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THE COSMETIC OUTCOME OF BREAST RECONSTRUCTION: REPRODUCIBILITY OF DIFFERENT METHODS ASSESSED BY DIFFERENT PROFESSIONALS

Resultado estético após reconstrução mamária: reprodutibilidade de diferentes métodos avaliados por diferentes profissionais

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ABSTRACT

Objective: To compare the reproducibility of different methods for assessing the cosmetic outcome of breast reconstruction, which was assessed by different health professionals. **Methods:** Photographs of 270 breast cancer patients who had been submitted to breast reconstruction of some type were included. A plastic surgeon, a resident in plastic surgery, two mastologists, two residents in mastology, and two psychologists performed the evaluation. The modified Garbay and Harvard scales and the objective BCCT.core software program were used. Cohen's Kappa and Spearman correlation coefficients were calculated. **Results:** The mean age of the patients was 55.7 (±11.1) years. Overall, 145 women (53.7%) underwent partial breast reconstruction and 125 (46.3%), total breast reconstruction. The mean follow-up time was 63.7±45.6 months. By applying the Harvard scale, the interobserver reproducibility among the different professionals was minimal; whereas the Garbay scale had no agreement. The correlations between the BCCT.core software program and the Harvard and modified Garbay scales were moderate. **Conclusion:** Correlations between both the modified Garbay scale and the Harvard scale and the objective (BCCT.core) test were moderate. There was less interobserver variability with the Harvard scale compared to the modified Garbay scale.

KEYWORDS: breast neoplasms; reconstructive surgical procedures; surgery, plastic.

RESUMO

Objetivo: Comparar a reprodutibilidade de métodos diferentes de avaliação dos resultados estéticos de cirurgias reconstrutivas da mama, por avaliadores distintos. **Métodos:** Foram incluídas fotografias de 270 pacientes portadoras de neoplasia da mama que passaram por cirurgias reconstrutivas da mama. As notas da avaliação foram dadas por um cirurgião plástico, um residente em cirurgia plástica, dois mastologistas, dois residentes em mastologia e dois psicólogos. Foram utilizadas as escalas de Harvard e Garbay modificada e a nota objetiva do programa BCCT.core. Foram calculados os índice Kappa de concordância interobservador e de correlação de Spearman. **Resultados:** A média de idade das pacientes foi de 55,7 anos (±11,1). No geral, 145 (53,7%) mulheres foram submetidas a tratamento conservador com cirurgia oncoplástica e 125 (46,3%) passaram por mastectomia e reconstrução total. A média de tempo de seguimento foi de 63,7±45,6 meses. Para a escala de Harvard, houve uma reprodutibilidade interobservador razoável para os diferentes profissionais, enquanto na escala de Garbay, a reprodutibilidade foi pobre entre os profissionais. De forma geral, a nota dada pelo programa BCCT.core correlacionou-se moderadamente com a escala de Harvard e a de Garbay modificada. **Conclusão:** As escalas de Harvard e de Garbay modificada correlacionam-se igualmente de forma moderada com o teste objetivo (BCCT.core). A escala de Harvard tem menor variabilidade interobservador, se comparada com a escala de Garbay.

PALAVRAS-CHAVE: neoplasias da mama; procedimentos cirúrgicos reconstrutivos; cirurgia plástica.

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INTRODUCTION

Breast-conserving surgery is widely used today in the treatment of locoregional breast cancer[1]. When radical surgery is required, immediate or delayed, breast reconstruction can be performed in a large proportion of cases. The breast reconstruction cosmetic outcome may vary. Its assessment in a standardized manner is difficult[2]. Some methods have been developed to standardize cosmetic evaluation, including the BCCT.core software program[3], the Garbay[4] and Harvard scales[5-7].

Difficulties involved in aesthetic evaluation following breast cancer surgery include the lack of a gold-standard method. Likewise, considerable interobserver variability has been found[6], and there is a lack of agreement when the results of evaluation are compared between healthcare professionals and the patients themselves.

BCCT.core is an objective method that was initially developed to standardize and quantify the cosmetic outcome of breast-conserving surgery[7]. It was later validated for the breast reconstruction evaluation following mastectomy[8]. This software program performs a photographic evaluation of the breasts by analyzing different parameters related to symmetry, scarring, and skin coloring[3,7]. BCCT.core is currently the most commonly used method for the aesthetic evaluation of breast cancer patients. Its results are classified as excellent, good, fair, or poor[9].

The method developed and modified by Garbay et al.[4] takes the volume, shape, and placement of the breast into consideration, as well as the location of the inframammary fold and the final scar appearance. One advantage of this scale is the number of analyzed parameters, which may result in a more complete evaluation of the outcome[10]. The Harvard scale, on the other hand, evaluates only postoperative symmetry and classifies it in four categories according to the degree of distortion of the operated breast in relation to the normal breast[11].

Few studies have been published on the reproducibility of different methods of evaluating cosmetic outcome in the same population, from the patient's point of view and in the opinion of a multidisciplinary healthcare team[10,12]. The present study aimed to compare the reproducibility of three methods used to evaluate the breast reconstruction cosmetic outcome according to the type of evaluator.

METHODS

This was a retrospective cohort study conducted in a private clinic and in a tertiary referral hospital for the treatment of breast pathologies. Frontal photographs of 270 patients who had completed six months since radiotherapy (or since having surgery if radiotherapy was not required) were included in the study. All the patients had been diagnosed with breast cancer and submitted to breast-conserving surgery or radical mastectomy, with partial or total breast reconstruction. Data were collected between January 2015 and September 2016, when the patients returned for a scheduled follow-up visit. Patients with local recurrences that could negatively affect the cosmetic outcome were excluded from the study, as were those undergoing reconstruction with the use of a temporary tissue expander who had not exchanged it yet for a permanent breast implant.

Evaluation methods

Evaluation was conducted by members of a multidisciplinary team, consisting of a plastic surgeon and a plastic surgery resident, two breast specialists trained in breast reconstruction, two medical residents specializing in breast disease, and two psychologists. The analyses were performed blindly and randomly, without any type of patient or assistant team's identification. The Harvard scale[5-7], the modified Garbay scale[4] and the score given by the BCCT.core objective software tool were compared (Chart 1 and Figure 1).

Statistical analysis

The SPSS statistical software program and the <www.statstodo.com> internet page were used for the statistical analysis. Measures of central tendency and percentages were calculated, as well as Cohen's Kappa coefficient to measure interobserver agreement and Spearman's rank-order correlation (rho). The Kappa coefficient ranges from 0.0 to 1.0, and agreement was classified as:

- between 0.01 and 0.20: slight;
- between 0.21 and 0.40: fair;
- between 0.41 and 0.60: moderate;
- between 0.61 and 0.80: substantial;
- between 0.81 and 1.0: almost perfect[13,14].

Spearman's correlation coefficient ρ ranges from -1 to 1, and the closer it lies to one of these extremes, the greater the association between the variables.

Ethics approval and consent to participate

The internal review board of the Teaching Hospital from Universidade Federal de Goiás approved the study protocol (018/2015), and the procedures were conducted in accordance with the principles defined in the Helsinki convention. The participants were volunteers and signed an informed consent form prior to their admission to the study.

RESULTS

A total of 270 women were included in the study, in which 176 patients (65.2%) were from a private clinic and 94 (34.8%) were from a public hospital. Mean time of follow-up was 63.7±45.6 months. The mean age of the patients was 55.7±11.1 years. Breast cancer was classified as invasive ductal carcinoma in 200 cases (74.3%). In 208 cases (80.9%), the disease was at an early stage (0, 1 or 2). Breast-conserving surgery with partial breast reconstruction was

the treatment of choice in 145 cases (53.7%). In 144 women (53.3%), contralateral symmetrization was performed. Reconstruction was immediate in 254 cases (94.1%) and was performed by a breast specialist in 208 cases (77.9%). Breast reconstruction consisted of a one-stage surgical procedure in 185 cases (68.5%). The nipple-areola complex was reconstructed in 55 patients (45.8%) in whom it had been removed. Some type of early or late complication was found in 48% of the patients. Characteristics of the patients, disease, and treatment are provided in greater details in Table 1.

Interobserver reproducibility with the Harvard scale was fair among different professionals (Kappa=0.27) and poor between plastic surgeons and psychologists (Kappa=0.17); however, the difference was not statistically significant (Table 2). Reproducibility with the Garbay scale was equally poor among the different professionals (Kappa=0.12).

In general, correlation between the score provided by the BCCT.core software program and Harvard (Rho BCCT 0.39 to 0.61) and modified Garbay (Rho BCCT 0.37 to 0.58) scores was moderate, with no statistically significant difference between them. The plastic surgery resident (42.2%) and the plastic surgeon (15.6%) were more likely to rate the outcome as poor compared to the other professionals (range 3.0–14.1%) and to the BCCT.core program (6.7%). The BCCT.core program was more likely to rate the results as good and more likely to avoid the extremes (poor and excellent), as seen in Tables 3 and 4.

DISCUSSION

Evaluation of the breast reconstruction cosmetic outcome is controversial, not only with respect to the selection of optimal methods, but also regarding the interpretation of the obtained results. Nevertheless, these results need to be validated in different population subgroups. This is the largest study to focus specifically on the methodology of evaluation. In addition, it aimed at comparing the Harvard scale, the modified Garbay scale, and the BCCT.core software program.

The greater the number of involved parameters and the more complex the model of evaluation, the poorer a method

Chart 1. Chart showing the modified Garbay[10] and Harvard scales[5-7] for the breast reconstruction cosmetic outcome.

Garbay scale			
Parameter / Score	**0 points**	**1 point**	**2 points**
Breast volume	Marked discrepancy relative to contralateral side	Mild discrepancy relative to contralateral side	Symmetrical volume
Breast shape	Marked contour deformity or shape asymmetry	Mild contour deformity or shape asymmetry	Natural or symmetrical contour
Breast placement	Marked displacement	Mild displacement	Symmetrical and aesthetic placement
Inframammary fold	Poorly defined / unidentified	Defined, but asymmetrical	Defined and symmetrical
Breast scars	Poor (hypertrophy, contracture)	Fair (wide scars, poor color match, but no hypertrophy or contracture)	Good (thin scars, good color match)
Harvard scale			
Category	**Results**		
Excellent	Treated breast nearly identical to untreated breast		
Good	Treated breast slightly different from untreated breast		
Fair	Treated breast clearly different from untreated breast, but not seriously distorted		
Poor	Treated breast seriously distorted		

Figure 1. Examples of photograph classification according to evaluations performed with the BCCT.core computer software program regarding the breast reconstruction cosmetic outcome.

reproducibility tends to be[15]. This statement is also valid for the present study, in which the Harvard scale, which is the simplest, also proved to be the most reproducible among healthcare professionals. Thus, in view of the inherent limitations of the evaluation methods and absence of a gold-standard method to evaluate the breast reconstruction cosmetic outcome, it may be advisable to perform the evaluation using more than one method and with more than one professional.

Correlations between the objective test (BCCT.core) and both the modified Garbay scale and the Harvard scale were equally moderate. The lowest interobserver variability was found with the Harvard score, because it is simpler, with fewer categories. Despite the poor reproducibility between the used scales, the correlation between both scales and the objective (BCCT.core) evaluation was similar and either can be used according to the observer's preference.

Patients tend to be more satisfied with the outcome of breast reconstruction compared to observers from the healthcare professions, with this rater role being generally played by surgeons[16,17]. This is expected, since both the BCCT.core program and the Harvard and modified Garbay scales concentrate on symmetry. Thus, symmetry does not always coincide with the beauty concept. Therefore, patients could have symmetrical breasts but be dissatisfied with their appearance and, inversely, despite a certain degree of asymmetry, they may consider their breasts more attractive than they were before the cancer treatment, for

Table 1. Descriptive data on characteristics of the patients, the tumors, and the treatment provided.

	Mean	SD	n	%
Patients' characteristics				
Age (years)	55.7	11.2		
Body mass index	26.3	4.15		
Smoker			13	4.9
Former smoker			31	11.7
Diabetic			25	9.3
Hypertensive			97	36.5
Previous breast surgery			65	27.4
Disease characteristics				
Clinical size of the tumor (mm)	34.5	23.5		
Clinical staging				
0			7	2.7
I			81	31.5
II			120	46.7
III			46	17.9
IV			3	1.2
Histological type				
Invasive ductal carcinoma			200	74.3
Invasive lobular carcinoma			16	5.9
In situ ductal carcinoma			34	12.6
Grade 2			148	59
Subtype*				
Luminal A			103	45.0
Luminal B			46	20.1
Luminal B/HER			36	15.7
HER			18	7.9
Triple negative			26	11.3

	Mean	SD	n	%
Follow-up (months) 63.7 45.6				
Local recurrence			9	3.3
Metastases			6	2.2
Treatment characteristics				
Reconstruction				
Partial			145	53.7
Total			125	46.3
Immediate			254	94.1
Delayed			16	5.9
Contralateral symmetrization			132	48.9
Reconstruction of the nipple-areola complex (when removed)			55	45.8
Number of surgeries				
1			185	68.5
2			51	18.9
≥3			34	12.6
Type of reconstruction				
Oncoplasty			134	51.1
Prosthesis/tissue expander			58	22.1
Pedicle TRAM flap			66	25.2
Latissimus dorsi flap			4	1.5
Surgeon performing breast reconstruction				
Breast specialist			208	77.9
Plastic surgeon			59	22.1
Chemotherapy			176	65.2
Hormone therapy			216	81.2
Trastuzumab			32	12.1
Radiotherapy			197	74.4
Early complication			98	36.3
Late complication (>2 months)			83	30.9
Any complication**			131	48.7

*Luminal A (ER+ and/or PR+, HER2- and Ki67<14%), Luminal B (ER+ and/or PR+, HER2- and Ki-67≥14%), Luminal B/HER (ER+ and/or PR+, HER2+), HER (ER-, PR- and HER2+), and Triple negative (ER-, PR- and HER2-); **early and/or late complication; TRAM: transverse rectus abdominis myocutaneous; HER2: human epidermal growth-factor receptor 2; ER: estrogen receptor; PR: progesterone receptor; SD: standard deviation.

Table 2. Interobserver variability according to the Harvard and Garbay scales.

Harvard scale	Kappa	95%CI
Among breast specialists	0.35	0.32–0.38
Among plastic surgeons	0.27	0.19–0.34
Among psychologists	0.23	0.14–0.32
Between breast specialists and plastic surgeons	0.28	0.26–0.29
Between breast specialists and psychologists	0.33	0.31–0.35
Between plastic surgeons and psychologists	0.17	0.14–0.20
Among all professionals	0.27	0.26–0.29
Garbay scale	**Kappa**	**95%CI**
Among breast specialists	0.13	0.11–0.15
Among plastic surgeons	0.16	0.10–0.22
Among psychologists	0.16	0.09–0.22
Between breast specialists and plastic surgeons	0.12	0.11–0.13
Between breast specialists and psychologists	0.14	0.12–0.15
Between plastic surgeons and psychologists	0.1	0.08–0.12
Among all professionals	0.12	0.11–0.13

CI: confidence interval of 95%.

instance. Hence, new evaluation methods should be developed and investigated to include a broader measure of cosmetic appearance that would better correspond to the patients' expectations and possibly to their degree of satisfaction[18].

In the majority of previous evaluations made by patients, professionals or the BCCT.core program, outcome was reported as good or excellent, with rates similar to those cited in the literature, depending on the criteria taken into consideration[3,6,17]. In the present study, curiously, the scores awarded by plastic surgeons for the cosmetic outcome were the lowest. Nevertheless, the correlations between their scores and the objective evaluation made by the computer software program were similar to those of other professionals, rendering them equally valid. Conversely, Leonardi et al. found that plastic surgeons and male professionals tended to provide better scores for the outcome[6]. The explanation given by those investigators for this phenomenon was that, in such study, the plastic surgeons were rating their own results and thus tended to be more tolerant and more aware of the difficulties involved in each case. A similar explanation could be given here, since the breast specialists performed over three-quarters of breast reconstructions.

In the present study, more than half of the patients underwent partial breast reconstruction, a procedure usually associated with

Table 3. Correlation between the scores awarded by professionals according to the Harvard Scale and the scores given by the BCCT.core software program.

Frequency (%)	Poor		Fair		Good		Excellent		Rho BCCT	95%CI
	n	%	n	%	n	%	n	%		
Senior breast specialist	13	4.8	82	30.4	115	42.6	60	22.2	0.61	0.51–0.70
Junior breast specialist	38	14.1	59	21.9	91	33.7	82	30.4	0.49	0.39–0.60
Second-year resident/ breast disease program	24	8.9	97	35.9	86	31.9	63	23.3	0.5	0.38–0.59
First-year resident/ breast disease program	25	9.3	88	32.6	63	23.3	94	34.8	0.42	0.32–0.53
Senior plastic surgeon	42	15.6	98	36.3	80	29.6	50	18.5	0.48	0.38–0.59
Plastic surgery resident	114	42.2	65	24.1	68	25.2	23	8.5	0.48	0.38–0.59
Senior psychologist	22	8.1	74	27.4	120	44.4	54	20.0	0.54	0.42–0.63
Junior psychologist	8	3.0	37	13.7	116	43.0	109	40.4	0.39	0.29–0.51
BCCT.core	18	6.7	77	28.5	144	53.3	31	11.5	1	–

CI: confidence interval of 95%.

Table 4. Modified Garbay Scale: mean scores and correlation with scores given by the BCCT.core software program.

	Mean (±SD) 95%CI		Rho BCCT (95%CI)	
Senior breast specialist	7.16 (±1.93)	6.92–7.39	0.58	0.47–0.67
Junior breast specialist	7.37 (±2.68)	7.05–7.69	0.51	0.39–0.60
Second-year resident/ breast disease program	7.04 (±1.74)	6.83–7.25	0.46	0.36–0.57
First-year resident/ breast disease program	7.07 (±2.27)	6.8–7.35	0.42	0.31–0.53
Senior plastic surgeon	5.68 (±2.49)	5.38–5.98	0.41	0.31–0.53
Plastic surgery resident	6.36 (±2.08)	6.11–6.61	0.49	0.40–0.61
Senior psychologist	6.66 (±2.34)	6.38–6.94	0.48	0.37–0.59
Junior psychologist	7.47 (±1.71)	7.27–7.67	0.37	0.29–0.51

CI: confidence interval; SD: standard deviation.

lower morbidity, better aesthetic results, greater degree of satisfaction and the same oncologic benefit[17,19,20]. The complication rates can be considered normal, since the criteria established for recording the complications were extremely rigorous and even minimal changes were considered to represent events, including a slightly wider than normal scar, a small seroma, a small depression, or an oil cyst seen at mammography, for example. The complication rates cited in literature vary widely as a result of the different adopted criteria. Most of the studies fail to clearly describe their complication definition and fail to report on the severity of events. Hence, while some authors already consider the presence of subclinical fat necrosis following a transverse rectus abdominis myocutaneous (TRAM) flap procedure to be a complication, others only register a complication when there is flap necrosis with losses exceeding 20%[21-23].

Some potential limitations of our study were the retrospective design and the evaluation of results by the same team that operated the patients. However, the analyses were performed blindly and randomly, which reduces the possibility of measurement bias. Also, patients with different postoperative periods were included, which may have influenced the distribution of results considered to be poor, fair, good or excellent. Finally, the limitations inherent in the photographic registration[24] may also justify small differences in cosmetic results between different methods and populations.

CONCLUSION

Correlations between the modified Garbay and the Harvard scales and the objective test (BCCT.core) were equally moderate. Interobserver variability was lower with the Harvard scale. Although scores may vary depending on the observer, all correlations were valid in accordance with the objective test.

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