A Meta-Analysis Comparing Breast Conservation Therapy Alone to the Oncoplastic Technique

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Abstract: When immediate reconstruction is applied to breast conservation therapy (BCT), the benefits extend well beyond the minimization of poor cosmetic results. The purpose of this analysis was to compare literature outcomes between BCT alone and BCT with the oncoplastic approach.

Methods: A meta-analysis was performed in PubMed using key words "oncoplastic," "partial breast reconstruction," and "breast conservation therapy." Case reports, series with less than 10 patients, and those with less than 1-year follow-up were excluded from the analysis. The 3 comparative groups included BCT with oncoplastic reduction techniques (Group A), BCT with oncoplastic flap techniques (Group B), and BCT alone (Group C).

Results: Comparisons were made on 3165 patients in the BCT with oncoplastic group (Groups A and B, 41 papers) and 5494 patients in the BCT alone group (Group C, 20 papers). Demographics were similar, and tumor size was larger in the oncoplastic group (2.7 vs 1.2 cm). The weight of the lumpectomy specimen was 4 times larger in the oncoplastic group. The positive margin rate was significantly lower in the oncoplastic group (12% vs 21%, $P < 0.0001$). Reexcision was more common in the BCT alone group (14.6% vs 4%, $P < 0.0001$), however, completion mastectomy was more common in the oncoplastic group (6.5% vs 3.79%, $P < 0.0001$). The average follow-up was longer in the BCT alone group (64 vs 37 months). Local recurrence was 4% in the oncoplastic group and 7% in the BCT alone group. Satisfaction with the aesthetic outcome was significantly higher in the oncoplastic group (89.5% vs 82.9%, $P < 0.001$).

Conclusions: The oncoplastic approach to BCT allows a generous resection with subsequent reduction in positive margins. The true value on local recurrence remains to be determined. Patients are more satisfied with outcomes when the oncoplastic approach is used.

Key Words: partial breast reconstruction, oncoplastic, breast conservation therapy, recurrence, outcome, complications

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Breast conservation therapy (BCT) has comparable survival and acceptable recurrence rates for women with breast cancer when compared to total mastectomy.[1,2] The second major goal with BCT is to preserve breast shape and symmetry, which is unfortunately not always obtained. Up to 30% of women after BCT will have a residual deformity that is often difficult to correct.[3,4] Baja et al[5] has recently reviewed 21 patients who underwent BCT, and although 18 patients were satisfied, all noted some asymmetry. The oncoplastic approach to BCT has been developed to minimize these concerns. It involves strict attention to tumor oncology as well as breast shape and symmetry. The popularity of this technique continues to increase, with a 220% increase in publications seen in the literature over the last 5 years.[6] Although the initial driving force was to prevent the poor cosmetic result or deformity after BCT, there are additional benefits to the oncoplastic approach.[7,8] This approach has been felt to broaden the indications for BCT in patients with tumors larger than 4 cm, locally advanced cancers, and prior neoadjuvant chemotherapy.[9] However, there are other oncologic claims such as the effect on margin control and tumor recurrence that are yet to be adequately proven. When reviewing the available literature on oncoplastic surgery, most papers are retrospective series, editorials, and review articles (level III–V evidence).[6] We understand the difficulty in prospective comparisons between BCT alone and BCT with the oncoplastic approach because there is selection bias in deciding which approach to take. There is subsequently a lack of randomized control data comparing the 2 groups.

Literature reviews exist for oncoplastic reductions, but no comparisons have been made to oncoplastic flaps techniques and BCT alone.[10,11] The purpose of this review was to perform a meta-analysis comparing BCT to BCT with oncoplastic reconstruction in an attempt to try and answer some of these questions regarding oncological outcomes with the hope that larger sample sizes might eliminate some of the this inherent selection bias associated with the groups.

METHODS

A literature search was performed in PubMed using key words "oncoplastic," "partial breast reconstruction," and "breast conservation therapy." All series were reviewed and papers were selected. Two independent reviewers extracted data from all the selected studies using a standardized data abstraction form. This electronic data form included the lead author, publication year, type of technique used, sample size, age, diagnosis (invasive, in situ, and other), tumor characteristics, specimen weight, margin status, reexcision rate, completion mastectomy rate, follow-up, early complications, outcome (recurrence and free of disease), and satisfaction. Case reports, series with less than 10 patients, and those with less than 1-year follow-up were excluded from the analysis. Delayed partial breast reconstruction was not included in these series. The 3 comparative groups included BCT with oncoplastic reduction techniques (Group A), BCT with oncoplastic flap techniques (Group B), and BCT alone (Group C). Additional comparisons were made between the BCT with oncoplastic groups (Groups A and B) and BCT alone (Group C). For standardization of satisfaction results, any aesthetic or general satisfaction that was rated as good to excellent was considered to be satisfied.

All rates used in the analysis were based on the number of patients in each series.

The percentages were all compared between the groups using χ^2 tests (for those studies that reported these measures). A P value of less than 0.05 was considered significant.

RESULTS

Demographics

The number of patients included in the meta-analysis was 3165 in the BCT with oncoplastic group (Groups A and B) and 5494 in the BCT alone group (Group C). The oncoplastic group was divided into 1773 oncoplastic reduction patients (Group A) and 1392 in the oncoplastic flap patients (Group B). This was from a total of 24 oncoplastic reduction papers,[12–35] 17 BCT with oncoplastic flap

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reconstruction[36–51] and 20 BCT alone papers.[52–70] There were no significant differences in the patients' age, percentage of in situ to invasive disease diagnosis, and positive node status (Table 1).

Tumor Characteristics

The percentage of patients with in situ disease was similar in the 2 groups with 13.1% in the oncoplastic group and 11.8% in the BCT alone group. The average tumor size and lumpectomy weight was larger in the oncoplastic groups (Table 2); however, statistical analysis was not possible based on the data reported. The positive margin rate was 12.3% (n = 342/2772) in the oncoplastic group versus 20.6% (n = 619/3014) in the BCT alone group ($P < 0.0001$). The reexcision rate was significantly lower in the oncoplastic group 4% (n = 104/2564) compared to 14.6% (n = 421/2882) in the BCT alone group ($P < 0.0001$). Completion mastectomy, however, was more common in the oncoplastic group 6.5% (n = 165/2553) versus 3.79% (n = 99/2610) ($P < 0.0001$) in the BCT alone group (Table 2).

Outcomes

The average follow-up in the oncoplastic group was 37.1 months (range, 12–74 months) and in BCT alone group was 64.4 months (range, 30–240 months). Local recurrence was 4.2% (121/2867) in the oncoplastic group compared to 7.0% (248/3551) in the BCT alone group ($P < 0.0001$), however, follow-up being longer in the BCT alone group (Table 3). Early complication rates were not routinely reported in the BCT alone group, however, were on average 25.9% (n = 201/775), compared to 15.5% (386/2482) in the oncoplastic group. Satisfaction with the aesthetic outcome was significantly higher in the oncoplastic group 89.5% (1148/1283) versus 82.9% (1590/1916) ($P < 0.0001$) in the BCT alone group.

DISCUSSION

The intolerance with poor cosmetic results after BCT for the treatment of breast cancer has fueled the rising popularity of oncoplastic breast surgery. It has, however, become apparent that this approach has benefits well beyond the mere prevention of BCT deformities and unsatisfactory aesthetic results. It allows wide excisions with good aesthetic outcomes, broadens the indications for BCT in some patients and avoids mastectomy, less surgery and lower morbidity when compared to skin sparing mastectomy and reconstruction, improvement in quality of life and self-esteem, and improved radiation dosimetry in women with macromastia.[7,8] Additional benefits to the oncoplastic technique are documented and discussed in this meta-analysis. The purpose of meta-analyses is not meant to confirm hypotheses and make recommendations, but rather to recognize trends and provide insight into future studies that potentially accept or reject certain hypotheses.

Patient demographics between the 2 groups were similar; however, the average tumor size was slightly larger in the oncoplastic group. The average size of the tumor in the oncoplastic group was 2.7 cm compared to 1.2 cm in the BCT alone group. The oncoplastic approach has been touted as beneficial because it allows a generous resection. Although not conclusive based on this meta-analysis, the ability to increase the extent of resection is an advantage of the oncoplastic technique, broadening the indications for BCT indirectly demonstrated in our analysis. One disadvantage of BCT alone is that generous resections are restricted by aesthetic concerns; however, this is not the case when the defect is reconstructed at the time of resection. Clough et al[16] have shown that extensive resections are possible with this technique in over 101 patients with the average specimen weight of 222 g. We have shown that the average tumor weight in the oncoplastic group is well over 200 g. Although this is easily understood in the oncoplastic reduction patients because they have large breasts and hence are amenable to larger resections, similar large resections were also found in the oncoplastic flap group (184 g), which is typically performed in woman with smaller breasts. The resection weights reported in studies with the oncoplastic approach are significantly larger than the resection weights (typically 50 g) reported with BCT alone.

The ability to perform a generous resection using the oncoplastic approach without sacrificing breast shape is a major advantage; however, are there oncological advantages? Negative pathologic surgical margins after breast cancer surgery are mandatory. Positive margins are defined as having tumor cells at the cut edge of the surgical specimen. Close margins are defined as having tumor cells within 1 or 2 mm from the cut edge.[71] The question then is whether this more generous resection with the oncoplastic approach translates into fewer positive margins? It makes intuitive sense that for similar size tumors, a generous resection is likely to incorporate more normal tissue and subsequently have a lower positive margin rate and a larger negative tumor margin. Only 2 studies have specifically examined the effect of oncoplastic surgery on surgical margins. Kaur et al[18] performed a prospective trial comparing quadrantectomy alone (n = 30) and resection with oncoplastic reconstruction (n = 30). They demonstrated larger resection weights (200 vs 118 g) ($P = 0.16$) resulted in fewer close or positive margins (16.7% vs 43.3%) ($P = 0.5$) in the oncoplastic group. Ductal carcinoma in situ histology was more prevalent in quadrantectomy alone group and accounted for some of the differences. Giacalone et al[27] performed a similar prospective comparative study comparing quadrantectomy alone (n = 43) and resection with oncoplastic reconstruction (n = 31). They found margins greater than or equal to 5 mm in 67% of oncoplastic group versus 42% in the quadrantectomy alone group ($P = 0.3$). This meta-analysis found a reduction in the positive margin rate for both invasive and in situ disease from 21% with BCT alone to 12% when the oncoplastic approach is performed. This was true despite the fact that the in situ percentage was slightly higher in the oncoplastic group, a group more likely to have positive surgical margins. Although the incidence of positive margins in the oncoplastic groups is lower, when the margins are positive the patients are more likely to undergo completion mastectomy than reexcision. Patients having oncoplastic surgery frequently have larger volumes of malignancy than patients having BCT alone and when a generous resection has been performed and positive margins persist, the patient may no longer be a candidate for breast preservation and completion mastectomy becomes a logical next step. Some positive margins are simply radiated depending on the nature of the disease and others might have been removed with the reduction specimen, which is why the reexcision and completion mastectomy numbers will often not add up to the positive margin rate.

Oncoplastic resections are generous and allow for wider excisions and subsequently a reduced risk of positive margins, a basic oncologic principle. The next question is whether having wide pathologic margins impacts the tumor recurrence rate? We can all agree on the fact that positive margins after BCT have consistently been associated with increased recurrence, and Singletary[71] has shown this in a review of published reports where involved margins results in higher recurrence rates in 30 of 34 studies. However, the size of

TABLE 1. Patient Demographics

	Oncoplastic	BCT Alone	*P*
No. patients	3165	5494	
Age, y	50.4	55.8	NS
% in situ disease	13.1 (367/2798)	11.8 (410/3472)	0.1182
% positive nodes	32.3 (344/1065)	34.5 (559/1623)	0.2407

NS indicates not significant.

TABLE 2. Resection Data

	Oncoplastic Reduction	Oncoplastic Flap	BCT Alone	*P*
Tumor size (range), cm	2.51 (1.5–4)	2.92 (2–4.4)	1.23 (0.7–1.5)	
Lumpectomy weight (range), g	249 (200–338)	184 (94–310)	64	
Positive margins, %	12.4 (206/1658)	12.2 (136/114)	20.6 (619/3014)	<0.0001
Reexcision, %	2.94 (45/1522)	5.66 (59/1042)	14.6 (421/2882)	<0.0001
Completion mastectomy, %	7.87 (118/1522	4.46 (46/1031)	3.79 (99/2610)	<0.0001

negative pathologic margin does not seem to reduce recurrence for invasive breast cancer.[71] Because ductal carcinoma in situ has a tendency to be multifocal with skip lesions, there are some data that suggest wider margins 10 mm or greater are associated with lower recurrence rates (3% at an average of 92 months follow-up).[72] Accurate local recurrence rate comparisons are difficult to make based on our data because the average follow-up interval was shorter in the oncoplastic group than in the BCT alone group. However, published BCT data have shown that recurrence rates increase significantly for patients with positive margins, compared to those with negative margins.[71] Another factor that makes accurate local recurrence rate comparisons difficult from the published literature is that the tumor staging in the 2 groups is not standardized. The oncoplastic group did seem to have slightly larger tumor sizes than the BCT alone group, but the local recurrence rate was the same as in the BCT only group. The bottom line is that recurrence rates do not seem to be higher in patients undergoing oncoplastic surgery despite often including patients with larger tumors in that group. Longer follow-up is necessary to determine if the oncoplastic approach truly broadens the indications for BCT with equivalent recurrence rates. It is not possible based on these data to infer that wider margins in the oncoplastic group translate to lower recurrence rates, because more data and longer follow-up are needed.

Another basic oncologic tenant of breast cancer treatment is the timely initiation of adjuvant therapy when indicated. One of the initial concerns regarding partial breast reconstruction at the time of resection was that the additional surgery would result in complications and delay adjuvant therapy. The average complication rate in the oncoplastic reduction group was 16%, and in the oncoplastic flap reconstruction group was 14%, however, there was no delay in the initiation of adjuvant therapy. In the largest oncoplastic series with 540 patients, the complication rate was 16%.[32] Complications are rarely recorded in the BCT alone papers, however in a series of 714 patients with BCT alone, the reported complication rate was 24%.[66] Complications, especially in the BCT alone group are often managed conservatively. The severity of the complications in the oncoplastic groups is different with the need for surgical intervention being roughly 3%.[32] It does not seem that complications in the oncoplastic groups, although potentially higher, have any negative impact on patient care from an oncologic standpoint. Appropriate technique and patient selection is required to minimize morbidity when this approach is selected. Safety is further confirmed by the lack of any adverse affects on cancer surveillance in both the oncoplastic reduction and flap reconstruction groups.[73,74] Late complications requiring additional surgery are usually related to aesthetic outcome, radiation changes, or recurrence.

The second main goal with BCT in addition to meeting oncologic tenets is to have a satisfied patient and preservation of breast shape and symmetry. There is very little in standardization of satisfaction when it comes to BCT, making accurate comparisons difficult. It is, however, known that the poor cosmesis after BCT occurs in 5% to 30%.[75] Improvement in cosmesis is one of the main driving forces behind the oncoplastic approach, and many of the indications for oncoplastic surgery revolve around predicting high-risk patients and minimizing the potential for a poor cosmetic result. Iwuchukwu et al[11] reviewed oncoplastic reduction techniques in the literature and cited a 5% to 14% poor cosmetic outcome after these procedures. When aesthetic and patient satisfaction was evaluated in our meta-analysis, we found that the overall satisfaction in the BCT alone group was 80%, compared to 90% in the oncoplastic group. Patient dissatisfaction was correlated with postoperative complications and breast asymmetry.[66] Radiation changes were not addressed independently in any of the studies. Having a 90% satisfaction in the oncoplastic groups is understandable because these are self-selected high-risk patients for poor cosmetic results, and despite immediate reconstruction corrects the volume loss secondary to tumor resection, the adverse affects of radiation therapy, although reduced, will still exist. Proponents of the oncoplastic approach can therefore not claim an elimination of poor cosmetic results, but rather a potential reduction in poor outcomes and an improvement over BCT alone. Satisfaction was not stratified by technique; however, women with larger breasts who underwent an oncoplastic reduction were most satisfied. We do recognize the lack of standardization when it comes to assessing patient satisfaction and aesthetic outcome, and that most of the satisfaction data compiled from these series are mainly subjective. Future studies using validated breast questionnaires or 3-dimensional imaging to assess these parameters after oncoplastic surgery will be interesting.

We recognize the limitations of this analysis and the fact that the groups by nature were not identical. Not all series are homogeneous and we realize that some carry more power than others. There remains a wide range of confounding factors in the available studies and differences in some of the outcome measures. However, it is felt that the large sample sizes in this analysis will reduce some variability, making comparisons more accurate and informative.

The oncoplastic approach is a valuable addition to the options available for women with breast cancer. We have demonstrated in this analysis that the benefits of the oncoplastic approach extend

TABLE 3. Outcome and Satisfaction

	Oncoplastic Reduction	Oncoplastic Flap	BCT Alone	*P*
Follow-up, mo	34.9	40.6	69.8	
Complication, %	16.45 (241/1466)	14.23 (145/1016)	25.97 (201/775)	<0.0001
Recurrence, %	4.71 (73/1545)	3.64 (48/1322)	6.97 (248/3551)	<0.0001
Satisfaction, %	89.15 (995/1116)	91.89 (153/167)	82.99 (1590/1916)	<0.001

well beyond the mere reduction in poor cosmetic results. Future studies with longer follow-up and standardization of data will likely cast more light on this topic. A better understanding of the oncological and aesthetic benefits of the oncoplastic approach can only translate into improved outcomes for women with breast cancer who wish to preserve their breasts.

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