

Tracking the aesthetic outcomes of prosthetic breast reconstructions that have complications

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BACKGROUND: Aesthetic results following breast reconstruction have been shown to be a major contributor to patient satisfaction. While many presume that complications after reconstruction impact final aesthetic results, little data exist to substantiate this putative relationship.

OBJECTIVE: To track and evaluate aesthetic outcomes following implant reconstructions with complications.

METHODS: A chart review was conducted on a series of consecutive expander-implant breast reconstructions performed by the senior author between 2004 and 2012. Included patients completed their prosthetic reconstruction or converted to autologous methods and had a minimum follow-up period of 130 days. Four blinded members of the division of plastic surgery independently rated postoperative anterior photographs of patients' breasts using a validated scoring scale with respect to five distinct aesthetic domains: breast mound volume, contour, placement, scarring and inframammary fold.

RESULTS: Of the 172 patients who met the inclusion criteria, 36 experienced a complication. The tissue expander in one-half of these patients was salvaged and the remaining patients converted to autologous reconstruction. The average aesthetic scores for each domain did not differ significantly between patients who experienced a complication and retained their expander and those who did not experience a complication. Patients who converted to autologous tissue reconstruction after experiencing a complication had the highest aesthetic scores.

DISCUSSION: The ability to obtain aesthetic results following a complication that were not statistically different from results in those without complications may reflect the surgeon's refined attempt to salvage the initial implant reconstruction; in other circumstances, the improved cosmesis was achieved through conversion to an autologous tissue-based method.

CONCLUSION: The present study quantitatively assessed the impact of complications on aesthetic outcomes following implant breast reconstruction. Continuance of prosthetic reconstruction and conversion to autologous reconstruction serve as viable options to obtain adequate aesthetic scores following a complication. Information gained from the present analysis will help manage patient expectations.

Key Words: *Aesthetic; Breast reconstruction; Outcomes; Prosthetic*

Breast reconstruction can help moderate the distressing postoperative changes in body image and the quality of life of breast cancer patients undergoing mastectomy (1-4). In particular, the literature has shown aesthetic results following reconstruction to be a major contributor to patient satisfaction and overall quality of life (5). With numerous reconstruction techniques currently available, myriad studies have detailed the postoperative surgical and cosmetic outcomes of such methods. In addition, factors that may influence final aesthetic results, such as body mass index (BMI), preoperative and postoperative radiation, and age, have also been assessed (6-21). However, little data regarding the impact of postoperative complications on aesthetic

Le suivi des résultats esthétiques des reconstructions par prothèses mammaires qui s'associent à des complications

HISTORIQUE : Il est démontré que les résultats esthétiques après une reconstruction mammaire contribuent énormément à la satisfaction des patientes. On présume souvent que les complications observées après une reconstruction nuisent aux résultats esthétiques finaux, mais il existe peu de données pour corroborer ce prétendu lien.

OBJECTIF : Suivre et évaluer les résultats esthétiques après des reconstructions par prothèse s'associent à des complications.

MÉTHODOLOGIE : Les chercheurs ont examiné les dossiers consécutifs de reconstructions mammaires par prothèses d'expansion effectuées par l'auteur principal entre 2004 et 2012. Les patientes participantes ont subi une reconstruction prothétique complète ou sont passées à une méthode autologue et ont été suivies pendant au moins 130 jours. Quatre membres de la division de chirurgie plastique ont évalué de manière indépendante et en insu les photographies postopératoires antérieures des seins des patientes au moyen d'une échelle d'évaluation validée dans cinq domaines esthétiques : volume du monticule mammaire, contour, emplacement, cicatrices et pli inframammaire.

RÉSULTATS : Chez les 172 patientes qui respectaient les critères d'inclusion, 36 ont présenté une complication. La moitié d'entre elles ont pu conserver leur prothèse d'expansion, mais les autres sont passées à une reconstruction autologue. Les résultats esthétiques moyens de chaque domaine ne différaient pas de manière significative entre les patientes qui avaient subi une complication et conservé leur prothèse et celles qui n'avaient pas subi de complication. Les patientes qui sont passées à une reconstruction par tissus autologues après une complication obtenaient les meilleurs résultats esthétiques.

EXPOSÉ : Les résultats esthétiques après une complication qui n'étaient pas statistiquement différents de ceux des patientes n'ayant pas vécu de complication reflètent peut-être la tentative perfectionnée du chirurgien de sauvegarder la prothèse initiale. Dans les autres situations, la conversion aux tissus autologues favorisait une meilleure esthétique.

CONCLUSION : La présente étude visait à obtenir une évaluation quantitative des effets des complications sur les résultats esthétiques après une reconstruction mammaire par prothèse. Le maintien de la reconstruction par prothèse et la conversion à une reconstruction autologue permettaient d'obtenir des résultats esthétiques satisfaisants après une complication. L'information tirée de la présente analyse contribuera à gérer les attentes des patients.

outcomes of breast reconstruction exist (22). Does having a complication necessarily mean an adverse aesthetic outcome? We endeavored to track aesthetic outcomes following implant reconstruction in patients who experienced a complication.

Studies have shown that complications following surgery can negatively impact a patient's health status, extend hospital stays and lead to higher medical bills (23-26). The potential ramifications of complications on local vasculature and wound healing may be of particular importance in the reconstruction population, in which improved aesthetic outcomes enhance a patient's self image and well-being. To date, there has been little investigation into whether complications actually

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TABLE 1
Preoperative patient demographics and characteristics

Characteristic	Complication		P
	No (n=136)	Yes (n=36)	
Age, years, mean \pm SD	49.31 \pm 15.53	51.57 \pm 8.35	0.547
Body mass index, mean \pm SD	27.04 \pm 5.91	29.40 \pm 6.06	0.038*
Diabetes	2.22	11.11	0.106
Smoking	5.88	0.00	0.597
Hypertension	19.12	16.67	1.000
Radiation			
Previous radiation	6.06	12.50	1.000
Postoperative radiation	18.75	29.41	0.335
Chemotherapy	46.21	58.82	0.327
Acellular dermal matrices	48.51	36.84	0.730
Bilateral	41.91	50.00	0.515

Data presented as % unless otherwise indicated. *Statistically significant.

result in poorer cosmetic outcomes in these patients. Previous studies involving reconstruction patients have focused on the overall aesthetics associated with various methods, with some additional analysis of factors that may have contributed significantly to the final cosmetic result (6,10,13,15). Such studies have revealed that autologous tissue-based reconstruction can yield superior aesthetic results compared with prosthetic methods (6,18,19), while implicating breast size, final implant volume, radiation status and BMI as important contributors to aesthetic outcomes in the implant population (10,11).

The present study aimed to track aesthetic outcomes in implant breast reconstruction cases that involved complications. A more thorough understanding of how complications influence aesthetics may be derived from our use of a validated aesthetic scoring scale. Moreover, we stratified aesthetic outcomes according to a more detailed validated metric that encompassed breast mound volume, placement, contour, scarring and inframammary fold definition.

METHODS

Following institutional review board approval, a retrospective chart review was conducted on a series of consecutive expander-implant breast reconstruction operations performed by the senior author between 2004 and 2012. Patients were excluded from the study if they had <130 days of follow-up. Demographic and oncological variables included: age, BMI, active smoking status, diabetes, postmastectomy radiation therapy, history of radiation therapy and chemotherapy. Surgical variables included operative time, intraoperative tissue expander fill volume and final implant fill volume. Complications and final reconstruction technique (continued prosthetic or conversion to autologous) were tracked via retrospective review of physician and clinical notes.

Four blinded members of the division of plastic surgery who did not participate in the care of the patients were asked to independently rate postoperative anterior photographs of patients' breasts using a three-point scale (0 to 2) with respect to five distinct aesthetic domains: breast mound volume, contour, placement, scarring and inframammary fold. Additional photographic views were inconsistently captured for patients and, therefore, not incorporated into the analysis. Gui et al (17) described a rating of zero in each of the respective fields as the following: marked difference in volume relative to the contralateral side; marked contour deformity or shape asymmetry; marked displacement of breast mound; hypertrophic scars and evident contracture; and a poorly defined inframammary fold. A score of 1 on the Lowery scale reflected mild discrepancies in volume and contour relative to the contralateral side, fair scarring (ie, poor colour match or wide scars without hypertrophy or contracture) and a defined yet asymmetrical inframammary fold. Any criterion with a score of 2 had quality aesthetic outcomes – specifically, minimal differences in volume, contour

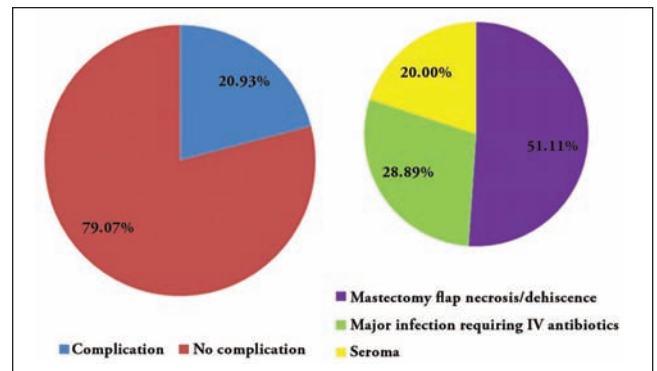


Figure 1) Breakdown of complications in the patient population. IV Intravenous

and placement, thin scars and symmetrical inframammary folds. Kappa (κ) scores were calculated to statistically evaluate the inter-rater agreement of the four raters in the study; all measures fell into the good or excellent categories ($\kappa > 0.60$).

Aesthetic scores of the cohorts with and without complications were statistically compared and analyzed using Student's *t* tests. Demographic variables were compared using Student's *t* tests for continuous variables and χ^2 or Fisher's exact test for categorical variables, as appropriate. A complication was defined as the presence of one or more of the following: mastectomy flap necrosis or dehiscence, seroma and infection requiring intravenous (IV) antibiotics (ie, National Cancer Institute Common Toxicity Criteria grade 3 or higher) (27). The complication cohort was further stratified according to final reconstruction method (implant versus autologous reconstruction), with aesthetic scores evaluated using Student's *t* tests. All analyses were performed using SPSS version 20.0 (IBM Corporation, USA).

RESULTS

Of the 172 patients who met the inclusion criteria, 36 (20.93%) experienced at least one defined complication (Table 1). The most common complication was mastectomy flap necrosis/dehiscence, found in 63.89% of patients with a recorded complication. Slightly more than 35% of these patients also experienced a major infection requiring IV antibiotics and 25% had a seroma (Figure 1). The cohort with complications had, on average, a higher BMI (29.40 kg/m² versus 27.04 kg/m²; $P = 0.038$) compared with the population without complications (Table 1). However, the cohorts were relatively similar regarding other captured characteristics, with no significant differences in age, active smoking status, chemotherapy, diabetes and hypertension.

Eighteen of the 36 patients who experienced a complication salvaged their expander and continued with prosthetic reconstruction, while the remaining 18 converted to autologous reconstruction. The aesthetic scores for all five domains (breast mound volume, contour, placement, scarring and the inframammary fold) for patients with a complication who kept their expander and those without any complication are presented in Figure 2. Inter-rater agreement on aesthetic scoring was examined by kappa score analysis and deemed to be acceptable ($\kappa > 0.60$). The inframammary fold proved to be the highest-scoring category in the complication cohorts, while placement was the highest scoring in the group without complication. The lowest-scoring category for patients who completed prosthetic reconstruction (with or without complications) was breast contour. The population without complications trended toward higher aesthetic scores compared with the population who experienced a complication and retained the expander for all five domains (breast mound volume, contour, placement, scarring and inframammary fold definition); however, these did not reach statistical significance. Photographic documentation of aesthetic outcomes in patients who experienced complications is presented in Figures 3 and 4.

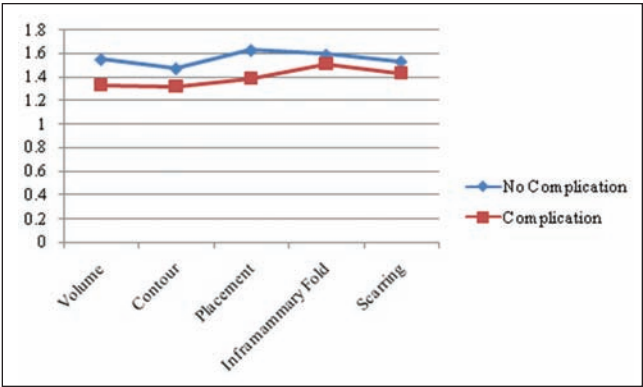


Figure 2) Aesthetic scores in patients who experienced a complication and completed prosthetic reconstruction compared with patients without complications

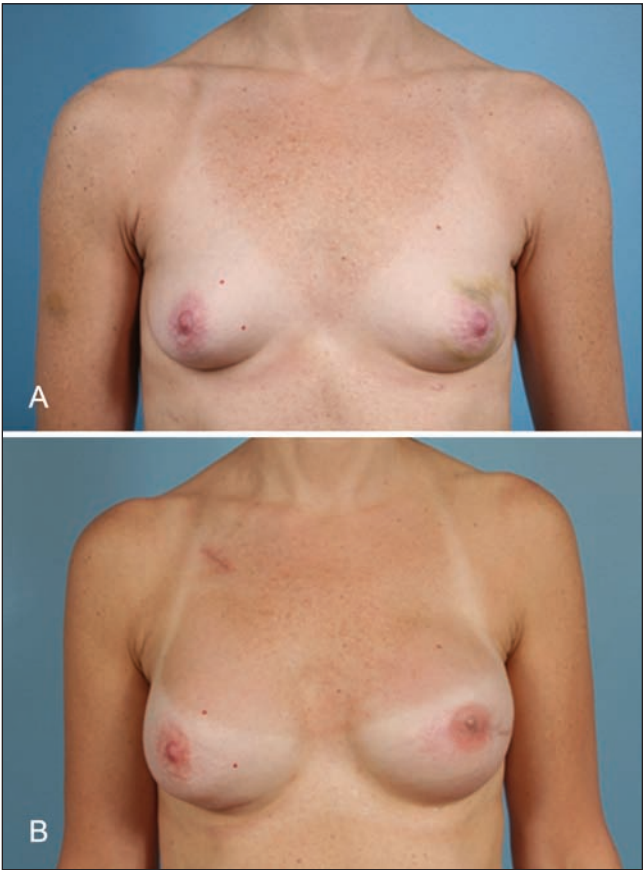


Figure 3) Reasonable aesthetic outcomes in a patient who experienced a complication. **A** Preoperative photograph. **B** Postoperative photograph. This is a 53-year-old woman who underwent left skin-sparing mastectomy with CPX3 expander placement, followed by postoperative radiation. She acquired a major infection requiring hospital admission and intravenous antibiotics. She subsequently underwent exchange to silicone implant with contralateral augmentation for symmetry. Figure 2B represents her photographic result eight months after resolution of the infection

Aesthetic scores for all five domains were also compared within the population that experienced a complication. Evaluation based on final reconstruction revealed that patients who converted to an autologous tissue flap had superior aesthetic ratings in breast volume, contour and placement, as well as inframammary fold definition, compared with those who completed implant surgery (Figure 5).



Figure 4) Poor aesthetic outcomes in a patient who experienced a complication. **A** Preoperative photograph. **B** Postoperative photograph. This is a 34-year-old woman who underwent bilateral skin-sparing mastectomy with expander placement, followed by postoperative radiation to the left breast. She experienced left mastectomy flap necrosis requiring debridement. The flap was salvaged without surgery and she subsequently underwent bilateral exchange to silicone implants. Note the postoperative tightening, apparent volume loss and elevation of the inframammary fold nine months after resolution of her complication

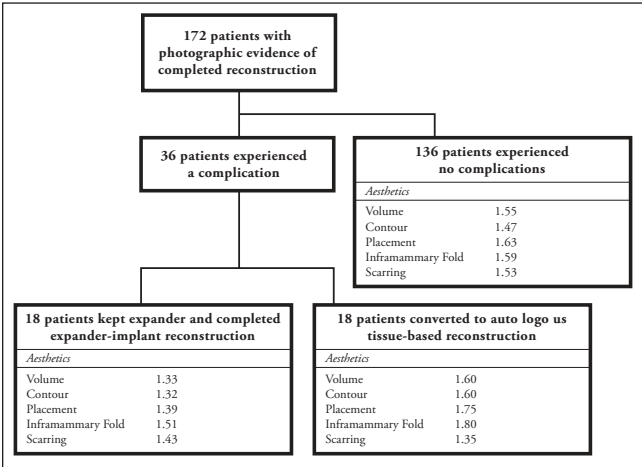


Figure 5) Tracking aesthetic outcomes in implant-based reconstruction with complications

DISCUSSION

The literature has shown that breast reconstruction helps ameliorate the known physical, emotional and psychological impact of mastectomy in breast cancer patients (1-5). The aesthetic outcomes of reconstruction, in particular, serve as an important contributor to the

recovery and overall quality of life in this patient population. As such, concern exists as to how – and to what degree – complications following reconstructive surgery impact final aesthetic outcomes and patient satisfaction. While many hypothesize that postoperative complications do impact cosmesis, there remains a paucity of firm data to support this putative connection.

Many studies have focused on aesthetic results and patient satisfaction following breast reconstruction, and additional investigation has been conducted on factors that influence final cosmesis (6,18,28,29). However, the impact of such findings is mitigated by the fact that the majority of these studies used nonvalidated aesthetic scoring scales and lacked details regarding specific aesthetic domains. While one specific study revealed that implant patients with complications have lower aesthetic satisfaction rates compared with those who did not experience a complication, the authors did not provide adequate information regarding the final reconstruction course of these cases; these findings also lacked any correlation to specific aesthetic domains or aesthetic scores. Therefore, our understanding of how complications directly impact breast reconstruction aesthetics remains limited. The present study was the first to track and quantitatively evaluate aesthetic outcomes of implant reconstructions that have had complications using a validated aesthetic scoring scale.

Patients who experienced a complication in our study were relatively similar to those who did not experience a complication, with the exception of having a significantly higher average BMI. Aesthetic analysis revealed no significant differences in scores between the populations with and without complications in any of the five measured aesthetic domains. While the complication cohort did trend toward lower average scores in all domains, this may be partially attributable to predisposing patient factors. Importantly, the higher BMI and greater use of radiation noted in this population were likely partial contributors to poorer aesthetic scores. This is substantiated by examination of radiation use and outcomes in our own database, which revealed that average contour and placement scores were 1.33 and 1.45 in the radiated cohort, respectively, compared with scores of 1.51 and 1.74 in the nonradiated cohort ($P < 0.05$).

The ability to obtain aesthetic results following a complication that were not statistically different from results in those without complications may reflect the surgeon's refined attempt to salvage the initial implant reconstruction. In other circumstances, the improved cosmesis was achieved through conversion to an autologous tissue-based method. Of note, patients who had a complication and retained their original expander displayed a downward trend in aesthetic scores for all five domains compared with the uncomplicated population. Those who experienced a complication and decided to convert to autologous reconstruction actually obtained higher aesthetic scores than patients who never experienced a complication. This is consistent with previous literature reporting that autologous reconstruction yields the best aesthetic results (6,18). While a postoperative complication is never a desired or intended outcome, our results provide information that may aid in patient education both preoperatively and in the postoperative period. Specifically, for individuals who encounter a complication, it may be helpful to understand the benefits and drawbacks of trying to salvage an original reconstruction compared with converting to autologous reconstruction.

We acknowledge that the insignificant variances in aesthetic values between patients with complications may correlate to significant clinical differences for patients. A study by Colakoglu et al (22) revealed a significant decrease in postreconstruction aesthetic satisfaction in individuals who experienced a complication. However, it is unknown what impact the complications specifically had on cosmesis because details regarding aesthetics were not reported. Moreover, participant demographic data were not provided and, therefore, certain patient factors – including radiation use – could have contributed to poorer aesthetic outcomes in these patients. Additionally, the survey used in the study by Colakoglu et al (22) may have been subject to participant bias because individuals who experienced a complication

could have held a more negative impression of their overall postoperative experience and been inclined to provide lower satisfaction scores for any area pertaining to their operation. Additional analysis regarding the association between complications and aesthetic satisfaction and scores is, therefore, needed to allow for further clarification of this relationship.

We recognize that our study had inherent limitations. Implementing a minimum follow-up period of 130 days reduced the number of patients included. Our study population size was also limited by a lack of proper photographic documentation in many tracked patients. Even with a set follow-up period in place, we acknowledge the possibility that unresolved complications could have been present at the time of aesthetic evaluation. This may have contributed to the lower, albeit insignificant, aesthetic scores associated with the complication cohort in the present study. While others place merit in computer-assisted volumetric evaluations of photographs, scoring scales present several advantages, namely accessibility, intuitively meaningful data and lower costs. Therefore, we used a validated scale specific to breast cosmesis evaluation with well-described subcriteria. The specific scale used in the present study has significantly higher inter-rater reliability compared with scales without specific criteria. To prove this, we calculated kappa scores to statistically evaluate the inter-rater agreement of the four raters in our study and all measures fell into the good or excellent categories ($\kappa > 0.60$).

CONCLUSION

Through the present quantitative aesthetic assessment of prosthetic breast reconstruction cases with complications, we reveal that both continuance of prosthetic reconstruction and conversion to autologous reconstruction serve as viable options to obtain adequate aesthetic scores. Specifically, patients with salvaged expanders did not experience a significant adverse impact to breast placement, contour and volume, scarring or inframammary fold definition scores. By isolating specific features of aesthetic outcomes, these findings will enhance the management of patient expectations.

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