

Current Practices and Barriers to the Integration of Oncoplastic Breast Surgery: A Canadian Perspective

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ABSTRACT

Background. Despite the safety and popularity of oncoplastic surgery, there is limited data examining utilization and barriers associated with its incorporation into practice. This study examines the use of oncoplastic techniques in breast conserving surgery and determines the barriers associated with their implementation.

Methods. A 13-item survey was mailed to all registered general surgeons in Ontario, Canada. The survey assessed surgeon demographics, utilization of specific oncoplastic techniques, and perceived barriers.

Results. A total of 234 survey responses were received, representing a response rate of 32.2 % (234 of 725). Of the respondents, 166 surgeons (70.9 %) reported a practice volume of at least 25 % breast surgery. Comparison was made between general surgeons performing oncoplastic breast surgery ($N = 79$) and those who did not use these techniques ($N = 87$). Surgeon gender, years in practice, fellowship training, and access to plastic surgery were similar across groups. Both groups rated the importance of breast cosmesis similarly. General surgeons with a practice volume involving >50 % breast surgery were more likely to use oncoplastic techniques (OR 8.82, $p < .001$) and involve plastic surgeons in breast conserving surgery (OR 2.21, $p = .02$). For surgeons not performing oncoplastic surgery, a lack of training and access to plastic surgeons were identified as significant barriers. For those using oncoplastic techniques, the absence of specific billing codes was identified as a limiting factor.

Conclusions. Lack of training, access to plastic surgeons, and absence of appropriate reimbursement for these cases

are significant barriers to the adoption of oncoplastic techniques.

Breast conserving therapy (BCT) has become a cornerstone in the management of invasive breast cancer and ductal carcinoma in situ.^{1–5} The primary goal of BCT is complete excision of the tumor with negative margins while preserving the shape of the breast. However, large resections with eventual collapse of the seroma cavity can result in significant breast deformity. Poor cosmesis is noted in up to 40 % of BCT patients and has been shown to significantly affect patients' quality of life and psychosocial outcomes.^{6–9}

Oncoplastic breast surgery techniques were developed to improve the cosmetic outcomes of BCT. These techniques allow wide excision of tumors with immediate breast tissue reshaping using plastic surgery techniques.¹⁰ This surgical approach has gained wide acceptance in Europe, but is less used in North America, despite studies that have demonstrated its oncologic safety and cosmetic benefit.^{11–16}

The utilization, practice patterns, and surgeons' attitudes toward oncoplastic surgery have not been studied in Ontario, Canada. The purpose of this study is to identify the number of general surgeons using oncoplastic techniques in breast conserving surgery and to examine the barriers associated with implementing these techniques into practice. Ontario was chosen for its large number of patients and surgeons as well as its variability in access across the province.

Specifically, Ontario is Canada's most populated province with 13,791,100 inhabitants and 1,076,395 square kilometers of land.¹⁷ There are 962 general surgeons and 277 registered plastic surgeons.¹⁸ The majority of breast cancer surgery in Ontario is performed by general surgeons in community hospitals (70 %). General surgeons with no

identified subspecialty perform 69 % of breast cancer operations followed by subspecialty breast surgeons and surgical oncologists.¹⁹ In 2012, there were 10,283 new breast cancer cases in Ontario.²⁰ Two-thirds of women diagnosed with breast cancer will undergo breast conserving surgery. Regional variation in the rate of BCS exists in Ontario and can be explained by differences in cancer stage at presentation, patient or physician preferences, and regional resource availability.

METHODS

A cross-sectional survey of Ontario general surgeons was conducted from April 1 to October 31, 2015. Institutional review board approval was obtained prior to commencement of this study. The survey consisted of a 13-item questionnaire designed to gather information on general surgeons' demographics, utilization of oncoplastic techniques, and challenges associated with incorporating oncoplastic surgery into their practice. The general surgeons were identified through the College of Physicians and Surgeons of Ontario (CPSO) online database, which contains information for all independently licensed physicians in Ontario including gender, practice location, years in practice, and surgical training history. General surgeons with subspecialty practices in thoracic, vascular, and pediatric surgery were excluded. Three reminders were sent to non respondents until the study closed in October 2015.

Questionnaire

The questionnaire was developed based on current literature regarding oncoplastic surgery in practice.^{3,10-12,14,21} Surgeon and practice demographics, use of oncoplastic techniques, and barriers to integration were specifically addressed. Demographic questions included time in practice, type of hospital (academic vs. community), subspecialty training (general surgical oncology, breast surgical oncology, or none), and percentage of practice involving breast surgery. General surgeons with a breast practice were the target population. The survey instrument is included in Appendix A.

Oncoplastic surgical techniques commonly used during breast conserving surgery were identified in the literature and are presented in Fig. 1.^{10-13,21} Surgeons were asked to indicate which techniques they use when performing breast conserving surgery. They were asked to identify potential barriers to the use of oncoplastic surgery such as lack of training, concerns regarding delay of adjuvant treatment, management of positive margins, poor cosmesis, lack of access to plastic surgeons and/or radiation oncology, patient interest, increased operative time, and lack of applicable billing codes.

Standard Breast Conserving Surgery Techniques and Oncoplastic Techniques	
Standard Techniques	Oncoplastic Techniques
<ul style="list-style-type: none"> • Skin Incision Planned for Optimal Cosmesis • Undermining of Skin • Undermining of Nipple Areolar Complex • Leave Lumpectomy Cavity Open to allow for seroma formation 	<ul style="list-style-type: none"> • Glandular/Breast Tissue Reapproximation (i.e. Parenchal Flaps) • De-Epithelialization & Nipple Areolar Complex Repositioning • Mammoplasty Incision (+/- Superior/Inferior/Lateral/Pedicle • Bat-Wing or Hemi Bat-Wing Incision

FIG. 1 Standard breast conserving surgery versus oncoplastic techniques. Adapted from Silverstein et al.¹⁰ and Clough et al.²¹

Statistical Analysis

Continuous data were summarized using medians and interquartile ranges, and categorical data were summarized using frequencies and percentages. The Wilcoxon rank sum test was used for comparison of continuous data and Fisher exact test for categorical data. Two sets of multivariable logistic regression analysis were performed to determine the odds of using oncoplastic techniques when performing breast surgery. The first analysis included physician characteristics and access to plastic surgeons in breast conserving surgery cases. The second analysis included all potential barriers to access. For the analysis, general surgeons were considered "oncoplastic users" or "oncoplastic non-users" based on their responses to use of oncoplastic techniques. Non-users of oncoplastic techniques were limited to skin incision planning and leaving a seroma cavity. Missing values were included as a separate category. All analyses were 2-tailed, and significance was set at a *p* value of .05. The data analysis was conducted using SAS version 9.3.

RESULTS

A total of 962 general surgeons were registered with the CPSO in the study period. There were 237 general surgeons with subspecialty practice in vascular, thoracic, and pediatric surgery who were excluded. A total of 234 responses were received, representing a response rate of 32.2 % (234 of 725). Of those respondents, 68 (29.1 %) were general surgeons who did not perform breast surgery. The remaining 166 surgeons reported a practice volume of at least 25 % breast surgery; 79 of 166 (47.6 %) were

TABLE 1 Baseline characteristics of oncoplastic technique users versus non-users

Variable	Oncoplastic users N = 79	Non-users N = 87	Total N = 166	p value
Surgeon gender				0.15
Unknown	15 (19.0 %)	12 (13.8 %)	27 (16.3 %)	
Male	37 (46.8 %)	54 (62.1 %)	91 (54.8 %)	
Female	27 (34.2 %)	21 (24.1 %)	48 (28.9 %)	
Amount of referral based practice involving breast surgery				<0.0001
Missing	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	
0–50 %	54 (68.4 %)	82 (94.3 %)	136 (81.3 %)	
>51 %	25 (31.7 %)	5 (5.8 %)	30 (18.1 %)	
Years in practice				0.25
Missing	0 (0.0 %)	2 (2.3 %)	2 (1.2 %)	
10 years	35 (44.3 %)	29 (33.3 %)	64 (38.6 %)	
11–20 years	21 (26.6 %)	31 (35.6 %)	52 (31.3 %)	
≥21 years	23 (29.1 %)	25 (28.7 %)	48 (28.9 %)	
Practice location/type				
Community hospital	55 (69.6 %)	65 (74.7 %)	12 (72.3 %)	0.49
Academic hospital	19 (24.1 %)	15 (17.2 %)	34 (20.5 %)	0.34
Regional Cancer centre	11 (13.9 %)	10 (11.5 %)	21 (12.7 %)	0.65
Other	3 (3.8 %)	1 (1.1 %)	4 (2.4 %)	0.35
Subspecialty fellowship training				0.08
Missing	1 (1.3 %)	1 (1.1 %)	2 (1.2 %)	
Yes	22 (27.8 %)	13 (14.9 %)	35 (21.1 %)	
No	56 (70.9 %)	73 (83.9 %)	129 (77.7 %)	
Type of fellowship				0.22
Missing	58 (73.4 %)	74 (85.1 %)	132 (79.5 %)	
Breast surgery	4 (5.1 %)	1 (1.1 %)	5 (3.0 %)	
Surgical oncology	15 (19.0 %)	11 (12.6 %)	26 (15.7 %)	
Plastic surgery/Reconstruction fellowship	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	
Other	2 (2.5 %)	1 (1.1 %)	3 (1.8 %)	
Access to plastic surgeons				0.42
Missing	2 (2.5 %)	1 (1.1 %)	3 (1.8 %)	
Yes	62 (78.5 %)	62 (71.3 %)	124 (74.7 %)	
No	15 (19.0 %)	24 (27.6 %)	39 (23.5 %)	
Involvement of plastic surgeons in BCS cases				0.12
Missing	3 (3.8 %)	5 (5.7 %)	8 (4.8 %)	
Never	29 (36.7 %)	45 (51.7 %)	74 (44.6 %)	
Rarely	39 (49.4 %)	34 (39.1 %)	73 (44.0 %)	
Often	7 (8.9 %)	2 (2.3 %)	9 (5.4 %)	
Always	1 (1.3 %)	1 (1.1 %)	2 (1.2 %)	

identified as oncoplastic technique users, and 87 of 166 (52.4 %) as non-users.

Table 1 compares the baseline characteristics of general surgeons who utilize oncoplastic techniques to those who do not use these techniques. The 2 groups were similar in terms of gender, years in practice, type of hospital, subspecialty training, and access to plastic surgery. The majority of general surgeons in both groups did not have subspecialty

training (70.9 vs. 83.9 %, $p = .08$). General surgeons reporting more than 50 % breast surgery volume were more likely to be oncoplastic technique users than non-users (31.7 vs. 5.8 %, $p < .001$). There was a trend toward nononcoplastic users having less access to plastic surgeons compared with oncoplastic users (19.1 vs. 27.6 %, $p = .42$).

A scale of 1 to 10 was used to rate the importance of cosmesis, with a score of 10 corresponding to extremely

TABLE 2 Barriers to integration of oncoplastic techniques in breast surgery

Barriers identified by oncoplastic non-users as compared to those who use oncoplastic techniques	Adjusted OR (95 % CI)	<i>p</i> value
I am unfamiliar with these techniques	0.16 (0.07–0.39)	<0.001
I am concerned about delay of adjuvant treatment	0.54 (0.21–1.38)	0.20
I am concerned about the need for re-operation for positive margins	0.09 (0.43–2.26)	0.97
I do not have support from plastic surgery	0.41 (0.18–0.97)	0.04
I do not have support from radio oncology	0.87 (0.25–3.09)	0.83
I am concerned about increased operating room time	1.24 (0.54–2.86)	0.62
I am concerned about the lack of specific billing codes	4.06 (1.67–9.9)	0.002
I am concerned about poor cosmesis	1.02 (0.41–2.52)	0.66
My patients are not interested	1.24 (0.48–3.23)	0.45
I am concerned about the rate of post-operative complications	1.62 (0.46–5.71)	0.79
I am concerned about managing post-operative complications	0.85 (0.25–2.86)	0.41

important. Both groups rated the importance of cosmesis at 7 of 10 or higher; however, the median scores were higher for the oncoplastic users than non-users (8–9 vs. 7–8, $p = .01$).

Logistic regression analysis of the variables described in Table 1 was performed to examine the odds of using oncoplastic techniques in breast conserving surgery. General surgeons with a practice volume involving >50 % breast surgery were more likely to use oncoplastic techniques (adjusted odds ratio [OR] 10.1; 95 % confidence interval [95 % CI], 2.66–38.7; $p = .0007$). Oncoplastic technique users were also more likely to involve plastic surgeons in breast conserving surgery (adjusted OR 2.56; 95 % CI 1.17–5.59; $p = .02$).

Lack of training was identified as a significant barrier for general surgeons who do not use the techniques (adjusted OR 0.16; 95 % CI 0.07–0.39; $p < .001$) (Table 2). In addition, decreased access to plastic surgeons was identified as a significant barrier for oncoplastic surgery non-users (adjusted OR 0.41; 95 % CI 0.18–0.97; $p = .04$). For those using oncoplastic techniques, the absence of specific billing codes was identified as a barrier (adjusted OR 4.06; 95 % CI 1.67–9.9; $p = .002$). Factors such as concerns in delay in adjuvant treatment, reoperation for positive margins, poor cosmesis, patient interest, support from radiation oncology, and increased operating room time were not considered significant barriers (Table 2).

DISCUSSION

The traditional approach to partial mastectomy consists of incision placement over the tumor, resection to clinically and/or radiographically clear margins, and closure of skin without parenchymal closure, thus leaving a seroma cavity. While this may provide adequate cosmesis in the immediate

postoperative period, over time the seroma absorbs, leaving a breast contour deformity, which is exacerbated by adjuvant radiotherapy. Factors known to contribute to poor cosmesis in BCT include high tumor volume to breast ratio, excision of >20 % of breast volume, tumor location, breast ptosis, and large body habitus.^{22–24} Clough et al. define oncoplastic surgery as the “third pathway” between traditional breast conservation and mastectomy that allows for wide excision of disease without compromising breast contour.²¹ While there are no universally accepted guidelines for oncoplastic breast surgery, Clough and colleagues have proposed a classification system and quadrant-by-quadrant approach to oncoplastic surgery.²¹ Their approach was used in the current study to define oncoplastic techniques. These techniques are classified as level 1 versus level 2 and vary in degree of complexity. Clough has suggested that level 1 techniques do not require additional training or involvement of a plastic surgeon, while level 2 techniques require formal training and/or plastic surgery involvement.¹⁷ This sentiment is echoed by other leaders in the field, with additional knowledge required for more advanced oncoplastic procedures.^{25,26}

Lack of training was identified in this study as a major barrier to the use of oncoplastic surgery. In Ontario, informal oncoplastic surgery training opportunities exist; however, these are not well advertised or well known, leaving interested surgeons to seek out training in a piecemeal fashion. Multiple sources have identified the need for improved oncoplastic training worldwide.^{27–29} In the United States, only 53 % of recent breast surgical oncology fellowship graduates were comfortable performing oncoplastic breast surgery.³⁰ Oncoplastic breast surgery clinical fellowships have been developed successfully in the United Kingdom and Brazil.^{28,31} While these training opportunities increase access for recent surgery graduates, many practicing general surgeons are unable to participate

because enrollment would interrupt their practice for a significant period of time. Shorter courses are available for practicing surgeons, but these often require travel, are costly, and may be didactic rather than offering practical experience. The development of regional oncoplastic courses would provide increased access for practicing breast surgeons. Furthermore, incorporation of oncoplastic breast surgery techniques into existing breast surgery fellowships and general surgery residency programs will produce a generation of surgeons who are trained in these procedures and will not have to seek out additional training.

Lack of access to plastic surgeons was also identified as a major barrier. In Ontario, the oncologic portion of breast surgery is generally performed by the general surgeon, while the reconstruction portion is performed by a plastic surgeon in the immediate or delayed setting. Limitations of this method include delay of primary treatment for scheduling reasons and geographic inequalities that arise when a center does not have access to plastic surgeons.³¹ It is not the intent of oncoplastic surgeons to diminish the role of the plastic surgeon in breast reconstruction. Rather, oncoplastic surgery serves to supplement this role and allow plastic surgeons to focus on techniques not available to the general surgeon, such as implant-based and autologous whole breast reconstruction. Ideally, oncoplastic surgery should be undertaken in a spirit of collaboration rather than competition. As it stands, general surgeons without access to plastic surgery are less likely to perform oncoplastic surgery. Training general surgeons in oncoplastic surgery would increase patient access to these procedures.

General surgeons who are currently using oncoplastic techniques identified the lack of appropriate financial remuneration as a significant barrier. In the province of Ontario, there are no specific billing codes for oncoplastic procedures. Therefore, general surgeons bill for a standard lumpectomy, which does not account for the additional operative time or complexity of the oncoplastic case. Without appropriate financial compensation and with increased operative time, utilizing these techniques will not be sustainable and patient access might be compromised. This is an issue that needs to be addressed on the health policy level with further investigation into the cost/benefit profile of oncoplastic breast surgery.

One of the limitations of this study is the selection bias inherent in survey research. Survey responses represent surgeons' subjective perceptions of their current practice and could reflect bias in reporting. The survey used in this study was not validated or previously tested for predictive power, which may limit its generalizability. However, since the study is intended to be descriptive only, the survey responses do provide insight into the barriers that need to be further addressed. Furthermore, the low

response rate must be taken into account. While our sample size does reflect general surgeons with a breast practice, the CPSO database does not identify subspecialties that do not typically practice breast surgery such as hepatobiliary, transplant, and recent graduates currently in fellowship training programs. Many of these surgeons could not be excluded a priori and may constitute a significant portion of nonresponders. Nevertheless, a response rate of more than 30 % has been identified as an acceptable standard when physicians are surveyed.³²

This study provides the first Canadian data regarding general surgeons' attitudes and practice patterns toward oncoplastic breast surgery. The results indicate that lack of familiarity with techniques, lack of support from plastic surgery, and absence of appropriate reimbursement for these cases are significant barriers to the adoption of these techniques. Our data supports the need for increased teaching of oncoplastic techniques during general and subspecialty surgery training as well as the need to advocate for more appropriate financial remuneration for these cases. Future studies investigating the opinions of plastic surgeons regarding their involvement in oncoplastic surgery may improve collaboration and further decrease barriers to full integration of these techniques.

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ONCOPLASTIC BREAST SURGERY IN ONTARIO SURVEY

Please clearly circle your chosen response.

1. What percentage of your referral based practice involves breast surgery?
 1. 0%
 2. 1–25%
 3. 26–50%
 4. 51–75%
 5. $\geq 76\%$
2. How many years have you been in practice?
 1. ≤ 5 years
 2. 6–10 years
 3. 11–15 years
 4. 16–20 years
 5. ≥ 21 years

3. What type of hospital do you work in? (circle all that apply)
 1. Community hospital
 2. Academic hospital
 3. Regional cancer centre
 4. Other, please specify:
4. Do you have subspecialty fellowship training in breast surgery, surgical oncology or plastic/reconstructive surgery?
 1. Yes
 2. No
5. If YES, please indicate which type of fellowship:
 1. Breast surgery
 2. Surgical oncology
 3. Plastic surgery/reconstruction based fellowship
 4. Other, please specify:
6. On a scale of 1–10, how important is cosmesis in breast conserving surgery? (1 = no importance, 10 = utmost importance)

1 2 3 4 5 6 7 8 9 10
7. How often do you achieve good cosmesis?
 1. Never
 2. Rarely
 3. Often
 4. Always
8. Do you use any of the following techniques when performing breast conserving surgery? (Circle all that apply)
 1. Skin incision planned for optimal cosmesis
 2. Undermining of skin
 3. Undermining of nipple areolar complex
 4. Glandular/breast tissue reapproximation (i.e. parenchymal flaps)
 5. Leave lumpectomy cavity open to allow for seroma formation
 6. De-epithelialization and nipple areolar complex repositioning
 7. Mammoplasty incision +/- superior/inferior/lateral pedicle
 8. Bat-wing or hemi bat-wing incision
 9. None of the above
 10. Other, please specify:
9. What patient factors would lead you to offer any of the above advanced techniques?
 1. Patient age
 2. Patient has significant concerns regarding cosmesis
 3. Breast size

4. Tumour characteristics
5. Other, please specify:

10. Do you have access to plastic surgeons in your institution?
 1. Yes
 2. No
11. Do you involve plastic surgeons in your breast conserving surgery cases?
 1. Never
 2. Rarely
 3. Often
 4. Always

What factors would lead you to involve plastic surgeons?

12. To what extent do you consider the following as reasons for NOT using oncoplastic breast surgery techniques?

Reason for not using oncoplastic technique	Strongly disagree	Disagree	Agree	Strongly Agree	N/A
I am unfamiliar with these techniques					
I am concerned about delay of adjuvant treatment					
I am concerned about the need for re-operation for positive margins					
I do not have support from plastic surgery					
I do not have support from radiation oncology					
I am concerned about increased OR time					
I am concerned about the lack of specific OHIP billing codes					
I am concerned about poor cosmesis					
My patients are not interested					
I am concerned about the rate of post-operative complications					
I am concerned about managing post-operative complications					
Other, please specify:					

13. Is there anything else you would like to comment on regarding the use of oncoplastic techniques in breast surgery?

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