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Evaluation of the Perimamillar Breast-Conserving Surgery as a Standard Level-I Modified Round Block Oncoplastic Breast Surgery

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Abstract

Round block Oncoplastic Breast-Conserving Surgery (OBCS) can cause dilatation of the areola and a sharp periareolar scar that leads to significant asymmetry of the breasts. Here, we modified the round block OBCS by using the tendency of areolar expansion and placing the incision line and de-epithelization of the epidermal layer in the Perimamillar (PM) area rather than in the periareolar area. PM OBCS was indicated for the radical resection of solitary or multifocal malignant tumors (<30 mm) located in any quadrant of the breast. The Breast Q questionnaire, BCCT.core, and Likert scale were used to evaluate the subjective and objective aesthetic results. A prospectively led database of 60 patients was used in this retrospective study. Re-excisions were performed due to involved margins in 5 (8.3%) cases. The median follow-up time was 11 months. In total, 8 (13.3%) grade-I complications and 2 (3.3%) grade-II complications were recorded. The PM OBCS technique did not significantly influence the subjective and objective aesthetic results. High patient satisfaction was observed. The PM OBCS technique is effective Level-I oncoplastic for cT1 breast tumors. Thus, "invisible" surgery could be a realistic expectation. Compared to periareolar de-epithelization, this technique allows better preservation of breast projection.

Keywords: Oncoplastic breast surgery; Round block oncoplasty; Breast cancer

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Introduction

Periareolar Oncoplastic Breast-Conserving Surgery (OBCS) is a widely-used level-I procedure and is mostly recommended for tumor removal with immediate parenchymal re-approximation in smaller (cT1) tumors located near the areola [1-4]. The major disadvantages of this technique include a tendency for dilatation of the areola, sharp periareolar scar that causes significant asymmetry with the contralateral non-operated breast (where skin discoloration is gradual from the areola to the hypo-pigmented skin envelope), risk of pathological scar formation, and loss of breast projection (Figure 1a, 1b). Areola expansion occurs because the tension is highest at the top of a hemisphere, and results in a dilation of the Nipple-Areola Complex (NAC). This can be reduced by using the Benelli suture (a non-absorbable purse-string suture on the superficial fascia) [5]. Nonetheless, in many cases, good cosmetic outcomes necessitate contralateral symmetrization and/or delayed reduction of the diameter of the areola, which can fail in the long term and further reduce breast projection. Although pathological scar formation occurs in fewer malignant cases due to adjuvant Whole-Breast Irradiation (WBI), its occurrence may indicate the need for further surgical

or nonsurgical (such as silicone patches and steroid infiltration) interventions. The higher the radius of the de-epithelized periareolar circle and the width of the de-epithelized skin band, the higher the decrease in breast projection.

Using a new surgical technique, we avoided the disadvantages of the periareolar oncoplastic technique by taking advantage of the tendency of areola expansion. We placed the incision line and de-epithelization lane of the epidermal layer not in the periareolar region, but in another natural fold—the Perimamillar (PM) area (Figure 2a). This was possible in cases where the areola was dilated, such as in postmenopausal or post-breastfeeding women and those with ptotic breasts. The present study provides a detailed technical description of this novel surgical technique-PM OBCS with areola reduction and presents clinico-pathological data to facilitate its acceptance as a standard procedure.

Materials and Methods

A single-center, retrospective study was performed between January 2019 and August 2020 using the data from a prospectively maintained institutional database of PM OBCS at the National Institute of Oncology in Budapest, Hungary. The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of NAME OF INSTITUTE (protocol code EtikaBiz. Ujhelyi Mihaly 101/01 July 2021 and date of approval: 01.07.2021). We included 60 patients with breast cancer (stages 0-II) with a dilated areola (diameter >50 mm, 45 mm to 55 mm normally). For women of any age, PM OBCS was indicated for the radical resection of solitary or multifocal malignant tumors (<30 mm) that are located in any quadrant of the breast. The optimal tumor location was central (towards the areola) and not peripheral. The exclusion criteria included a history of breast-conserving surgery and/or radiotherapy, skin-sparing mastectomy due to histological evaluation, loss to follow-up, and refusal to participate in the evaluation of the cosmetic outcome. Re-excision due to microscopically involved surgical margins in the histological finding was not an exclusion criterion [6].

The diagnosis and therapy of the breast cancer, as well as additional staging examinations and follow-ups were performed according to an institutional protocol based on the European Society of Medical Oncology (ESMO) guidelines [7]. Data such as age, Body Mass Index (BMI), smoking habits, diabetic comorbidity, breast cup size, type of axillary surgery, and operative time were retrospectively added to the institutional database. The database also included the clinical and pathological Tumor-Node-Metastasis (TNM; 8th Edition) stage, histological type, molecular subtype, and surgical margins of the tumor [8].

Postoperative complications were classified following the Clavien-Dindo Classification [9,10]. The final subjective and objective aesthetic outcomes were assessed in the 6th postoperative month following the therapeutic OBCS or three months after the WBI. To assess the aesthetic results, a 5-point Likert scale (scores: 1, strongly disagree; 2, disagree; 3, undecided; 4, agree; 5, strongly agree) was used to judge surgeons' responses to a questionnaire [9]. The evaluation was performed by a committee of three breast surgeons who were uninvolved in the operative procedure, evaluated the complete photo documentation, and individually scored each case. The mean score of the three committee members was used.

To exclude subjectivity, the aesthetic results were classified objectively based on photo documentation using the Breast Cancer Conservative Treatment-cosmetic results (BCCT.core) software (version 20) [11] and the BREAST-Q postoperative module [12]. The study information, the patients' informed consent forms, and BREAST-Q forms were either provided directly to the patients during an outpatient visit at six months postoperatively or mailed to them. We used only the postoperative module domains, including satisfaction with the breast and outcome and psychosocial, sexual, and physical well-being [12].

Biometric measurements were performed on the day before the surgery, on postoperative day 1, and at regular three-month onco-surgical follow-ups. Data such as the largest diameter of the areola, nipple projection, and difference of breast projections were measured using calipers, tape line, ruler, spirit level, or combinations of these. To measure nipple projection, we used a transparent plastic cylindrical cap whose side was divided into millimeters. Measurements were performed at standard positions. The largest diameter of the areola was measured horizontally at the level of the mammilla. Breast projection while standing was measured above the middle of the sternum with a spirit level and a ruler held at right angles above the sternum and the base of the nipple. Descriptive statistics were calculated using Statistica 13.5 (TIBCO Software Inc, Palo Alto, CA, USA) software.

Surgical technique for perimamillar OBCS

The PM OBCS surgical technique was first introduced and detailed by Zoltán Mátrai [13]. With the patient in a standing position, the surgical incision is drawn onto the areola around the base of the mammilla and is adapted to the largest diameter of the areola and the parameters of the tumor (Figure 1a). Preparing and draping is followed by the preoperatively planned incision. In this modified technique, we do not recommend subdermal plexus infiltration with a 0.5% solution of epinephrine and lidocaine to prevent any ischemia of the nipple. The surgeon elevates the mammilla gently with forceps and places the first incision through the epidermal layer of the skin directly around the base of the nipple. The second concentric transdermal incision is performed with a 7 mm to 15 mm larger radius around the perimamillar one, with subsequent a traumatic de-epithelization of the pigmented skin of the areola (Figure 2b). Subsequently, the surgeon transects the complete thickness in the derma and the subcutaneous layers of the skin in the direction of the tumor location. The length of the transdermal skin incision should be no longer than half of the complete circumference. This is different from the classic round block OPS where two-thirds of the periareolar circumference can be safely transected if retromammillar dissection is not planned. To avoid thermal injury to the skin, dissection in the

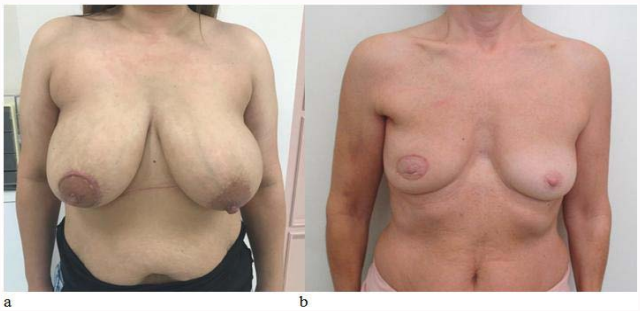

Figure 1: a-b: Postoperative result after periareolar oncoplastic breast surgery. Pathological scar formation is seen with a predilection for the skin in the periareolar region. Loss of breast projection is also visible.

Figure 2: a: Perimamillary planned skin incisions. b: De-epithelization of the marked pigmented skin of the areola and transection of the complete tumor from the derma and subcutaneous layer of the skin in the direction the tumor location. c: The tumorous parenchyma slice is elevated beyond the skin level, allowing complete access for radical resection. d: Mobilization of the surrounding breast tissue (glandular pillars) according to the pointed area. e: The tumor bed is closed with parenchyma re-approximation using tension-free absorbable sutures without any skin retraction or breast deformation. f: Subcutaneous sutures are placed perpendicularly. g: Sutures are placed perpendicularly to the skin in the perimamillar wound edge and longitudinally in the outer opposite wound edge. A subcutaneous silicone drain is placed between the sutures. h: Postoperative result after removal of the drain. i: Nipple flattening can be backward for large and ptotic breasts.

anterior plane should be undertaken at low power settings of the electro cautery/diathermic knife. The assistant elevates the edge of the skin flap with a traumatic skin hooks. Simultaneously, the surgeon pulls the parenchyma with adequate force and dissects sharply above the anterior layer of the superficial pectoral fascia that covers the glandular tissue (Figure 2c). An important practical tip for a traumatic handling of the mobilized nipple is to place a 4.0 monophyly long suture, which allows the surgeon to gently pull away from the already pedicled nipple directly from the wound. This prevents iatrogenic trauma or thermal injury to the pedicled nipple. Targeted exploration by synchronous moving of the skin edges (with hooks) and the nipple (with the holding suture) allows adequate exploration of the tumor. After reaching the tumor from the anterior side with adequate over dissection towards the periphery, the surgeon turns towards the pectoral muscle by cutting the parenchyma distally until reaching the posterior plane of glandular mobilization, which lies beneath the fascia covering the pectoralis major muscle. Subsequently, the tumorous parenchyma is grasped with a Mousseaux, which allows the surgeon to gently pull on the targeted glandular tissue (Figure 2c). Two parenchymal incisions are made in a radial direction on both sides of the tumor from the periphery to the mammilla. This allows mobilization of the tumor tissue from three sides with an adequate macroscopic safety margin (Figure 2d). At this point, the tumor is only adherent to the breast in the central area, and the surgeon can easily raise the mobilized parenchyma in front of the skin by turning the central retromammillar parenchyma from the inside to the outside. The surgeon should be careful not to undermine the retromammillar area aggressively, in a manner not justified by the extent and location of the tumor. On transecting the last central connection between the tumor and the breast, the resected specimen (with sufficient safety margins) is of full-thickness breast parenchyma, respecting oncological principles. Accurate orientation of the specimen is mandatory, and the tumor bed is marked with titanium clips. After an oncological sound procedure, the surrounding breast tissue (glandular pillars) is further mobilized (Figure 2d). The superficial dissection plane should be above the superficial fascia, to leave adequate blood supply to the skin. To fill the open cavity of the parenchyma using tension-free absorbable sutures without skin retraction or breast deformation, mobilization of the glandular pillars is extended (Figure 2e). Using a headlamp can facilitate exposure through the limited skin incision. A traumatic manipulation of the skin edges is crucial. There is a significant difference between the circumference of the inner PM incision and the outer wound edge. Therefore, special sutures are placed using absorbable 3.0 sutures to harmonically eliminate this incongruence. Allgöwer-Donati sutures (monophyly 4-0 surgical thread) are placed perpendicularly to the skin in the perimamillar wound edge and longitudinally in the outer opposite wound edge; alternatively, a running purse string suture can be used (Figures 2f-2i). Benelli-like sutures are not recommended so as to prevent compression of the retromammillar tissue and vessels and subsequent ischemia of the nipple. Axillary surgery (sentinel lymph node biopsy or axillary clearance) should be performed by a separate incision.

Results

A total of 69 patients who underwent PM OBCS were enrolled into the study. Six patients were excluded due to loss to follow-up or refusal to participate in the cosmetic outcome measurements. Of the remaining 63 patients, 3 (4.7%) had undergone complete mastectomy and were excluded. Finally, the clinico-pathological, aesthetic, and quality-of-life measurements of 60 patients were used in the present study. Six (10%) patients received primary systemic therapy, and re-excisions due to the involved margins were performed in 5 (8.3%) cases. The median follow-up time was 11 months (range; 7 to 27 months). Of the patients, 4 (6.7%) were active smokers, 1 (1.7%) had diabetes, and 2 (3.3%) had obesity as a comorbidity. The patients' details, tumor characteristics, and complications are listed in Table 1. The average diameter of the areola was 58 mm (range, 50 mm to 72 mm). The average width of de-epithelization was 12 mm (range, 8 mm to 15 mm; measured according to the preoperative drawings). In total, 8 (13.3%) grade-I complications were recorded. In 4 (6.7%) cases, seroma formation was observed and resolved with aspiration during wound check-ups. In 4 (6.7%) cases, partial nipple necrosis occurred with epidermolysis, which was healed by conservative treatment. In total, 2 (3.3%) grade-II complications were recorded. Subfertility occurred in 1 (1.7%) case. In 1 (1.7%) case, fever with wound erythema and limited fat necrosis was observed and treated with antibiotics. None of the complications were classified as grades III-V. The median time until the initiation of adjuvant treatment was 5.5 weeks (range, 4 to 9 weeks). During the follow-up period, all the enrolled patients were alive, and none experienced loco-regional recurrence. There was only one case with bone metastases and one with hepatic metastasis. The majority of the breast surgeons agreed with the statement that "this case has an excellent aesthetic outcome," with a mean score of 4.5 (range, 3 to 5). Correlational analysis showed that surgery using the PM OBCS technique did not significantly influence the BCCT.core objective aesthetic results (Table 2).

According to the measurements taken at the last follow-up (minimum six months postoperatively), the median difference between the largest diameter of the areola of the operated and contralateral sides was 3 mm (range, 1 mm to 8 mm) and only 2 (3.3%) cases needed further symmetrization procedures. There was a special disadvantageous outcome that could not be considered a morbidity but had more cosmetic relevance, namely the slight (12 cases, 20%) or significant (7 cases, 11.7%) flattening of the mammilla and limited dilatation of the perimamillar scar. There was no pathological scar formation observed after radiotherapy; however, in 12 (20%) cases, radiotherapy-associated areola discolorations were observed. At the six-month postoperative control measurement, the median difference between the projection of the NAC of the operated and contralateral sides was only 3 mm (range, 0 mm to 10 mm).

Discussion

The clinical results of our study showed that in selected patients, PM OBCS is an effective onco-surgical technique for radical tumor resection for centrally-located, cT1 tumors. Similar to other oncoplastic glandular re-approximation techniques, such as retroglandular or round-block OBCSs, the PM OBCS completely closes the tumor cavity with the adjacent parenchymal pillars and provides the basis for a good cosmetic outcome [14].

In a prospective study, Bramhall et al. [2] showed that in 57 patients with breast cancer treated by round block OBCS; the reported

Table 1: Patient details and tumor characteristics.

Number of patients	60
Age (median; range) years	56 (37-77) years
Height (mean ± SD) cm	167 ± 6 cm
Weight (mean ± SD) kg	74 ± 17 kg
BMI (mean ± SD) kg/m²	26.8 ± 6.4
Laterality	
Left	26 (43.3%)
Right	34 (56.7%)
Axillary surgery	
SLND	51 (85%)
ALND	9 (15%)
cT category	
Is	4 (6.7%)
1a	5 (8.3%)
1b	21 (35%)
1c	20 (33.3%)
2	10 (16.7%)
cN category	
0	58 (97.7%)
1	2 (3.3%)
M category at the last follow-up	
0	58 (97.7%)
1	2 (3.3%)
Duration of operation (median; min-max) min	45 (20; 80)
Invasive tumor diameter pathologically (mean ± SD) mm	17 ± 20 mm
DCIS diameter pathologically (mean ± SD) mm	4 ± 6 mm
Invasive + DCIS diameter (mean ± SD) mm	15 ± 8 mm
Resection distance from invasive component (mean ± SD) mm	3 ± 3.1 mm
Resection distance from DCIS (mean ± SD) mm	2.4 ± 2.2 mm
pT category	
Is	8 (13.3%)
1a	2 (3.3%)
1b	18 (30%)
1c	26 (43.3%)
2	6 (10%)
pN category	
0	43 (71.7%)
1mi	7 (11.7%)
1	8 (13.3%)
2	1 (1.7%)
3	1 (1.7%)
Histological type	
DCIS	8 (13.3%)
NOS	42 (70%)
ILC	10 (16.7%)
DCIS component	
No	31 (51.7%)

Yes	29 (48.3%)
Grade of invasive tumor	
1	12 (20%)
2	32 (53.3%)
3	8 (13.3%)
DCIS	8 (13.3%)
ER (median; min-max)	90 (0%-100%)
PR (median; min-max)	80 (0%-100%)
Ki67 (median; min-max)	10 (1%-80%)
Her2 of invasive tumor	
Negative	44 (73.3%)
Positive	8 (13.3%)
DCIS	8 (13.3%)
Radiotherapy	
Yes	52 (86.7%)
No	1 (1.7%)
+ BOOST	7 (11.7%)
Chemotherapy	
Neoadjuvant	6 (10%)
Adjuvant	9 (15%)
No	45 (75%)
Endocrine therapy	
No	9 (15%)
Yes	51 (85%)
Complications	
No	50 (83.3%)
Gr1	8 (13.3%)
Gr2	2 (3.3%)

BMI: Body Mass Index; SLND: Sentinel Lymph Node Dissection; ALND: Axillary Lymph Node Dissection; DCIS: Ductal Carcinoma *in situ*; NOS: Not Otherwise Specified; ILC: Invasive Lobular Carcinoma

rate of early postoperative complication was 21%, which is higher than our rate (16.7%). Our findings revealed an acceptable rate of fat necrosis (3.3%) after using direct closure. Seroma formation was not a specific morbidity after PM OBCS [2]. PM OBCS represents the same advantages as the round block OBCS while eliminating most disadvantages such as decreased breast projection, asymmetrically dilated areola (and consequent breast asymmetry), and pathological scar formation. The main advantage of this technique is that it uses the characteristic dilatation of the areola after circum-areolar incisions instead of trying to prevent it by special sutures, multiple times ineffectively. Thus, by placing the incision line in the PM fold, "invisible" surgery could be a realistic expectation (Figure 3a, 3b). The expansion of the residual areola after six months is predictable according to the reported follow-ups. The majority of cases (11 cases, 18.3%) showed only a slight difference between the widths of the areolas, no pathological scar formation, and radiotherapy-related discoloration. Thus, further symmetrization procedures after radiotherapy were not required. Cosmetic outcomes were very good, and patient satisfaction was high. Whereas periareolar de-epithelization causes a potentially significant loss of breast projection, the PM OBCS technique shows improved preservation of breast projection by using perimamillary de-epithelization with a smaller

Table 2: Results of the preoperative and postoperative BCCT.core and postoperative BREAST-Q measurements.

BCCT.core preoperative	
Excellent	47 (78.3%)
Good	11 (18.3%)
Fair	2 (3.3%)
BCCT.core postoperative	
Excellent	38 (63.3%)
Good	18 (30%)
Fair	4 (6.7%)
BCCT.core change	
No	49 (81.7%)
Worse	11 (18.3%)
Q1 (median; min-max)	90 (59%-100%)
Q2 (median; min-max)	27 (21%-45%)
Q3 (median; min-max)	93 (48%-100%)
Q4 (median; min-max)	35 (23%-49%)
Q5 (median; min-max)	62 (44%-74%)

Post-op Q1: Breast satisfaction; Post-op Q2: Adverse effect of radiation; Post-op Q3: Psychosocial wellbeing; Post-op Q4: Physical wellbeing; Post-op Q5: Sexual wellbeing

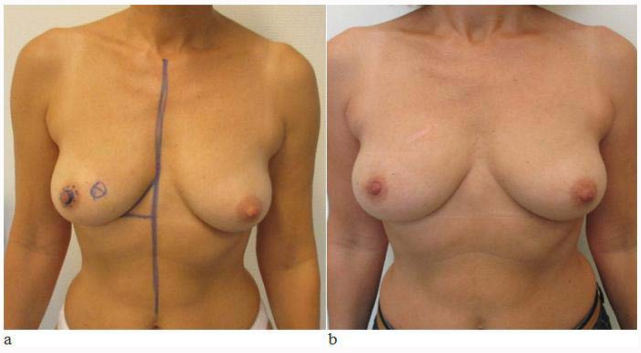

Figure 3: a-b: Preoperative drawings and ideal postoperative results without nipple flattening after six months.

radius measured according to the axis of the nipple. The limitation of this technique is that the procedure is applicable only for dilated areolas. Another limitation is the potential for nipple flattening (Figure 2i and Table 3).

In this PM OBCS study, the mean score for the five-point Likert scale was 4.5, and the majority of the surgeons agreed with the statement that "this case has an excellent or good aesthetic outcome." Pre- and post-operative BCCT.core correlational analysis showed that the novel breast surgery did not significantly influence the symmetry. These results indicate that PM OBCS can preserve the initial natural look and shape of the breast, and achieve the basic objective of breast surgery to perform safe and radical tumor resection.

Conclusion

The PM OBCS technique is a novel concept and an effective level-I oncoplastic technique for radical resection of cT1 breast tumors located in the central part of any breast quadrant. This technique uses the characteristic dilatation of the areola, whereby the de-epithelized skin of the areola re-expands to nearly its presurgical diameter. Thus, "invisible" surgery could be a realistic expectation, leading to very

Table 3: Advantages and disadvantages of the PM OBCS technique.

Advantages	Disadvantages
• Additional dilation of the skin and characteristic dilatation of the areola; "invisible" surgery could be possible by placing the incision line in the perimamillar natural fold.	• Only for small tumors ≤ 20 mm to 30 mm.
• Prevents differing diameters of the areolas and reduces asymmetry between the breasts.	• Potential flattening of the nipple.
• Prevents pathological periareolar scar formation.	• Shorter skin incision line and limited access to tumors located in the peripheral parenchyma; targeted surgical exploration is needed.
• Reduced need for further symmetrization.	• Applicable only for wide areolas, mainly after breastfeeding-related dilation.
• Better preservation of breast projection.	

good cosmetic outcomes and high patient satisfaction. This technique also allows better preservation of breast projection, although nipple flattening may occur. The acceptable number of minor complications encourages the use of this technique.

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