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Oncoplastic breast conserving surgery is associated with a lower rate of surgical site complications compared to standard breast conserving surgery☆

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ABSTRACT

Background: Oncoplastic breast conserving surgery (OBCS) integrates plastic surgery techniques in the resection of breast cancer and lowers the rate of re-excision while improving breast cosmesis. The goal of this study is to compare the surgical site complication rate of OBCS with that of standard BCS.
Methods: A single institution chart review evaluated all patients undergoing BCS for treatment of breast cancer. Patients treated from January 2009 to December 2010, prior to adoption of oncoplastic techniques, were identified as the standard surgery (SS) group. Patients treated with OBCS from January 2013 to July 2015 were identified as the oncoplastic surgery (OS) group. All surgical site complications were recorded.
Results: Overall, 561 patients were evaluated. The SS group comprised 273 patients compared with 288 patients in the OS group. Surgical site complications occurred in 49 patients (17.9%) in the SS group compared with 23 patients (8.0%) in the OS group ($p < 0.001$).
Discussion: Overall, BCS has a low rate of significant surgical site complications. OBCS has a lower rate of surgical site complications compared to standard BCS.

Introduction

Multiple landmark studies have demonstrated no difference in long-term survival in breast cancer patients treated with mastectomy or breast conserving surgery (BCS).[1,2,3] Recent advances in screening modalities and neoadjuvant chemotherapy regimens have allowed up to 80% of patients with breast cancer to consider breast conserving therapy; however, breast conservation continues to be underutilized despite its potential for positive effects on a patient's physical appearance and emotional well-being.[4,5,6]

The goal of breast conserving therapy is to resect breast cancer with adequate surgical margins while preserving breast cosmesis.[6,7] Balancing the oncologic need for wide local excision with the desire for an aesthetic result can be challenging, with reported suboptimal cosmetic outcomes occurring in up to 30% of patients undergoing BCS.[8,9] Major deformity and asymmetry can contribute to negative body image and poor quality of life.[8,9,10]

Oncoplastic BCS techniques maximize oncologic outcome while preserving breast aesthetics by combining plastic surgery techniques and immediate tissue transfer with tumor resection.[8] This approach reduces the incidence of positive margins and need for post-operative re-excision while preserving, or even enhancing, the natural shape, symmetry, and cosmetic appearance of the breast.[10,11] Oncoplastic procedures not only preserve cosmesis, but also enable resection of larger tumors without resorting to mastectomy.[11] Although studies have demonstrated the oncologic benefit of oncoplastic surgery, few have addressed complications.[12] The primary goal of this study is to compare surgical site complication rates for oncoplastic BCS and standard BCS. As a secondary goal, we endeavored to delineate the relationship between breast surgery specialization and surgical site complications within breast surgery.

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Patients and methods

This is a single institution study evaluating the rates of surgical site complications at The Breast Center at Virginia Mason in Seattle, WA before and after adoption of oncoplastic BCS. The study was approved by the institutional review committee and met the guidelines of the Benaroya Research Institute. All patients with breast cancer treated at The Breast Center at Virginia Mason from January 2009 to July 2015 were reviewed. From January 1, 2009 to December 31, 2010, patients were treated with standard surgery (SS group). From January 1, 2013 through July 31, 2015, patients were treated with oncoplastic surgery (OS group) performed by surgical breast oncologists. Oncoplastic surgery was adopted in 2011; however, patients treated between January 2011 and December 2012 were excluded from the study to allow for the learning period needed during the adoption of new surgical techniques. Oncoplastic techniques included predominantly radial ellipse with adjacent tissue transfer, racquet mammoplasty, mastopexy, and reduction mammoplasty. Patients undergoing mastopexy, reduction mammoplasty, and racquet mammoplasty were offered symmetry procedures on the contralateral side when appropriate. No tissue flaps were offered to this cohort. All patients in this study underwent standard external beam radiation therapy following partial mastectomy.

All patients diagnosed with breast cancer underwent standard preoperative workup including mammogram, ultrasound, and breast MRI when not contraindicated. Candidacy for BCT was determined by the surgical breast oncologist based on imaging studies, clinical exam and patient desire for BCT. The preoperative work up was similar during the two time periods. All patients were seen in post-operative follow-up within two weeks of their operation and as needed for management of complications. Patients treated in the OS group had an additional six month follow up visit with the operating surgeon and were followed in the Breast Clinic annually thereafter. The additional follow up in the OS group was due to surgeons preference and thus institutional change in standard breast cancer surveillance.

All complications associated with the SS group were identified through clinical chart review and Cancer Registry data. Complications for the OS group were identified through chart review as well as prospectively collected data in the Virginia Mason Multidisciplinary Breast Cancer Database.

Pearson's chi-squared tests were used for comparison of categorical variables and unpaired t-tests were used for comparison of continuous variables. Unadjusted logistical regression was performed using MedCalc version 12.7.5. *P*-values less than or equal to 0.05 were considered statistically significant.

Results

A total of 561 patients were evaluated. The SS group comprised 273 patients. The OS group consisted of 288 patients. Patient age and tumor histology were not significantly different between the two groups. Tumor size in the OS group was significantly larger than in the SS group (16.7 mm *vs* 13.0 mm, $p = 0.001$) (Table 1). Overall, 72 (12.8%) patients out of the total 561 had a documented complication. None of the patients in either group had fatal or life-threatening complications such as perioperative death, myocardial infarction, or pulmonary embolism. The most common surgical site complications documented were infection requiring antibiotic therapy (including cellulitis and deep abscess), postoperative seroma, epidermolysis, superficial wound dehiscence, and post-operative ecchymosis.

In the OS group, 23 patients (8.0%) developed surgical site complications compared with 49 patients (17.9%) in the SS group (OR 0.28, 95% CI 0.16 to 0.51, $p < 0.001$). Patients in the SS group had a significantly higher rate of infection (SS 8.4% *vs* OS 1.7%, $p = 0.01$) and seroma formation (SS 4.4% *vs* OS 1.7%, $p = 0.04$) compared to patients in the OS group. There was no statistical difference in the rate of epidermolysis, superficial wound dehiscence, and post-operative ecchymosis (Table 2). In the OS group, 195 of the patients underwent symmetry procedures at the time of their partial mastectomy. 21 of the 23 complications occurred in the breast that had cancer and 2 occurred in the contralateral side from the symmetry procedure.

Smoking, BMI greater than 30, age greater than 61, administration of neoadjuvant or adjuvant chemotherapy as well as need for re-excision were not associated with increased rate of surgical site complications on both univariate and multivariate analysis.

Within the SS group, several general surgeons performed breast surgery. Surgeons who performed 50 or more breast surgery cases per year were considered high volume breast specialists.[13] The surgical site complication rate in the SS group was significantly lower when BCS was performed by breast specialists (15.8% *vs* 32.6%, $p = 0.012$) (Fig. 1). All surgeons in the OS group were breast specialists; therefore, similar comparisons were not done for the OS group. When patients in the SS group whose operations were performed by surgeons who were not breast surgeons were excluded, the complication rate for SS group remained significantly higher than for the OS group (15.8% *vs* 8.0%, $p = 0.017$).

Despite the differences in surgical site complications, the need for post-operative interventions was not statistically different (SS 54.9% *vs* OS 60.1%, $p = 0.80$). No patients in either group required reoperation for management of their complications. Interventions in both groups were limited to outpatient aspirations, antibiotics, suture removal, and local wound care.

The most commonly employed oncoplastic techniques in the OS group included radial ellipse with adjacent tissue transfer (74 cases), racquet mammoplasty (75 cases), mastopexy (65 cases), and reduction mammoplasty (51 cases) (Table 3). The surgical site complication rate was highest in patients who underwent reduction mammoplasty (13.7%), and lowest in patients who underwent radial ellipse (4.1%). The most prevalent complication in the reduction mammoplasty group was superficial triple point dehiscence (3 cases), all of which healed without intervention.

Discussion

Overall, BCS is associated with a low incidence of surgical site complications. Oncoplastic surgery has not been widely adopted in the United States despite its oncologic and cosmetic benefits.[5] Critics postulate that operations of higher complexity and large degree of tissue rearrangement carry unnecessary increased risk of surgical site complication. This study demonstrates that oncoplastic BCS is associated with a lower rate of surgical site complications compared to standard BCS.

Previous studies have demonstrated that oncoplastic BCS is associated with lower rates of mastectomy and re-excision than traditional BCS.[11] Additionally, studies have also shown that mastectomy is associated with negative body image and high surgical site complication rates.[5,14] Given this constellation of findings, oncoplastic surgery may be the ideal approach to maximize oncologic and cosmetic outcomes while reducing rates of mastectomy, re-excision, and surgical site complications.

Patients with significant comorbidities are considered poor candidates for plastic surgery procedures and may be discouraged from considering oncoplastic surgery. Patients at our institution are offered oncoplastic BCS regardless of body mass index, smoking history, factors that are known to impart an increased risk of wound healing and surgical site complications.[15] Patients are counseled

Table 1
Patient demographics and tumor histology.

Demographics	SS N = 273 (%)	OS N = 288 (%)	P value
Age (years)	61.0 ± 12.07, range 35–91	60.9 ± 12.82, range 29–86	0.57
Tumor size (mm)	13.0 ± 10.6, range 0–64	16.7 ± 15.2, range 0–130	**0.003**
BMI	28.20 ± 6.86, range 16–49	28.24 ± 7.04, range 18–50	0.94
Smoking history	36 (13.2%)	42 (14.6%)	0.71
Chemotherapy	59 (21.6%)	78 (27.1%)	0.14
Neoadjuvant	11 (4.0%)	24 (8.3%)	**0.04**
Adjuvant	48 (17.6%)	54 (18.8%)	0.80
Required additional surgery for inadequate margins	96 (35.1%)	60 (20.1%)	<**0.001**
Histologic type:			
Invasive ductal carcinoma	145 (53%)	146 (51%)	
Invasive lobular carcinoma	13 (5%)	21 (7%)	
Invasive carcinoma with ductal and lobular features	37 (13%)	32 (11%)	0.62
Ductal carcinoma-in-situ	70 (26%)	79 (27%)	
Other	8 (3%)	10 (3%)	
Receptor Status:			
Estrogen Receptor Positive	243 (89.0%)	253 (87.8%)	0.69
Progesterone Receptor Positive	227 (83.2%)	233 (80.9%)	0.82
Her2 Positive	13 (4.8%)	20 (6.9%)	0.28

Table 2
Complication types.

Complication Type	SS N = 273 (%)	OS N = 288 (%)	P value
Infection	21 (8.4%)	15 (3.3%)	0.01
Epidermolysis	2 (0.7%)	2 (0.4%)	0.99
Seroma	12 (4.4%)	8 (1.8%)	0.04
Dehiscence	13 (4.7%)	14 (3.1%)	0.31
Post-operative ecchymosis	1 (0.4%)	4 (0.9%)	0.59
Total	49 (17.9%)	43 (9.5%)	<0.001

about the higher risk of complications associated with these conditions, but are not denied the opportunity for oncoplastic surgery on the basis of comorbidities. In our analysis, smoking, elevated BMI, and administration of chemotherapy were not associated with an increased rate of complications; therefore, high BMI and smoking history should not preclude consideration of oncoplastic surgery.

Patients who underwent mastopexy, reduction mammoplasty, and racquet mammoplasty were offered symmetry procedures on the contralateral side. One of the criticisms of oncoplastic surgery is the performance of operations on the contralateral side without medical necessity. In our study, only two patients out of the 195 (1%) that received symmetry procedures experienced complications on the contralateral breast. Both of the patients had superficial triple point dehiscence following reduction mammoplasty and neither patient required intervention.

Although the groups were similar with respect to overall use of chemotherapy, the OS group had a higher rate of patients undergoing neoadjuvant chemotherapy compared to the SS group. We postulate that this was largely due to the increased adoption of neoadjuvant regimens during that time period given increasing data demonstrating ability to downsize tumors in an effort to enable breast conservation.

Reduction mammoplasty is commonly employed as an immediate reconstructive option for patients undergoing BCS. Our reported rate of complications in the patients who underwent reduction mammoplasty in the oncoplastic surgery group is consistent with the rate of surgical site complications cited in the plastic surgery literature. Reduction mammoplasty, when performed for symptomatic macromastia, carries a 15–30% rate of surgical site complications[16] Some plastic surgeons have advocated

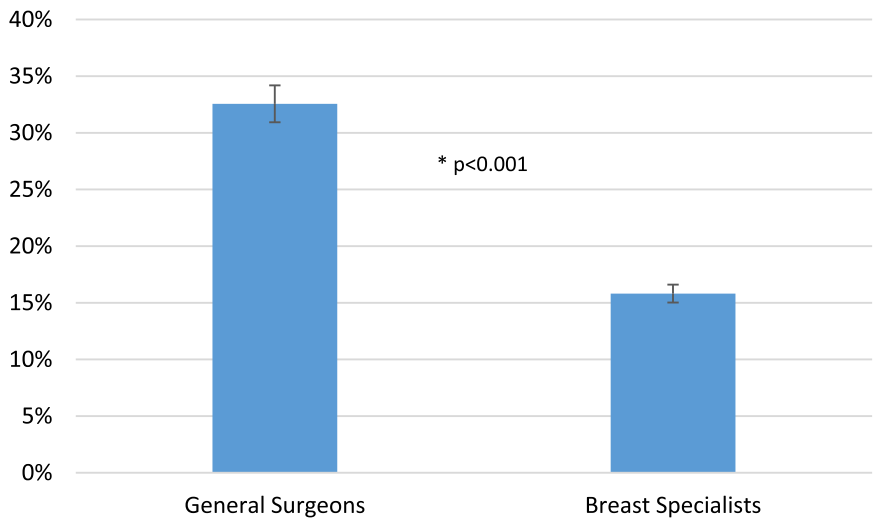

Fig. 1. Rates of surgical site complications for general surgeons and breast specialists in the standard surgery group.

Table 3
Types of oncoplastic surgery techniques and associated complication rates.

Technique	Total N = 288	% of OS cases	Complications	Complication Rate
Reduction Mammoplasty	51	18%	7	13.7%
Mastopexy	65	23%	5	7.7%
Racquet Mammoplasty	75	26%	8	10.7%
Radial Ellipse	74	25%	3	4.1%
Other	23	8%	0	0.0%

for staged reconstruction, with reduction mammoplasty being performed weeks and sometime months after the initial partial mastectomy; however, recent studies have demonstrated that risk of surgical site complications is lowest when reduction mammoplasty is performed immediately following partial mastectomy.[17] Egro et al. reported a 33% risk of surgical site complications when reduction mammoplasty was performed in a delayed immediate fashion and as high as a 60% risk when performed in a delayed fashion.[18] This study showed an even lower complication rate (13.7%) when reduction mammoplasty was performed at the time of cancer resection, supporting the use of reduction mammoplasty in oncoplastic BCS.

There is increasing interest in relationships between patient outcomes and surgeon specialization, surgeon volume, and hospital volume. As demonstrated most effectively in the colorectal surgery literature, higher volume surgeons have been associated with improvement in postoperative mortality, local recurrence, and long term survival.[18,19] There are fewer studies in breast surgery; however, a single institution study at the University of Indiana found that surgeons who specialize in diseases of the breast demonstrate significant improvement in short-term outcomes associated with breast cancer treatment when compared to surgeons who do not specialize in diseases of the breast.[20] Our results also demonstrated a lower incidence of surgical site complications when operations were performed by surgeons specializing in breast surgery. Further studies are warranted to identify factors contributing to these differences and to identify specific volume thresholds associated with lower surgical site complications.

This study is limited by its single institution design. It reports outcomes of breast surgeons with unique skills in advanced oncoplastic surgical techniques who perform both the oncologic resection and the tissue rearrangement techniques without the assistance of plastic surgeons. In most institutions, the paradigm is for general surgeons or breast surgeons to perform the oncologic portion of the procedure and for plastic surgeons to perform tissue rearrangement techniques. Moreover, most surgeons who perform breast conserving surgery are not specialized breast surgeons. These factors further limit the study's generalizability.

Oncoplastic BCS comprises a wide range of surgical techniques and can be utilized in most patients with breast cancer. Incorporation of oncoplastic BCS techniques into surgical breast oncology practices maximizes the oncologic and cosmetic advantages of oncoplastic BCS. This study shows that the use of oncoplastic BCS is associated with a reduced rate of surgical site complications in patients undergoing BCS and can be offered to patients regardless of medical comorbidities.

Conflicts of interest

The authors have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.amjsurg.2018.06.014.

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