 3 The relation between both (nipple-tumor distance and tumor size) and pathological invasion of nipple–areola complex

Items	Positive		Negative		*P* value
	Mean	SD	Mean	SD	
Distance from tumor to NAC	1.58	1.2	2.4	1	0.04
Tumor size	1.9	2	2.5	1.2	0.27

NAC, nipple–areola complex.

were assessed preoperatively by clinical examination to detect patients with clinically suspicious NAC who may be manifested with nipple retraction, ulceration, and/or erosion. It was then proved that depending only on clinical manifestations of NAC was not enough, being an inefficient predictive factor for suspecting NAC tumor involvement, as it gave 11.4% false-negative results, as patients who had normally looking NAC were found to have pathologically involved nipples. However, 14.2% (5/35) of patients gave false-positive impression of tumor involvement, but in fact, they were proved to be pathologically free. Among 172 patients in a study done by Piato *et al.* [15], false-negative cases (17%) proved to have involved NAC without any clinical evidence. On the contrary, patients (6%) who had retracted nipples were proved to be free of tumor, as false-positive cases.

Additionally, preoperative radiological assessment proved to be a very crucial element in predicting the possibility of NAC involvement, by using both MRI and mammography, and correlating their results properly, to calculate the approximate distance between the lesion and NAC, which was considered the most accurate predictive tool in our study. Infiltrated nipples were confirmed to be pathologically involved in 14 (40%) patients. Among which, tumors located at a distance of 2 cm or less in those patients were 11 (78.6%), whereas only three (21.4%) patients had a tumor-NAC distance more than 2 cm. On the contrary, 21 (60%) patients proved to have pathologically free NAC by both frozen and paraffin sections, of whom, 14 (66.7%) had tumor-NAC distance more than 2 cm, whereas less than 2 cm in seven (33.3%) patients. Using a Student *t* test, patients who had a positive pathological invasion of NAC postoperatively had a smaller distance from tumor to NAC (<1.58 cm), whereas patients who had tumor-to-NAC distance of more than or equal to 2.4 cm had a higher probability of negative invasion of NAC in pathological assessment, with *P* value 0.04. As a result, it can be concluded that prediction of NAC involvement depends largely on the tumor distance away from the nipple.

Similar to our context, Smith *et al.* [16] have reported a higher likelihood of NAC pathological infiltration, if the nipple was clinically involved and/or the primary tumor was retroareolar or within 2 cm from NAC. In another detailed study, Lagios *et al.* [17] have found that the most important predictor of NAC infiltration was the proximity of tumor to the nipple, as with 95% of involved nipples, primary tumors lay within 2.5 cm of their edge. During univariate analysis, by Khan *et al.* [18] on 136 cases, all the cases studied had tumors more than 4 cm from the NAC and 0% frequency of involvement was reported, whereas the presence of tumor at 1-cm distance from the NAC had reported frequency of 58% . Vyas *et al.* [19] have recommended that in cases where the tumor is more than 2.5 cm from the NAC, preserving the NAC would be worthwhile, as this distance, in their study emerged as an independent risk factor and predictor for NAC involvement. However, a recent study was done by Piato *et al.* [15], which revealed that the most important MRI characteristics to exclude the possibility of neoplastic involvement of the NAC in breast cancer patients rather than the distance of the lesion from the NAC were the absence of enhancement between the lesion and the nipple associated with the absence of retraction of the nipple. The negative predictive value of the combination of the absence of these two characteristics was 83.3%.

Karamchandani *et al*. [20] supported the importance of interpretation of MRI results preoperatively because of its high sensitivity in detecting NAC involvement, as among a total of 41 cases enrolled in the study, 35 (85.4%) of 41 had concordance between pathologic and radiologic findings.

However, it could be noticed that the problem of the predictive factors are not consistent across studies, and some are even contradictory to each other. Our study has revealed histologically proved postoperative positive axillary nodes were found in only two of 14 patients who were proved to have infiltrated nipples. Regarding the intrinsic subtypes of breast cancer (ER, PR, and Her-2-Neu) together with the histological type of the tumor particularly (DCIS), no significant implications on the probability of NI among our patients were found. Only one patient has been reported to have DCIS compared with 13 patients having invasive carcinoma. This is in contrary to Suarez [21], who stated that, the majority of NAC neoplastic involvement was affected by DCIS (59.5%), followed by invasive carcinoma (35.1%).

The most accurate method to predict neoplastic involvement of the nipple was the subareolar frozen-section (nipple coring biopsy) examination intraoperatively. Studies involving expressive cohorts showed that the subareolar frozen-section examination could yield false-negative rates between 1.3 and 9.3% [22]. Frozen section examination was performed in our institute for all patients, on the excised mass together with a subareolar biopsy (coring of the nipple), and the safety margins were satisfactory in all patients included in our study.

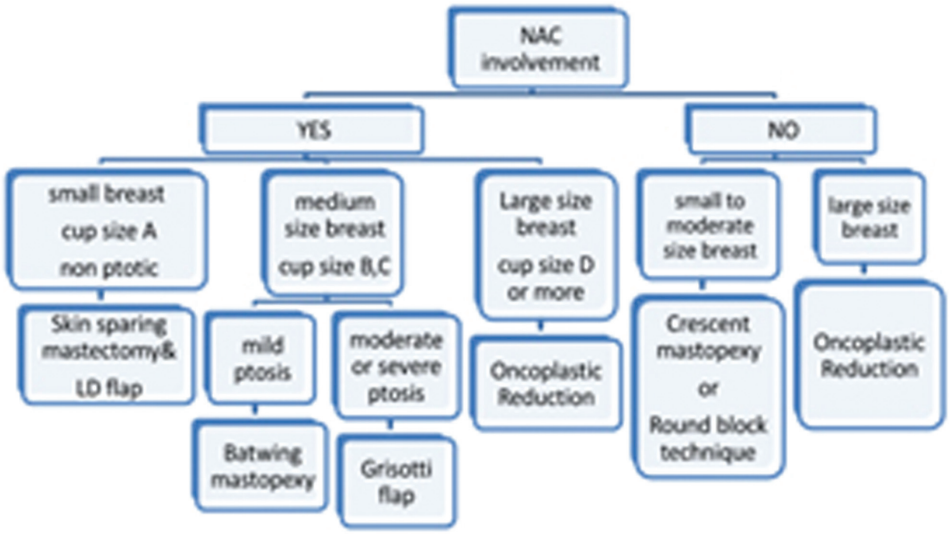
The high incidence of NAC involvement associated with retroareolar tumors necessitates, usually, NAC resection together with an adequate safety margin around the tumor, which has yielded nonsatisfactory cosmetic results. In cases where NAC was not involved, Flierl and Hanker [23] have reported satisfactory oncologic and cosmetic results, as simple preservation of the breast mound for a feminine body contour is the most essential requirement for women. In our institute, patients with retroareolar breast cancer were managed as follows: whenever there is a great suspicion of NAC involvement preoperatively (suspicious enhancement and/or suspicious findings within 2 cm of the nipple proved by MRI and/or mammography) in patients having large and/or ptotic breast, central quadrantectomy with or without remodeling was done. Overall, four cases were subjected to central quadrantectomy without remodeling through an elliptical incision, whereas 11 cases were subjected to Grisotti technique. When lesions were found at a sufficient distance from the NAC in small breasts, RBT (13 cases) and crescent mastopexy (two cases) were done. However, in larger breasts, reduction mammoplasty was the optimal technique; one case was subjected to this technique. Sometimes tumors were found to be extended to the upper pole of the breast (segment II). Dome-shaped mastopexy was the best option in areolar discs more than 4 cm in diameter; two cases were done in our institute. However, in case of small areolar discs more than 4 cm in diameter, Batwing mastopexy would be a suggested option, and we have done two cases with Batwing mastopexy. Similar to our study, McCulley *et al.* [24] have also used the central quadrantectomy technique that largely depends on the tumor-to-breast size ratio, the degree of ptosis, and the preference of the surgeon, through central elliptical excision of the tumor with direct closure of the defect. However, Grisotti technique has become more popularly used, especially when there is adequate breast size or ptosis with the distance between the nipple and the inframammary fold being at least 8 cm.

Furthermore, the same techniques have been applied in a study conducted by Moustafa and Fakhr [25], with slightly higher rate of complications 5/20 (25.0). As in our study, the postoperative complications were 8/35 (22.88%). Overall, four cases of postoperative seroma were reported and had resolved after multiple aspirations. Additionally, one case of wound dehiscence was found during a purse-string suture procedure and three cases developed postoperative wound infection. Regarding the patients' satisfaction toward the surgical procedure done, 60% showed excellent results (21 of 35 patients); 15 (71.4%) of 21 patients were subjected to round block and dome-shaped technique, as the NAC was still preserved with also symmetrical both breasts. Overall, 30% of patients were good and 15% fair. In the survey of surgeons (two surgeons) regarding the aesthetic evaluation, the breast shape and symmetry yielded a mean score of 7.8 points, indicating that the overall results were satisfactory, where the highest scores had been attributed mainly to the techniques, where the NAC were still preserved like RBT and dome-shaped mastopexy. Dissatisfaction by the patients mainly related to the absence of NAC as the breast seemed to be amputated, asymmetry of both breasts, and the shape of the scar to some extent. Our cosmetic results have achieved almost the same results that have been reported in other studies such as Moustafa and Fakhr [25]. Pasta *et al.* [8] have proposed another technique for involved NAC (modified hemi-Batwing technique), which can be performed on centrally located breast tumors with the inclusion of the NAC. The modified Batwing technique was then introduced with the purpose of getting better aesthetical outcomes. The realization of rounded margins (no more sharp) has resulted in the reproduction of the anatomic profile of the areola. On the contrary, operating small breasts might be harder, and so far, the aesthetic results could not be evaluated for larger breasts. In our study, we proposed an algorithm using the breast size (cup size) and the degree of breast ptosis to guide the selection of the oncoplastic technique (Fig. 10).

Conclusion

Multiple oncoplastic breast surgery techniques can be used safely for the resection of retroareolar breast tumors with satisfying cosmetic outcomes. The choice of the optimum surgical technique for each patient based upon multiple factors, such as breast size, degree of ptosis, and whether the NAC, has been involved with tumor or not. Based on the aforementioned data, one can conclude that all patients who present with retroareolar breast tumors, whether they are manifested with clinically involved nipples or not, should be assessed by MRI, to detect the distance between the tumor and the NAC and identify any other manifestations of involvement within 2 cm from the NAC, like nonenhancement lesions and/or retracted nipples, together with intraoperative frozen section to the excised lesion and nipple coring biopsy, to select the appropriate procedure for each patient as previously described. However, further long-term study is needed to assess the long-term outcome of

Figure 10



Guide for selection of oncoplastic technique.

these surgical procedures in terms of survival and recurrence.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1 Yoon JJ, Green WR, Kim S, Kearney T, Haffy BG, Eladoumikdachi F, Goyal S. Oncoplastic breast surgery in the setting of breast-conserving therapy: a systematic review. Adv Radiat Oncol 2016; 1:205–215.

2 Yiannakopoulou EC, Mathelin C. Oncoplastic breast conserving surgery and oncological outcome: systematic review. Eur J Surg Oncol 2016; 42:625–630.

3 Acea Nebril B. Oncoplastic techniques in the management of central breast cancer. Cir Esp (English Edition) 2009; 85:14–19.

4 Wagner E, Schrenk P, Huemer GM, Sir A, Schreiner M, Wayand W. Central quadrantectomy with resection of the nipple-areola complex compared with mastectomy in patients with retroareolar breast cancer. Breast J 2007; 13:557–563.

5 Fitzal F, Mittlboeck M, Trischler H, Krois W, Nehrer G, Deutinger M, Jakesz R, Gnant M. Breast-conserving therapy for centrally located breast cancer. Ann Surg 2008; 247:470–476.

6 Farouk O, Attia E, Roshdy S, Khater A, Senbe A, Fathi A, *et al.* The outcome of oncoplastic techniques in defect reconstruction after resection of central breast tumors. World J Surg Oncol 2015; 13:285.

7 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.

8 Pasta V, D'Orazi V, Merola R, Frusone F, Amabile MI, De Luca A, *et al.* Oncoplastic central quadrantectomies. Gland Surg 2016; 5:422–426.

9 Shiffman MA. Classification of breast ptosis. In: Shiffman MA, editor. Breast augmentation: principles and practice. Berlin, Heidelberg: Springer Berlin Heidelberg; 2009. 251–255

10 Jimenez RE, Hieken T, Peters MS, Visscher DW. Paget disease of the breast. Breast 2018; XX:169–176.

11 Chan YH. Biostatistics 103: qualitative data-tests of independence. Singapore Med J 2003; 44:498–503.

12 Chan YH. Biostatistics 102: quantitative data – parametric & non-parametric tests. Blood Press 2003; 140:79–00.

13 Park HC, Kim HY, Kim MC, Lee JW, Chung HY, Cho BC, *et al.* Partial breast reconstruction using various oncoplastic techniques for centrally located breast cancer. Arch Plast Surg 2014; 41:520.

14 Simmons RM, Brennan M, Christos P, King V, Osborne M. Analysis of nipple/areolar involvement with mastectomy: can the areola be preserved?. Ann Surg Oncol 2002; 9:165–168.

15 Piato JR, Jales Alves de Andrade RD, Chala LF, de Barros N, Mano MS, Melitto AS, *et al.* MRI to predict nipple involvement in breast cancer patients. Am J Roentgenol 2016; 206:1124–1130.

16 Smith J, Payne WS, Carney JA. Involvement of the nipple and areola in carcinoma of the breast. Surg Gynecol Obstet 1976; 143:546–548.

17 Lagios MD, Gates EA, Westdahl PR, Richards V, Alpert BS. A guide to the frequency of nipple involvement in breast cancer: a study of 149 consecutive mastectomies using a serial subgross and correlated radiographic technique. Am J Surg 1979; 138:135–142.

18 Khan K, Chakraborti S, Mondal S. Morphological predictors of nipple areola involvement in malignant breast tumors. Indian J Pathol Microbiol 2010; 53:232.

19 Vyas JJ, Chinoy RF, Vaidya JS. Prediction of nipple and areola involvement in breast cancer. Eur J Surg Oncol 1998; 24:15–16.

20 Karamchandani DM, Chetlen AL, Riley MP, Schetter S, Hollenbeak CS, Mack J. Pathologic-radiologic correlation in evaluation of retroareolar margin in nipple-sparing mastectomy. Virchows Arch 2015; 466:279–287.

21 Suarez J. Predictors of nipple-areolar complex involvement by breast carcinoma: histopathologic analysis of 787 consecutive therapeutic mastectomy specimens. Breast Dis 2012; 4:350–351.

22 Govindarajulu S, Narreddy S, Shere MH, Ibrahim NB, Sahu AK, Cawthorn SJ. Preoperative mammotome biopsy of ducts beneath the nipple areola complex. Eur J Surg Oncol 2006; 32:410–412.

23 Flierl D, Hanker JP. Oncoplastic techniques for immediate reconstruction with nipple-areolar preservation following radical resection of a centrally located breast cancer. Zentralbl Gynakol 2001; 123:399–402.

24 McCulley SJ, Durani P, Macmillan RD. Therapeutic mammaplasty for centrally located breast tumors. Plast Reconstr Surg 2006; 117:366–373.

25 Moustafa A, Fakhr I. Outcome of different oncoplastic surgical (OPs) techniques for centrally located breast cancer (CLBC). J Egypt Natl Canc Inst 2014; 26:203–209.