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Impact of Contralateral Symmetry Procedures on Long-term Patient-reported Outcomes Following Unilateral Prosthetic Breast Reconstruction

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Abstract

Background: One aim of unilateral post-mastectomy breast reconstruction (BR) is to restore symmetry with the contralateral breast. As such, unilateral prosthetic reconstruction often requires a contralateral symmetry procedure (CSP). There is sparse literature on the impact of CSPs on long-term patient-reported outcomes (PROs) such as satisfaction and health-related quality of life (HRQoL). The current study aims to describe patient-reported outcomes following CSPs, using a validated PRO tool, BREAST-Q. The hypothesis is that CSPs are associated with greater patient-reported satisfaction and HRQoL.

Methods: The current study is a single institutional analysis of prospectively collected BREAST-Q scores of patients who underwent unilateral prosthetic breast reconstruction during 2011–2015. Women 18 and older with BREAST-Q scores measured 9 months after BR with or without CSP(s) at the time of expander replacement were included. Patients were classified into four sub-cohorts: augmentation, mastopexy, reduction, and no symmetry procedure (controls). Socio-demographic, clinical characteristics and BREAST-Q scores were analyzed. Multivariable linear regression was performed.

Results: Of 553 patients, 67 (12%) underwent contralateral augmentation, 68 (12%) mastopexy, 93 (17%) reduction, and 325 (59%) were controls. Mean follow-up time was 52 months. Satisfaction with breast and outcomes were higher in the augmentation compared to the control groups ($p=0.01$). On multivariable analysis, augmentation remained an independent predictor of satisfaction with breast ($p=0.04$). Physical well-being scores were lower for contralateral

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mastopexy and reduction compared to the controls with a trend towards statistical significance on multivariable models. Psychological and sexual well-being was similar across groups.

Conclusions: Prosthetic reconstruction with contralateral breast augmentation was associated with greater satisfaction with breast and reconstructive outcome. In contrast, breast reduction and mastopexy procedures demonstrated equivalent satisfaction with breasts compared to controls but may be associated with lower physical well-being. Such information can be used to improve the shared decision-making process for women who choose unilateral prosthetic breast reconstruction.

Keywords

BREAST-Q; contralateral symmetry procedure; unilateral prosthetic breast reconstruction

INTRODUCTION

One of the principal aesthetic aims of unilateral post-mastectomy breast reconstruction is to create a breast mound symmetric with the remaining natural breast. When compared to autologous transfer, it may be more challenging for the plastic surgeon to achieve adequate and reliable symmetry using prosthetic techniques^{1, 2}. Implants tend to create a more rounded and full appearance to the breast, especially in the upper pole, which often does not resemble the remaining natural breast. For this reason, a contralateral symmetry procedure is often performed in this setting.

Three contralateral symmetry procedures (CSPs) commonly performed include augmentation, mastopexy, and reduction^{1,2}. The choice is based on the shape, size and projection of the remaining natural breast as well as patient preference. Despite the high number of CSPs completed for unilateral implant breast reconstruction, most outcomes are derived from subjective physician opinion with sparse data on patient-reported outcomes (PRO)^{3–7}. The absence of PROs limits plastic surgeons' ability to counsel patients effectively about post-operative health-related quality of life (HRQoL) and to properly align expectations.

The BREAST-Q is a validated breast reconstruction specific instrument used to evaluate patient-reported satisfaction and HRQoL⁸. The satisfaction with breast domain of the BREAST-Q reconstruction module was chosen as the primary outcome because it specifically asks questions about and measures post-reconstruction symmetry. The study aim is to compare patient-reported outcomes following unilateral implant-based breast reconstruction with and without one of the three common symmetry procedures. The hypothesis is that patient-reported satisfaction improves when prosthesis-based breast reconstruction is combined with a symmetry procedure.

METHODS

The current study is a single institutional retrospective analysis of prospectively collected BREAST-Q scores from patients who underwent unilateral implant-based breast reconstruction during 2011–2015. Before initiation, the study was approved by the institutional review board. Inclusion criteria consisted of women who underwent staged

immediate unilateral prosthetic reconstruction with placement of a tissue expander at the time of mastectomy. Patients subsequently underwent a tissue expander exchange to permanent silicone or saline implant with or without a simultaneous CSP such as augmentation, mastopexy, and reduction. The details of the symmetry procedure were at the discretion of the operating surgeon but included both subglandular and submuscular implant placements as well as both vertical and wise pattern mammoplasty and mastopexy. CSP procedures were defined using CPT codes. A minimum follow-up time of nine months following the exchange and symmetry procedure was required for inclusion. Exclusion criteria included patients with a prior history of breast cancer treated with radiotherapy or previous elective breast surgery (e.g., augmentation, mastopexy, reduction). To ensure a homogenous cohort we excluded patients who underwent nipple sparing mastectomy, tissue expander removal/replacement for infection, any autologous breast reconstruction such as latissimus or deep inferior epigastric artery flap, delayed symmetry procedure, combined symmetry procedures such as mastopexy augmentation, and revisionary or secondary breast reconstructive surgeries following the exchange operation (e.g., fat grafting). Based on the status and type of CSP performed, patients were divided into four sub-cohorts: augmentation, mastopexy, reduction, and no symmetry (control).

The most recent available BREAST-Q reconstruction module scores including satisfaction with breasts, satisfaction with outcomes, psychosocial well-being, sexual well-being and physical well-being were included in the analysis. The BREAST-Q scores of each domain were obtained by transforming the scale item responses with the Q-score software program⁸. The transformed scores range from 0 to 100, and higher scores indicate greater satisfaction and HRQoL.

Demographic (e.g. age, BMI) and oncological variables (e.g. chemotherapy, post-mastectomy radiotherapy) were noted for each patient. Follow-up time was calculated as the time duration between implant exchange with or without symmetry procedure and the most recent available BREAST-Q score. Pair-wise comparison was done separately for each of the symmetry procedures with the no symmetry group as control. Continuous variables were compared using t-test or ANOVA, whereas categorical variables were analyzed using the Chi-square or Fishers exact test statistics. Multivariable linear regression analyses were performed to account for baseline confounders. All analyses were done using STATA 12.0 (College Station, TX) and a $p < 0.05$ was considered as significant.

RESULTS

A total of 553 patients met selection criteria for inclusion in the study. Of these, 228 (41%) patients underwent a CSP—67 (12.1%) underwent contralateral augmentation, 68 (12.3%) mastopexy, and 93 (16.8%) reduction. The 325 (58.8%) patients who did not undergo a symmetry procedure were categorized into the no symmetry or control group.

Patient demographics and clinical characteristics are listed in Table 1. There was no significant difference in the age distribution of patients among all groups ($p=0.62$). Mean BMI in the augmentation, mastopexy, reduction, and no symmetry group was 23, 26, 29, and 25, respectively. These values were significantly different ($p<0.01$). The proportion of

patients who received postmastectomy radiotherapy (PMRT) also differed between the augmentation, mastopexy, reduction, and no symmetry groups, i.e. 10%, 15%, 33%, and 20%, respectively ($p < 0.01$). The proportion of patients receiving chemotherapy and mean follow-up time did not differ significantly between groups. Overall follow-up time to the BREAST-Q assessment was distributed evenly across all sub-cohorts ($p = 0.61$), and the mean follow-up time was 52 months for the entire cohort.

Augmentation versus No Symmetry: Univariable Analysis

The scores for satisfaction with breast and satisfaction with outcomes were significantly higher, on average by 6 and 7 points, respectively, in the augmentation group than in the control group ($p = 0.01$ for both; Table 2). There was no significant difference between psychosocial, sexual, and physical well-being scores between the two groups.

Mastopexy or Reduction versus No Symmetry: Univariable Analysis

Mean physical well-being scores were significantly lower, on average by 5 points, in both the mastopexy and reductions groups compared to controls ($p < 0.05$; Table 3 and 4). There was no significant difference in the scores for satisfaction with breast, satisfaction with outcomes or psychosocial and sexual well-being between the CSP groups and controls ($p > 0.05$).

Post-hoc Analyses after Excluding Women with PMRT

To eliminate the effect of post-mastectomy radiotherapy on the statistical analyses, separate post-hoc univariate analysis after excluding women with PMRT were performed. These data are similar to those of the original cohort, i.e., women with contralateral augmentation reported greater satisfaction with breast ($p = 0.03$) and outcomes ($p = 0.02$) compared to the control group (Supplementary Table S1). Physical well-being was significantly lower in women who underwent contralateral mastopexy or breast reduction ($p = 0.05$).

Multivariable Analyses

Multivariable linear regression analysis was performed to adjust for potential confounders. Augmentation was associated with increased satisfaction with breasts, by 5 points ($p = 0.04$; Table 5). Elevated BMI, chemotherapy and PMRT were also independent predictors of lowered patient satisfaction with breasts ($p < 0.05$; Table 5).

After adjustment, scores for physical well-being remained lower and trended towards statistical significance for both the mastopexy ($p = 0.07$; Supplementary Table S2) and breast reduction groups ($p = 0.09$, Supplementary Table S3). PMRT was also identified as an independent predictor of reduced physical well-being scores ($p < 0.01$; Supplementary Tables S2 and S3).

DISCUSSION

To our knowledge, the current study is the first comparing long-term patient-reported outcomes, using a validated and breast reconstruction-specific instrument, in the setting of unilateral prosthetic reconstruction with and without a symmetry procedure. The study

results demonstrate that women who choose a contralateral augmentation are significantly more likely to be satisfied with their breasts and overall outcome when compared to those who did not undergo a balancing procedure. The satisfaction with breast domain of the BREAST-Q asks questions about breast size, symmetry, and appearance in clothing. A greater than 5-point difference in the current study was measured for the satisfaction with breast and outcome domains when comparing the augmentations to the controls, a change significant enough to be interpreted as a clinically minimal important difference ^{8, 9}

A number of factors may contribute to the enhanced postoperative satisfaction of women undergoing contralateral breast augmentation. The adage of “replacing like with like” is highly applicable in this instance, similar to other aspects of plastic surgery. The best way to match an implant is with another implant. Even a small implant augmentation will create a more projecting breast with upper pole fullness akin to the reconstructed breast. Another important observation in this study is the low BMI of patients undergoing augmentation, which was the lowest of all study groups. These patients would seemingly be ideal candidates for implant reconstruction in general since they have less tissue at the lateral chest wall aesthetic unit, which in large body types creates a challenge to blend smoothly into the permanent implant reconstruction ¹⁰.

In contrast to the outcomes with contralateral augmentation, there was no difference in reported satisfaction with breasts or outcomes between patients who underwent either a mastopexy or breast reduction compared to controls. These findings suggest limitations of current mastopexy and reduction techniques in achieving reliable symmetry with implant reconstructions. Moreover, these findings may encompass secondary longitudinal changes that occur with lifted and reduced breasts, such as recurrent ptosis. While short-term follow-up may not highlight such differences, the lengthy mean follow-up time of four years captures the temporal changes that commonly occur with skin-tightening procedures. In contrast to the elective bilateral mastopexy or reduction procedures, ageing effects are particularly magnified when the comparator breast is a static and stable implant reconstruction. Consideration also needs to be given to the impact of weight fluctuations that can accompany post-mastectomy hormonal ablation therapy and its effect on symmetry.

There are two other studies identified in the literature that measure the outcomes associated with CSP following unilateral prosthetic reconstruction. A Taiwanese study, reported subjective outcomes of good to excellent, in women who underwent a contralateral augmentation ¹¹. Another study used the BREAST-Q as a categorical, not continuous variable, to assess post-operative outcomes in 582 women who underwent unilateral implant-based reconstruction. The authors reported improved outcomes, defined as a raw BREAST-Q score ≥ 4 , in women with contralateral augmentation, compared with contralateral mastopexy or reduction ¹².

The physical well-being domain of the BREAST-Q reconstruction module asks questions about sensory disturbances, such as pain, aches, tightness, pulling, and nagging involving the chest and surrounding areas. It is noteworthy that the physical well-being scores were significantly lower in the reduction and mastopexy than in the no symmetry group. On multivariable regression analysis, the reduction in physical well-being domain score trended

towards significance (Supplementary Tables S2 and S3). Barone et al. also reported that women with contralateral augmentation achieved significantly better physical well-being than their comparator groups mastopexy or reduction¹². Nonetheless, as they did not include a control group without a symmetry procedure, the findings of greater chest wall morbidity following reduction or mastopexy are unique to the current study. Because these procedures involve additional incisions, tissue manipulation, and scars on the contralateral side, women should be advised about potential trade-offs when considering either reduction or mastopexy. Not surprisingly, PMRT also significantly lowered physical well-being scores as well.

The main strength of this study is its use of a condition-specific PRO instrument, BREAST-Q reconstruction module, to evaluate long-term outcomes of contralateral symmetry procedures in a homogenous cohort from a single high-volume center. The lengthy follow-up period has also added objective evidence about some of the longitudinal shortcomings of prosthetic relative to autologous breast reconstruction. That is, over time, patient-reported satisfaction with implants can be less stable than with autologous transfer. The study also has some limitations. Preoperative satisfaction with breasts was not available. Patients' baseline satisfaction with their breasts could have a positive or negative influence on BREAST-Q scores. Future studies should be designed to further elucidate this question. Lastly, because of the retrospective nature of the study, data on the reasons why some women chose to undergo symmetry procedures and others did not, was also unavailable. Qualitative preoperative and postoperative interviews with patients might prove useful to shed some light on the reasons underlying this important choice.

CONCLUSIONS

Prosthetic reconstruction with contralateral breast augmentation was associated with significantly greater satisfaction with breasts and reconstructive outcome compared to the controls. In contrast, patients undergoing mastopexy or breast reduction demonstrated no improvement in satisfaction and simultaneously experienced lower physical well-being. Such information can be used to improve the shared decision-making process for women who choose unilateral prosthetic breast reconstruction.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1:**Baseline Patient Demographics and Clinical Characteristics**

Characteristics	Augmentation (n = 67)	Mastopexy (n = 68)	Reduction (n = 93)	Controls (n = 325)	p-Value
Age, mean (SD), years	53 (10.10)	52 (9.92)	52 (9.64)	50 (9.80)	0.62
BMI, mean (SD)	23 (3.98)	26 (3.63)	29 (5.28)	25 (5.75)	<0.01
PMRT, n (%)	7 (10%)	10 (15%)	31 (33%)	65 (20%)	<0.01
Chemotherapy, n (%)	29 (43%)	38 (56%)	51 (55%)	152 (47%)	0.25
Follow-up time, mean (SD), months	52 (33.31)	51 (34.88)	50 (31.27)	48 (30.08)	0.61

BMI, body mass index; PMRT, post-mastectomy radiotherapy; controls, no contralateral symmetry procedure; SD, standard deviation

Table 2:

BREAST-Q scores of contralateral augmentation versus no symmetry group

BREAST-Q Domain	Contralateral Augmentation (n = 67), Mean (SD)	No symmetry procedure (n = 325), Mean (SD)	p-value
Satisfaction with Breasts	66.22 (18.89)	60.01 (18.22)	0.01
Satisfaction with Outcomes	78.13 (21.75)	71.05 (20.90)	0.01
Psychosocial Well-being	77.13 (21.93)	76.68 (19.63)	0.86
Sexual Well-being	58.74 (21.39)	54.46 (22.62)	0.16
Physical Well-being	77.64 (16.95)	76.92 (16.08)	0.73

SD, standard deviation

Table 3:

BREAST-Q scores of mastopexy versus no symmetry group

BREAST-Q Domain	Mastopexy (n = 68), Mean (SD)	No symmetry group (n = 325), Mean (SD)	p-Values
Satisfaction with Breasts	58.00 (22.47)	60.01 (18.22)	0.42
Satisfaction with Outcomes	67.01 (21.51)	71.05 (20.90)	0.15
Psychosocial Well-being	72.59 (20.13)	76.68 (19.63)	0.12
Sexual Well-being	54.35 (22.83)	54.46 (22.62)	0.97
Physical Well-being	71.94 (18.66)	76.92 (16.08)	0.02

SD, standard deviation

Table 4:

BREAST-Q scores of reduction versus no symmetry group

BREAST-Q Domain	Reduction (n = 93), Mean (SD)	No symmetry (n = 325), Mean (SD)	p-Value
Satisfaction with Breasts	59.24 (21.72)	60.01 (18.22)	0.72
Satisfaction with Outcomes	68.15 (26.04)	71.05 (20.90)	0.26
Psychosocial Well-being	73.34 (21.12)	76.68 (19.63)	0.16
Sexual Well-being	53.96 (26.52)	54.46 (22.62)	0.86
Physical Well-being	71.93 (18.79)	76.92 (16.08)	0.01

SD, standard deviation

Table 5:

Multivariable linear regression analysis ^{*} for 'Satisfaction with Breast' domain BREAST-Q score with contralateral augmentation symmetry procedure

Independent Predictors	β Coefficient	<i>p</i> -Value
Symmetry Status (Augmentation vs. Control)	5.30	0.04
Age, years	-0.15	0.50
BMI	-0.37	0.04
Chemotherapy (yes vs. no)	-4.16	0.04
Post-mastectomy radiotherapy (yes vs. no)	-5.58	0.03
Follow up time, months	0.00	0.40

BMI, body mass index

^{*} Adjusted for age, BMI, chemotherapy, post-mastectomy radiotherapy, and the follow-up time in months.