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ORIGINAL ARTICLE – BREAST ONCOLOGY

Long-Term Comparison of Aesthetical Outcomes After Oncoplastic Surgery and Lumpectomy in Breast Cancer Patients

Gabriela Santos, MD, PhD[1], Cicero Urban, MD, PhD[2,7], Maria Isabel Edelweiss, MD, PhD[1], Gustavo Zucca-Matthes, MD, PhD[4], Vilmar Marques de Oliveira, MD, PhD[5], Gabriel Hubner Arana, MD[6], Marco Iera, MD[6], Mario Rietjens, MD, PhD[6], Rubens Silveira de Lima, MD[7,8], Cleverton Spautz, MD[7,8], Flávia Kuroda, MD[7], Karina Anselmi, MD[7], and Edison Capp, MD, PhD[1,3]

[1]Post-Graduation Medical Program, UFRGS, Porto Alegre, Brazil; [2]Positivo University, Curitiba, Brazil; [3]Departament of Gynecology and Obstetrics, Hospital de Clínicas, UFRGS, Porto Alegre, Brazil; [4]Breast Unit, Barretos Cancer Hospital and School of Medicine of Botucatu, UNESP/PGDGOM, Botucatu, Brazil; [5]Breast Unit, Santa Casa de São Paulo, São Paulo, Brazil; [6]Plastic and Reconstructive Division, European Institute of Oncology, Milan, Italy; [7]Breast Unit, Hospital Nossa Senhora Graças, Curitiba, PR, Brazil; [8]Tocogynecology Department, UFPR, Curitiba, Brazil

ABSTRACT

Background. Lumpectomy may result in major deformities and asymmetries in approximately one-third of patients. Although oncoplastic surgery (OP) could be a useful alternative to avoid them, lack of strong data is causing some debate. The purpose of this study was to compare aesthetic outcomes in patients undergoing OP versus lumpectomy using three different assessment methods.

Methods. A total of 122 patients were included in this cross-sectional multicentric study; 57 underwent OP (46.7 %), and 65 underwent lumpectomy (53.3 %). Two breast surgeons and two plastic surgeons from different institutions using the Garbay scale independently evaluated aesthetic outcomes. BCCT.core software was applied in both groups, and the patients evaluated their aesthetic outcomes answering a questionnaire about their satisfaction rate.

Results. OP group had a higher proportion of excellent aesthetic results according to the BCCT.core software analysis ($p = 0.028$) and the specialists ($p = 0.002$). Multifactorial analyses showed that age ≥70 years (RP = 6.02; 95 % confidence interval [CI] 1.73–21.0; $p = 0.005$), tumors in the medial, inferior, and central quadrants (RP = 4.21; 95 % CI 1.88–9.44; $p < 0.001$), and large breasts (RP = 7.55; 95 % CI 2.48–23.0; $p < 0.001$) were significant risk factors for poor aesthetic outcomes after lumpectomy. The patients classified their results as better than those by the specialists and by the software, with no statistical difference between the groups.

Conclusions. Excellent aesthetic results were more frequent in the OP group according to BCCT.core software analysis and specialists. In addition, some clinical conditions and tumor locations in the breast can be considered risky factors for poor aesthetic outcomes in lumpectomy.

It is expected that nearly one-third of lumpectomies will result in major deformities and asymmetries, potentially having a negative impact on the quality of life of patients.[1–3] Thus, from the 1980s on, and especially in the 1990s, the oncoplastic surgery (OP) concept has been developed, combining both aesthetic and cancer surgery techniques. The purpose was to reduce the risk of late deformities and asymmetry after lumpectomy. In addition, these new techniques have broadened the indications for breast-conserving treatment (BCT), especially in patients with larger tumors, with the benefit of avoiding mastectomy in some cases. In addition, its philosophy is that the appearance of the breast and the quality of life of the patients should be components of the breast cancer treatment.

For women facing BCT, good aesthetic outcome is one of the main goals, and therefore measurement of this is critical for a better selection of the patients in clinical practice. Although OP has been receiving widespread attention as a good approach to avoid deformities in BCT, lack of strong

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C. Urban, MD, PhD
e-mail: cicerourban@hotmail.com

data has led to some debate about its real impact. Many individualized tools have been developed for its aesthetic evaluation. Parameters related to symmetry, differences in color, and resulting scars were analyzed in different scales. Some of them have been designed for the evaluation of the aesthetic outcomes by the surgeons, and others are patient-reported outcomes.[1,4–7] Current methods vary widely and could be complementary, because their focus are patient and surgeon-centered assessment methods. In addition, the software breast cancer conservative treatment cosmetic results (BCCT.core) is an objective and valid method developed for the evaluation of aesthetic outcomes in BCT.[4] However, it was not applied until now in OP.

Consequently, comparative data between aesthetic outcomes in lumpectomy and OP are limited to a few series in the literature. Therefore, the purpose of this study was to evaluate the aesthetic outcomes in patients with breast cancer undergoing lumpectomy and OP using the software breast cancer conservative treatment cosmetic results (BCCT.core), patient's, and surgeon's aesthetic evaluations.[4]

PATIENTS AND METHODS

This is a cross-sectional, multicentric, two-independent-group study, with patients undergoing BCT, in which the first group underwent level 2 OP techniques (bilateral surgeries with mammaplasty techniques) at the Hospital Nossa Senhora das Graças (HNSG) Breast Unit in Curitiba (Brazil). The second group underwent lumpectomy with incisions over the tumor, without removing skin (except in cases where the tumors where close to skin). Breast parenchymal reapproximation was performed in all cases, followed by intradermal suture, at three different hospitals in Novo Hamburgo: Unimed, Regina, and Municipal, between 2007 and 2012, by the same breast surgeon (GS).

All patients were included in this study who were diagnosed with ductal carcinoma in situ or invasive carcinomas (T1–T2), diagnosed by core-biopsy or mammotome, who were candidates for BCT through evaluation by clinical exam, mammography, ultrasonography, and/or magnetic resonance imaging. All participants agreed to take part in the study and have signed an informed consent form. In order to be included in this study, all patients had to be finished their treatments, and be at least 6 months after the conclusion of radiotherapy.

All patients were photographed with a Nikon 10.0 megapixels camera in the frontal, semi-profile, and bilateral profile views, in front of a dark background, and from the same distance (2 m) between them and the photographer (Figs. 1, 2). The objective aesthetic analysis was performed by two independent plastic surgeons from the European Institute of Oncology in Milan (Italy), and two breast surgeons—one from Hospital de Cancer de Barretos (Brazil), and other one from Hospital Santa Casa de São Paulo (Brazil). They independently evaluated the volume, shape, breast symmetry, position of the inframammary fold, and the scars, according to Garbay's criteria.[5] The conclusions were graded from 0 to 10. Zero corresponded to worst and 10 to the best result. The patients also answered a questionnaire about their satisfaction rate with the aesthetic results, and their answers were graded as excellent, good, regular, and unsatisfactory.

The aesthetic results were also evaluated with the use of BCCT.core software. The BCCT.core software summarizes all objective symmetry measurements. This software carries out a semiautomatic analysis of torso photographs in an anterior–posterior view. The examiner designates (predetermined points), followed by automated software calculations of different relational symmetry measurements including: breast volume, skin color and scars. An algorithm combines all the measurement results into an overall aesthetic score. The final results are based on a four-point scale: excellent, good, fair, and poor.[4,8,9] This study was approved by the Internal Review Board from Positivo University, in Curitiba, Brazil.

Statistical Analyses

The quantitative variables were described through average and standard deviation (symmetric distribution) or median and interquartile range (asymmetric distribution). The categorical variables were described by absolute and relative frequencies. To compare averages between the groups, the *t* test was applied. In cases of asymmetry, the Mann–Whitney was used. For the comparison of proportions, the Pearson test or Fisher exact-test was applied. To complement these analyses, the adjusted residuals test was used. For the concordance among specialists, software and patients, kappa coefficient was applied. The concordance power is established by the following manner: <0.2 = poor; between 0.21 and 0.40 = fair; between 0.41 and 0.60 = moderate; between 0.61 and 0.80 = good and >0.80 = very good. To control confounding factors, Poisson regression analysis (outcome variable: aesthetic results) or analysis of covariance (outcome variable: SF-36 scores) were used. The criterion for the inclusion of the variable in the multivariate model was that it presented a p value <0.20 in the bivariate analysis. The level of significance adopted was 5 % ($p \leq 0.05$), and the analyses were performed in the SPSS program version 18.0.

RESULTS

A total of 122 patients were included in this study. Among them, 57 underwent OP (46.7 %), and 65

FIG. 1 Method of oncoplastic surgery photos for specialist's analysis

underwent lumpectomy (53.3 %). The demographic and oncologic characteristics of the two groups are presented in Table 1. In the OP group, 38 patients (66.7 %) underwent inferior pedicle techniques, 17 (29.9 %) superior pedicle, 1 central quadrantectomy (1.7 %; contralateral symmetry in this case was with inferior pedicle), and 1 (1.7 %) round block. Both groups were similar in most of variables, but time between the surgery and the study analysis was shorter in OP group ($p = 0.047$). The educational level in OP group was higher ($p < 0.001$), as was their average body mass index (BMI) ($p = 0.012$). In addition, in the OP group all were patients in the private system, while the lumpectomy group had 38 % of patients from the Brazilian public health system (SUS).

Invasive ductal carcinoma was the most frequent diagnosis, corresponding to 67.3 % in OP group and to 86.2 % in lumpectomy group. Both groups showed a high prevalence of associated ductal carcinoma in situ, with 66 % in the OP group and 79.7 % in lumpectomy group. The weight of the surgical specimen was higher in the OP group, ranging from 40 to 121 g. The sentinel node biopsy was performed in 49 patients of the OP group (94.2 %) and 59 patients in lumpectomy group (92.2 %). There were more patients with axillary metastases in lumpectomy group. The reoperative rates were similar in both groups.

The OP patients showed a considerably higher proportion of excellent aesthetic outcomes, classified both by software ($p = 0.028$) and by specialists ($p = 0.002$; Table 2). The association of the aesthetic results with the tumor location, size of the breasts, and tumor size with the type of surgery is presented in Table 3. This association was relevant only in lumpectomy patients. Patients with

FIG. 2 Method of lumpectomy photos for specialist's analysis

large breasts had worse aesthetic results in lumpectomy group. Multifactorial analyses with Poisson's regression showed that age ≥70 years (RP = 6.02; 95 % confidence interval [CI] 1.73–21.0; $p = 0.005$), tumors in the medial, inferior and central quadrants (RP = 4.21; 95 % CI 1.88–9.44; $p < 0{,}001$), and large breasts (RP = 7.55; 95 % CI 2.48–23.0; $p < 0.001$) were significant risk factors for poor aesthetic outcome after lumpectomy.

Concordance among the four specialists was significant (kappa = 0.20; $p < 0.001$) but was considered poor, according to the Altman criteria (1991). When the concordance in each category was evaluated, it was observed that the categories "excellent" (kappa = 0.32) and "bad" (kappa = 0.29) showed a higher degree of concordance than the categories "good" (kappa = 0.10) and "regular" (kappa = 0.11). When the concordance between the four specialists and the BCCT.core was evaluated, it was found a poor concordance (kappa = 0.12; $p = 0.047$). There were relevant differences between the aesthetic evaluation by the specialists, the patients and the software ($p < 0.001$). The patients classified their results as better than the software.

DISCUSSION

Aesthetic results after lumpectomy may be unsatisfactory in approximately 30 % of the patients.[10,11] Both the deformity and asymmetry between the breasts remain as a

TABLE 1 Patient and tumor characteristics in oncoplastic surgery and lumpectomy

	Oncoplastic group ($n = 57$)	Lumpectomy group ($n = 65$)	p
Patient age (years)	58.4 ± 11.3	54.7 ± 10.6	0.061
Menopausal status			0.623
Pre	16 (28.1)	22 (33.8)	
Post	41 (71.9)	43 (66.2)	
Follow-up time (months)	36.2 ± 19.8	40.8 ± 16.3	0.170
Time gap between the surgery and the photo (months)	26.6 ± 14.8	32.0 ± 14.8	0.047
pT—*n* (%)			0.074
pTis	7 (13.2)	2 (3.1)	
pT1a/pT1b/pT1c	36 (67.9)	44 (67.7)	
pT2	10 (18.9)	19 (29.2)	
Education level—*n* (%)			<0.001
Unfinished primary school	4 (7.0)	21 (32.3)	
Full primary school	11 (19.3)	13 (20.0)	
High school	9 (15.8)	18 (27.7)[a]	
College degree	20 (35.1)[a]	8 (12.3)	
Specialization, Post-degree, Master's degree, Doctor's degree	13 (22.8)[a]	5 (7.7)	
BMI—*n* (%)			0.012
Underweight	0 (0.0)	1 (1.5)	
Normal (healthy weight)	23 (40.4)	32 (49.2)	
Overweight	27 (47.4)[a]	14 (21.5)	
Obese class	7 (12.3)	18 (27.7)[a]	
Breast size—*n* (%)			0.162
Small	1 (1.8)	3 (4.6)	
Medium	22 (38.6)	34 (52.3)	
Large/extra large	34 (59.6)	28 (43.1)	
Histological type—*n* (%)			0.022
Ductal carcinoma invasive	37 (67.3)	56 (86.2)[a]	
Ductal carcinoma in situ	8 (14.5)[a]	2 (3.1)	
Lobular carcinoma in situ	4 (7.3)	6 (9.2)	
Mucinous carcinoma	4 (7.3)[a]	0 (0.0)	
Others	2 (3.6)	1 (1.5)	
CDIS			0.152
No	17 (34.0)	13 (20.3)	
Yes	33 (66.0)	51 (79.3)	
Tumor localization—*n* (%)			0.316
Upper outer quadrant	14 (26.4)	22 (33.8)	
Lower outer quadrant	10 (18.9)	4 (6.2)	
Lower inner quadrant	2 (3.8)	5 (7.7)	
Upper inner quadrant	4 (7.5)	8 (12.3)	
Superior quadrants intersection	8 (15.1)	10 (15.4)	
Internal quadrants intersection	3 (5.7)	1 (1.5)	
Inferior quadrants intersection	4 (7.5)	9 (13.8)	
External quadrants intersection	7 (13.2)	5 (7.7)	
Central quadrant	1 (1.9)	1 (1.5)	
Weight (g)—median (P25–P75)	59 (40– 121)	45.5 (19– 57)	0.017
Tumor size (cm)	1.50 ± 0.96	1.63 ± 0.84	0.447
pN—*n* (%)			0.031
0	42 (85.7)[a]	44 (68.8)	

TABLE 1 continued

	Oncoplastic group ($n = 57$)	Lumpectomy group ($n = 65$)	p
1	7 (14.3)	13 (20.3)	
2	0 (0.0)	7 (10.9)[a]	
Grade—n (%)			0.412
1	11 (20.8)	18 (28.6)	
2	26 (49.1)	32 (50.8)	
3	16 (30.2)	13 (20.6)	
Sentinel node biopsy—n (%)			0.729
No	3 (5.8)	5 (7.8)	
Yes	49 (94.2)	59 (92.2)	
Estrogen receptor—n (%)			0.617
Negative	11 (22.4)	11 (16.9)	
Positive	38 (77.6)	54 (83.1)	
Progesterone receptor—n (%)			0.653
Negative	14 (28.6)	15 (23.1)	
Positive	35 (71.4)	50 (76.9)	
HER2—n (%)			0.560
Negative	33 (70.2)	51 (78.5)	
Positive	9 (19.1)	10 (15.4)	
Uncertain	5 (10.6)	4 (6.2)	

[a] Statistically significant association by testing waste set at 5 % significance

TABLE 2 Comparison of aesthetic results between the oncoplastic surgery and lumpectomy

	Oncoplastic group ($n = 57$)	Lumpectomy group ($n = 65$)	p	p adjusted*
BCCT.core—n (%)			0.028	0.004
Excellent	13 (22.8)[a]	4 (6.2)		
Good	31 (54.4)	48 (73.8)[a]		
Regular	12 (21.1)	10 (15.4)		
Bad	1 (1.8)	3 (4.6)		
Specialists—n (%)			0.002	<0.001
Excellent	29 (50.9)[a]	12 (18.5)		
Good	23 (40.4)	40 (61.5)[a]		
Regular	4 (7.0)	12 (18.5)		
Bad	1 (1.8)	1 (1.5)		
Patients—n (%)			0.242	0.320
Excellent	35 (61.4)	45 (69.2)		
Good	17 (29.8)	19 (29.2)		
Regular	2 (3.5)	1 (1.5)		
Bad	3 (5.3)	0 (0.0)		

* Multivariate analysis adjusted by age, follow-up time, time gap between the surgery and the photo, pT, education level, BMI, breast size, histological type, DCIS, and pN

[a] Statistically significant association by adjusted residual at 5 % significance

reminder of the disease and, therefore, interferes in the psychological adaptation and return to normality. The rate of unsatisfactory results in OP ranges from 0 to 18 % in the literature.[12–27] Therefore, an adequate selection of patients can reduce this by 25–30 %.[13]

Many other factors can influence aesthetic results after lumpectomy: age, BMI, size and location of the tumor, breast size, as well as the adjuvant treatment applied. Our findings showed an association of increased age with unsatisfactory results in the lumpectomy group, especially

TABLE 3 Association of the aesthetic results with different variables in oncoplastic surgery and lumpectomy

	Oncoplastic group			Lumpectomy group		
Variable[a]	Excellent/good	Regular/bad	*p*	Excellent/good	Regular/bad	*p*
Age (years)	59.3 ± 10.8	55.6 ± 13.1	0.316	53.4 ± 10.2	59.6 ± 11.1	0.061
<70	38 (88.4)	11 (84.6)		50 (96.2)	10 (76.9)	
≥70	5 (11.6)	2 (15.4)		2 (3.8)	3 (23.1)	
Obesity	4 (9.1)	3 (23.1)	0.333	13 (25.0)	6 (46.2)	0.176
Tumor localization *n* (%)			0.466			0.068
Upper outer quadrant	11 (26.2)	3 (27.3)		20 (38.5)	2 (15.4)	
Lower outer quadrant	6 (14.3)	4 (36.4)		3 (5.8)	1 (7.7)	
Lower inner quadrant	1 (2.4)	1 (9.1)		4 (7.7)	1 (7.7)	
Upper inner quadrant	4 (9.5)	0 (0.0)		7 (13.5)	1 (7.7)	
Superior quadrants intersection	6 (14.3)	2 (18.2)		8 (15.4)	2 (15.4)	
Internal quadrants intersection	3 (7.1)	0 (0.0)		0 (0.0)	1 (7.7)	
Inferior quadrants intersection	4 (9.5)	0 (0.0)		5 (9.6)	4 (30.8)	
External quadrants intersection	6 (14.3)	1 (9.1)		5 (9.6)	0 (0.0)	
Central quadrant	1 (2.4)	0 (0.0)		0 (0.0)	1 (7.7)	
pT *n* (%)			0.528			0.357
pTis	6 (14.3)	1 (9.1)		1 (1.9)	1 (7.7)	
pT1a/pT1b/pT1c	27 (64.3)	9 (81.8)		37 (71.2)	7 (53.8)	
pT2	9 (21.4)	1 (9.1)		14 (26.9)	5 (38.5)	
Breast size—*n* (%)			0.402			0.003
Small	1 (2.3)	0 (0.0)		3 (5.8)	0 (0.0)	
Medium	15 (34.1)	7 (53.8)		32 (61.5)[b]	2 (15.4)	
Large/extra large	28 (63.6)	6 (46.2)		17 (32.7)	11 (84.6)[b]	

[a] Expressed as mean ± standard deviation or *n* (%)

[b] Statistically significant association by testing waste set at 5 % significance

in patients older than age 70 years.[28] Approximately 35 % of breast tumors are located in the lower (inner or outer) quadrants,[29] and in lumpectomy this localization is a risk one (the same for inner and central quadrants), because loss of tissue there can distort and lower the nipple and areola complex. Another relevant data in our series was in relation to the breast size, because larger breasts were related with worse aesthetic outcomes in the lumpectomy group. In these larger-breasted women, OP has an important role for the improvement of aesthetic results and patients' satisfaction. In addition, OP results in lower risk of compromised margins in these patients. Significantly reducing breast size also improves and simplifies radiotherapy planning.[28]

The rates of satisfactory aesthetic results are encouraging with OP, as they range between 84 and 89 % compared with lumpectomy, which range from 60 to 80 %.[30] A recent meta-analysis showed significantly higher satisfaction with aesthetic results, in the OP group (89.5 vs. 82.9 % in lumpectomy; $p < 0.001$).[31] Our results showed that the evaluation by the specialists is similar to the ones mentioned in previous studies, with 91.3 % in the OP group and 80 % in lumpectomy.

Patients' self-evaluation is, certainly, the easiest one to perform. However, reproducibility is low, because it usually reflects their expectations before the surgery and psychosocial adaptation with the aesthetic results. Several factors, such as age and differences in social and economic levels, could influence the satisfaction rate and final analysis by the patients. Usually, patients considered their results more favorable than specialists.[8,32–34] Thus, our data are in agreement with the literature, as the patients classified their results as better than those by the specialists and by the software. In addition, there were differences in educational level (lower in the lumpectomy group), and the proportion of public health care patients (higher in lumpectomy group). In Brazil, it is frequently observed in daily practice that the expectations are higher in private practice and in patients with higher formal education. These factors can interfere with the patient's self-evaluation results in our series.

The most common subjective method used in practice is the evaluation by specialists.[1,35] Many authors have employed a variant of the scale originally described by Harris, which divides outcomes into four categories: excellent, good, fair, or poor.[4,33,36] In 2011, Veiga evaluated 45 breast cancer patients undergoing OP and 45

patients treated by lumpectomy, applying the subscales modified Garbay scale.[1] This scale takes more in account on some specific details in relation to symmetry, which, could be better for evaluation in OP. Although this could be a more meticulous method, its interobserver agreement was low here. In our study we used this scale, and observed a poor agreement between all surgeons and between plastic surgeons and breast surgeons too.

The BCCT.core software, is an objective method developed for the evaluation of aesthetic results in lumpectomy through photographic records of the patients in the anteroposterior position, analyzing parameters related to symmetry, differences in color and scarring, and through the points of reference compiled by the user (contour of breasts, nipples, and sternal furcula).[4] Results are classified as excellent, good, fair and poor. Some studies have shown their utility, observing concordance with the results obtained through the software in comparison with the evaluations by the observers using the Harris scale.[4,35] In our series, this software was applied for the first time in OP. Concordance between the specialists and the software was considered poor ($K = 0.12$). We believe that this, in part, was due to the use of the Garbay scale instead of Harris scale. Although Harris' scale is a good methodology for aesthetic evaluation in breast conserving surgery, Garbay's scale, in our view, takes more account on some specific details in relation to symmetry, which could be better for evaluation in OP. Another important point that could explain this result is that the software evaluation analyse the breasts in a single position, whereas specialists analyzed in three positions, as shown in Figs. 1 and 2.

The subjective and objective methods are complementary, and it is important to consider patient's opinion too. Objective methods might be more useful for the choice surgical technique itself, evaluating the symmetry between the breasts. In our study, OP patients had a significantly higher proportion of excellent aesthetic results evaluated through both software ($p = 0.024$) and by specialists ($p = 0.002$). Modest asymmetry registered by the software may not be relevant for the patients, and their evaluation, many times, can be affected by sociocultural elements. It is important to consider, however, that better results confirmed by the software, as in OP cases, mean more symmetric breasts and consequently could be positive for more satisfaction of the patients.

CONCLUSIONS

The original focus of OP was to maintain and even to improve quality of life of patients, because most of them are expected to enjoy long-term survival.[32] Results considered excellent both in subjective and objective evaluation were more frequent in patients undergoing OP. In addition, there are locations in the breast that can be considered as risky for poor aesthetic results in lumpectomy. Large breasts and advanced age also were determined factors associated with unsatisfactory results in lumpectomy. In these selected cases, OP should be considered a better option than lumpectomy.

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