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ORIGINAL PAPER

Comparison between breast conserving therapy and oncoplastic reduction mammaplasty: a retrospective study

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Abstract

Background Oncoplastic reduction mammoplasty (ORM) allows greater margins without compromising breast shape in comparison to breast conserving therapy (BCT). However, the long-term influence of this treatment on cancer recurrence remains unclear.

Methods The benefits of ORM in comparison to BCT were reviewed by conducting a retrospective review of 215 patients. Data on patient demographics, comorbidities, cancer histology, tumour size, receptor status, neoadjuvant or adjuvant therapies, surgical intervention duration, width of the microscopic and macroscopic narrowest margins, need for surgical re-excision or completion of mastectomy, morbidity, duration of hospital stay, recurrence, and mortality rate were gathered and analysed.

Results Two hundred fifteen patients with breast cancer were analysed: 58.1% underwent BCT and 41.8% underwent ORM. The median follow-up was 89.8 months. Immediate margin enlargement due to the margins being considered insufficient was performed in 58.6% of the patients in BCT group and 53.3% of those who underwent ORM. Margins of the initial breast specimen were reported as intersected in 25.6% of the BCT group and 9.2% of the ORM group. Margins were larger in the ORM (median 4.0 mm) than in the BCT group (median 2.0 mm). The number of mastectomies performed after breast sparing surgery was higher in the BCT (17.5%) than in the ORM group (5.6%). A delay of 22.5 days to the end of radiotherapy was found in the ORM group but was not statistically significant. The local and/or distant recurrence-free survival rates during the follow-up period did not differ, which were 96.0% and 94.4% in the BCT and ORM groups, respectively. Likewise, the cancer-specific survival rates were 96.8% and 96.7%, respectively.

Conclusions Despite a delay in the completion of radiotherapy, OMR offers wider margins, lower rates of positive margins, and lower rates of re-excision/mastectomy. No difference was found in the local and/or distant recurrence-free survival or breast cancer-specific survival.

Level of evidence: Level III, therapeutic study.

Keywords Breast cancer · Breast conserving surgery · Lumpectomy · Oncoplastic reduction mammaplasty · Mortality · Tumour-free margins

Introduction

BCT (breast conserving therapy) was presented by Veronesi et al. in 1994, introducing the concept of segmental breast parenchymal wide excision. This study showed no differences in long-term survival between women who underwent mastectomy and those who underwent BCT and radiotherapy, albeit with an increased risk of local recurrence [1].

The goals of BCT are to provide a survival equivalent to mastectomy, a low rate of recurrence in the treated breast, a cosmetically acceptable breast, preservation of body image

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and quality of life, and reduced psychological morbidity associated with breast cancer surgery [2, 3].

There is still the challenge of meeting the goals of oncology and cosmesis, with the former being to eliminate all locoregional disease and the latter relying on preservation of as much breast tissue as possible for optimal aesthetic outcome [4, 5].

For this reason, oncoplastic breast surgery, such as oncoplastic reduction mammoplasty (ORM), has been introduced [6–9]. In addition, other benefits have been reported [6, 8, 9] such as the incorporation of oncoplastic techniques with BCT that typically allows greater margins and volume of excision without compromising the breast shape [10].

Studies comparing BCT and oncoplastic reconstruction demonstrated larger resection weights, fewer close or positive margins, and fewer surgical re-excisions in the oncoplastic group [8, 9, 11, 12].

However, the long-term influence of this treatment on cancer recurrence remains unclear. Additional procedures, such as oncoplastic reconstruction, invariably increase complications and those may interfere with adjuvant therapy [13].

Thus far, studies have failed to show that complications following oncoplastic breast reduction have a negative impact on the oncologic management of breast cancer patients.

Objectives

The authors assessed the benefits of ORM in terms of long-term local and/or distant recurrence and survival rates as well as margin status and the need to perform mastectomy after the first breast sparing surgery by conducting a retrospective review of cases of BCT and ORM including 215 patients.

Methods

This was a retrospective study of all patients with breast cancer who underwent BCT or ORM performed by a plastic and oncologic breast surgery team at "Centro Hospitalar Vila Nova de Gaia/Espinho" between January 2010 and March 2018. This allowed a follow-up time of at least 5 years in every patient. Data from 215 patients were analysed. The study was approved by the hospital ethics committee.

This timeline allowed the authors to draw conclusions about long-term outcomes, as they had a follow-up period of at least 5 years. Follow-up was possible to retrieve in all patients.

Patients were divided into two groups based on the surgical procedures: those who underwent tumour resection with immediate oncoplastic bilateral reduction mammoplasty (ipsilateral therapeutic and simultaneous contralateral symmetrisation)—*oncoplastic reduction mammoplasty (ORM)*, and those treated with standard tumour resection—*breast conserving therapy* (*BCT*).

Data on patient demographics, comorbidities, cancer histology, tumour size, receptor status, neoadjuvant or adjuvant therapies, surgical intervention duration, width of the microscopic and macroscopic narrowest margins, need for surgical re-excision or completion of mastectomy, morbidity, duration of hospital stay, recurrence, and mortality rate were gathered and analysed.

Margin status was considered positive as "ink on tumour" and negative when the reported microscopic margin status was > 0 mm [14].

Intraoperative margin assessment was performed using immediate radiographic evaluation of the clips and/or extemporaneous histopathological frozen section examinations of the specimen. Margin enlargement with resection of more breast parenchyma was performed if the margins were accessed as insufficient.

The different outcomes of patients who underwent oncoplastic resection surgery were compared to those of patients who did not (ORM vs. BCT) and were analysed using the IBM SPSS Statistics program, version 25.

For the analyses a significance level (p) of 0.05 and a confidence interval of 95% (95%IC) was adopted. For all quantitative variables, the existence of a normal distribution was assessed using the Shapiro–Wilk normality test, asymmetry and kurtosis, and histogram. If normality was assumed, in the descriptive analysis, the mean and standard deviation (SD) were reported. If the variable had a non-normal distribution, the median and interquartile range (IQR) were reported as well as minimum and maximum descriptions (min–max). The Mann–Whitney U (U) test was used for quantitative variables without a normal distribution. To compare the nominal variables, the chi-square test (X^2) was used; when the assumptions for carrying out this test were not met, Fisher's exact test was reported. In this, the phi (φ) was calculated when both variables were dichotomous. If not, Cramer's V (φ_c) was calculated. The recurrence-free survival and the breast cancer-specific survival were illustrated by performing Kaplan–Meier curves and compared with the log rank test.

Results

A total of 215 breast cancers were analysed: 58.1% ($n = 125$) underwent BCT, and 41.8% ($n = 90$) underwent ORM. All patients were female ($n = 215$). The surgery was performed in patients between 33 and 84 years old, with a median of 59.0 years (IQR = 17; min–max 33–84 years). The overall median duration of follow-up to medical chart review was 89.8 months (IQR = 51; min–max 3–158 months); in the BCT group, the median was

85.6 months (IQR = 40; min–max 3–158 months), and in the ORM group, the median was 99.2 months (IQR = 53; min–max 23–156 months).

Women who underwent ORM (median 57 years; IQR = 15; min–max: 36–74) were younger than those submitted to BCT (median 50 years; IQR = 18; min–max 33–84) ($p = 0.028$). No difference in multiple comorbidities (diabetes mellitus (DM), HTN (hypertension), smoking status, dyslipidemia, depression/anxiety, and body mass index (BMI)) was found between the two groups. Regarding tumour size, in the ORM groups (median 15 mm; IQR = 8; min–max 5–30), the tumours excised were larger than in the BCT (median 11 mm; IQR = 7.3; min–max 1–30) (Table 1).

The location of the tumour was the main factor in deciding which oncoplastic technique was performed. *Values are median (IQR; min–max) (Table 2).

pT1 tumours were the most common (72.0%, $n = 90$, in BCT and 72.2%, $n = 65$, in ORM), whereas pTis, pT0, and pT2 tumours represented a minority. No pT3 tumours or pT4 were observed. Regarding other tumour characteristics like node TMN category, histological subtype, estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2 (HER2), and Ki67 status no differences were found between the two groups (Table 1).

As previously reported, intraoperative margin assessment was performed by radiographic and/or extemporaneous histopathological frozen section examinations of the specimen. If the oncological surgery team assessed the margins as "too close," immediate margin enlargement was performed. This was the case in 58.6% ($n = 68$) of the patients who underwent BCT and 53.3% ($n = 48$) of those who underwent ORM. No significant difference between the two groups was found ($X^2(1) = 0.24$; $p = 0.877$).

No significant differences were found in the histological presence of residual tumour in the breast enlargement specimen between the BCT (11.8%, $n = 8$) and ORM groups (10.4%, $n = 59$) ($X^2(1) = 0.051$; $p = 0.821$).

In contrast, a significant difference was found in the margins of the initial breast specimen (excluding the specimen of enlargement). It was reported as intersected in 25.6% ($n = 31$) of the BCT group and 9.2% ($n = 8$) of the ORM group. ($X^2(1) = 8.96$; $p = 0.003$; $\varphi = -0.2$).

Peripheral resection margins were significantly larger in the ORM group (median 4.0 mm, IQR = 8, min–max 0–27) than in the BCT group (median 2.0 mm; IQR = 3; min–max 0–31), which had the closest margins. ($U = 3040$; $Z = -5.23$; $p < 0.001$).

An additional surgical procedure (breast partial re-excision or mastectomy) resulting from positive margins or local recurrence was significantly more common in the BCT group (20.8%, $n = 26$) than in the ORM (5.6%, $n = 5$) ($X^2(1) = 9.85$; $p = 0.002$; $\varphi = -0.214$).

Conversion of BCT to mastectomy was performed in 17.5% ($n = 22$) of the cases, while partial re-excision was performed in 3.2% ($n = 4$) of the patients. Meanwhile, in oncoplastic breast resection, none of the patients underwent re-excision, and a conversion to mastectomy was performed in all of those with positive margins or local recurrence (5.6%, $n = 5$). A significant difference was observed in the number of mastectomies performed between the BCT and ORM groups. (Fisher, $p < 0.003$; φ_c 0.219; SAR I 2.6 l).

No significant difference was found among groups regarding the presence of residual carcinoma during the final histopathological examination. In the 26 reoperations that were performed after BCT, residual carcinoma was present in 30.8% ($n = 8$). In the 5 reoperations that were performed in the ORM group, residual carcinoma was present in 40.0% ($n = 2$) of the specimens (Fisher, $p > 0.999$).

A delay of 22.5 days to the end of adjuvant radiotherapy was found in the ORM group. The median end of adjuvant radiotherapy was 131.0 days ($n = 89$) in the BCS group, and in the ORM group, the median was 153.5 days ($n = 76$), although this difference was not significant ($U = 2861.5$; $Z = -1.702$; $p = 0.089$).

The local and/or distant recurrence-free survival rates during the follow-up period did not differ, with 96.0% and 94.4% in the BCT and ORM groups, respectively (Fig. 1) ($p = 0.899$; log rank test).

No differences in the mortality due to breast cancer in the BCT group (3.2%, $n = 4$) and the ORM group (3.3%, $n = 3$) were found. This resulted in cancer-specific survival rates of 96.8% and 96.7% during the follow-up period in the two groups, respectively ($p = 0.873$; log rank test) (Fig. 2).

Discussion

The choice of using ORM or BCT was discussed with the patient and the multidisciplinary breast team. In the presence of larger tumour-breast ratio, breast ptosis, or hypertrophy, ORM was preferred [15].

Regarding the oncoplastic technique, the most frequent procedure was the inverted T pattern (wise pattern). Concerning the NAC pedicle, the inferior pedicle was the most performed; however, when the tumour was in the inferior pole of the breast, other pedicles like superior, superomedial, or medial pedicles were commonly employed.

There is consensus that 'no tumour on ink' is an acceptable resection margin for invasive breast cancer [14]. It has been proposed that oncoplastic techniques allows larger resection margins [10], and this was confirmed in the present analysis; the median peripheral margins were wider in the ORM group (4 mm) than in the BCT group (2 mm). Positive margins were also significantly less

Table 1 General Overview of demographics and tumour characteristics by groups

	BCT	ORM	
Patient age (years)*	60 (18; 33–84)	57 (15; 36–74)	$U=4637.5$; $Z=-2.197$; $p=0.028$
Comorbidities			
DM	11.2% ($n=14$)	13.3% ($n=12$)	$X^2=0.224$; $p=0.675$
HTN	44.8% ($n=56$)	37.8% ($n=34$)	$X^2=0.303$; $p=0.329$
Positive smoker status	9.6% ($n=12$)	12.2% ($n=11$)	$X^2=0.639$; $p=0.726$
Dyslipidemia	26.4% ($n=33$)	23.3% ($n=21$)	$X^2=0.262$; $p=0.609$
Depression/anxiety	17.6% ($n=22$)	21.1% ($n=19$)	$X^2=0.418$; $p=0.518$
BMI	26.78 (18.8–48.9)	27.99 (19.3–42.0)	$U=49{,}711.5$; $Z=-1.4522$; $p=0.146$
Tumour size (mm)*	11 (7.3; 1–30)	15 (8; 5–30)	$U=2608$; $Z=-4.181$; $p<0.001$
Tumour category			
pTis	19.2% ($n=24$)	7.8% ($n=7$)	Fisher; $p=0.014$
pT0	2.4% ($n=3$)	3.3% ($n=3$)	
pT1	72.0% ($n=90$)	72.2% ($n=65$)	
pT2	6.4% ($n=8$)	16.7% ($n=15$)	
Node category			
N0	86.4% ($n=108$)	87.8% ($n=79$)	Fisher; $p=0.898$
N1a	7.2% ($n=9$)	6.7% ($n=6$)	
N1mi	4.8% ($n=6$)	3.3% ($n=3$)	
N2	1.6% ($n=2$)	1.1% ($n=1$)	
N3	0.0% ($n=0$)	1.1% ($n=1$)	
Histological subtype			
Ductal in situ	19.2% ($n=24$)	7.8% ($n=7$)	Fisher; $p=0.064$
Invasive STE	68.0% ($n=85$)	86.7% ($n=78$)	
Lobular in situ	1.6% ($n=2$)	0.0% ($n=0$)	
Lobular invasive	5.6% ($n=7$)	2.2% ($n=2$)	
Medullar	0.8% ($n=1$)	0.0% ($n=0$)	
Clear cell	0.8% ($n=1$)	0.0% ($n=0$)	
Solid papillary invasive	2.4% ($n=3$)	2.2% ($n=2$)	
Micropapillary invasive	1.6% ($n=2$)	1.1% ($n=1$)	
ER status			
Positive	90.4% ($n=113$)	90% ($n=81$)	$X^2=0.09$; $p=0.922$
Negative	9.6% ($n=12$)	10% ($n=9$)	
PR status			
Positive	84.8% ($n=106$)	88.9% ($n=80$)	$X^2=0.750$; $p=0.387$
Negative	15.2% ($n=19$)	11.1% ($n=10$)	
HER2 amplification			
Positive	8.8% ($n=11$)	12.2% ($n=11$)	$X^2=0.43$; $p=0.510$
Negative	80.8% ($n=101$)	83.3% ($n=75$)	
Missing	10.4% ($n=13$)	4.4% ($n=4$)	
Ki67			
Low	41.6% ($n=52$)	32.2% ($n=29$)	$X^2=2.959$; $p=0.228$
High	34.4% ($n=43$)	45.6% ($n=41$)	
Missing	24.0% ($n=30$)	22.2% ($n=20$)	
Neoadjuvant chemotherapy			
Yes	5.6% ($n=7$)	11.1% ($n=10$)	$X^2=2.183$; $p=0.140$
No	94.4% ($n=118$)	88.9% ($n=80$)	
Adjuvant chemotherapy			
Yes	25.6% ($n=32$)	42.2% ($n=38$)	$X^2=6.584$; $p=0.010$
No	74.4% ($n=93$)	57.8% ($n=52$)	
Endocrine treatment			
Yes	88.8% ($n=111$)	90.0% ($n=81$)	$X^2=0.079$; $p=0.779$
No	11.2% ($n=14$)	10.0% ($n=9$)	
Anti-HER2 targeted therapy			
Yes	5.6% ($n=7$)	7.8% ($n=7$)	$X^2=0.408$; $p=0.523$
No	94.4% ($n=118$)	92.2% ($n=83$)	

Table 1 (continued)

	BCT	ORM	
Surgery Time (minutes)*	102 (38; 35–263)	150 (39; 90–270)	$U=1319$; $Z=-9.573$; $p<0.001$
Inpatient stay (days)*	2 (1; 1–14)	5 (3; 3–14)	$U=1997.5$; $Z=-8.344$; $p<0.001$
Smallest peripheral margin (mm)*	2 (3; 0–31)	4 (8; 0–27)	$U=3040$; $Z=-5.23$; $p<0.001$

Table 2 Type of oncoplastic breast reduction technique regarding skin pattern and nipple-areola complex (NAC) pedicle

Pattern	Pedicle
7 Periareolar	7 Superior
8 Vertical	5 Superior 3 Superomedial
75 Inverted T (wise) pattern	37 Inferior 7 Inferior enlarged 2 Bipedicle vertical 6 Superior 14 Superomedial 2 Medial 5 Lateral 1 Free nipple graft (Thorek)

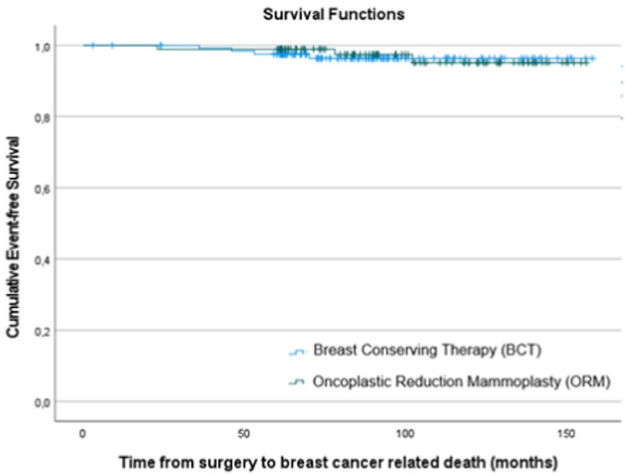

Fig. 1 Kaplan–Meier survival analysis of recurrence-free survival according to surgical technique

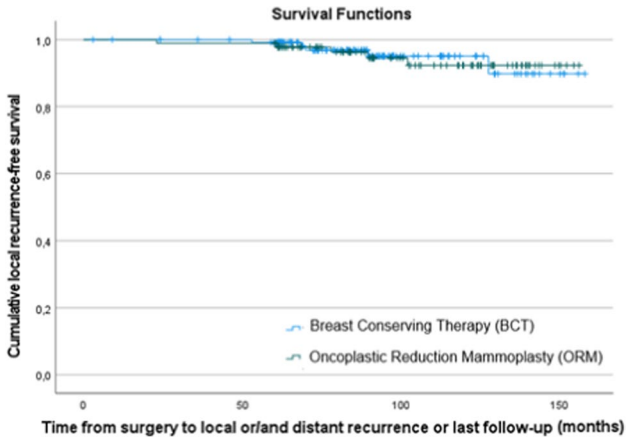

Fig. 2 Kaplan–Meier survival analysis of breast cancer-specific survival according to surgical technique

frequent in the ORM than in the BCT group (20.8% and 5.6%, respectively).

The importance of balancing excessive excision of healthy breast tissue and margin status has been highlighted by Haloua et al. [16]. The decision to perform intraoperative margin enlargement is supported by radiographic and/or frozen section examination. When the margin was inferior to 1 mm or in selected cases who are historically likely to require larger excisions (even when frozen immediate sections were not intercepted, like those with invasive lobular subtype, multifocality, or size > pT2) [17] wider margin excision in the same surgery which was executed.

Residual tumour in the breast enlargement specimen was present in a considerable number of cases (BCT: 11.8%; ORM: 10.4%). This supports the importance of the intraoperative assessment of the margins as a useful tool in a complete resection of the tumour [17].

A reoperation (breast partial re-excision or mastectomy) resulting from positive margins or local recurrence was significantly more common in the BCT group (20.8%, $n=26$) than in the ORM (5.6%, $n=5$). The rate of reoperation in the BCT group is in line with the previous reported literature of 17.6% [17]. The use of the ORM technique was beneficial in the reduction of reoperations.

In the current study, BCT had a 96.0% 5-year local and/or distant recurrence-free survival rates and cancer-specific survival rates of 96.8%. Meanwhile, 94.4% local and/or distant recurrence-free 5-year survival rates and cancer-specific 5-year survival rates of 96.7% was reported in the ORM groups. Therefore, oncoplastic breast reduction techniques did not alter the local and/or distant recurrence-free survival or breast cancer-specific survival when compared to the standard breast conserving therapy. This result was reported, even though patients undergoing ORM had larger tumours.

The slight delay (median delay of 22.5 days) regarding the conclusion of adjuvant radiotherapy in the ORM group had no statistical significance. This delay is largely as a

result of increased risk of wound complications but did not impact local control like Fasola et al. reported [18].

It is clear that surgery on the radiated breast can lead to increased complications and yield a diminished cosmetic result as compared with the nonradiated breast [19, 20]. This emphasizes even more the advantages of the simultaneous breast conserving surgery and reduction mammoplasty in patients with higher breast volume that have indication of reduction mammoplasty.

Conclusions

The incorporation of oncoplastic reduction techniques allows wider margin resection and reduces the incidence of positive margins, which aids in reducing the need for re-excision and the rate of posterior salvage mastectomy. A minimal delay in the completion of adjuvant therapy was noted. No difference was found in local and/or distant recurrence-free survival or breast cancer-specific survival.

ORM can be safely considered for appropriately selected patients with breast cancer.

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Data availability The data that support the findings of this study are available from the corresponding author, [LC], upon reasonable request.

Declarations

Ethical Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Centro Hospitalar Vila Nova de Gaia/Espinho (Date October 6, CES 159/2023-1).

Patient Consent Informed consent was obtained from all individual participants who participated in the study.

Conflict of interest Leonor Caixeiro, Carolina Chaves, Ana Rita Ferreira, Larissa Lanzaro, Leonor Rios, Fernanda Fernandes, Augusta Cardoso, and Horácio Costa declare no conflict of interest.

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