

An alternative to standard lumpectomy: a 5-year case series review of oncoplastic breast surgery outcomes in a Canadian setting

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Accepted May 21, 2019

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DOI: 10.1503/cjs.003819

Background: Oncoplastic surgery (OPS) is becoming the new standard of care for breast-conserving surgery (BCS). It has become increasingly popular in Europe; however, it has not yet been widely accepted in North America. This study aims to describe the experience with OPS at a Canadian tertiary care centre.

Methods: This study is a retrospective case series consisting of consecutive OPS cases at a single Canadian centre, the Royal Victoria Regional Health Centre in Barrie, Ontario, between 2009 and 2015.

Results: A total of 275 women who consecutively underwent OPS were included. The average size of the tumour was 17 mm (standard deviation [SD] 13 mm; range 0–110 mm). The average specimen weight was 155 g (SD 146 g; range 15–1132 g). Invasive ductal carcinoma was the most common diagnosis (237 patients, 86.2%), followed by ductal carcinoma in situ (18 patients, 6.6%) and then invasive lobular carcinoma (15 patients, 5.5%). A positive margin was recorded in 37 (13.5%) patients. Immediate postoperative complications included seroma and edema (32.7%), wound infection (13.1%), hematoma (8.7%) and delayed wound healing (6.5%). A delay to adjuvant therapy due to postoperative complications occurred in 7 of 217 (3.2%) patients. The median follow-up was 18 months. There were local and distant recurrences in 9 (3.3%) and 2 (0.7%) patients, respectively. Overall survival was 99.3%.

Conclusion: The findings of this study are comparable to results in the literature on OPS and demonstrate that OPS is an attractive alternative to standard lumpectomy for Canadian general surgeons who treat breast cancer.

Contexte : La chirurgie oncoplastique (COP) est en passe de devenir la nouvelle norme pour la chirurgie conservatrice du sein (CCS). Elle est de plus en plus populaire en Europe, mais elle n'a pas encore été largement adoptée en Amérique du Nord. Cette étude vise à décrire l'expérience d'un établissement de soins tertiaires au Canada en matière de COP.

Méthodes : Cette étude repose sur une série rétrospective de cas de COP dans un établissement canadien, le Centre régional de santé Royal Victoria de Barrie, en Ontario, entre 2009 et 2015.

Résultats : En tout, 275 cas consécutifs de COP ont été inclus. La taille moyenne des tumeurs était de 17 mm (écart-type [É.-T.] 13 mm; éventail 0–110 mm). Le poids moyen des spécimens était de 155 g (É.-T. 146 g; éventail 15–1132 g). Le diagnostic le plus fréquent était le carcinome canalaire invasif (237 patientes, 86,2 %), suivi du carcinome canalaire in situ (18 patientes, 6,6 %), puis du carcinome lobulaire invasif (15 patientes, 5,5 %). Une marge positive a été enregistrée chez 37 patientes (13,5 %). Parmi les complications postopératoires immédiates, mentionnons sérome et œdème (32,7 %), infection de plaie (13,1 %), hématome (8,7 %) et retard de cicatrisation de la plaie (6,5 %). Un retard du traitement adjuvant dû à des complications postopératoires est survenu chez 7 patientes sur 217 (3,2 %). Le suivi médian a été de 18 mois. On a noté des récurrences locales et à distance chez 9 (3,3 %) et 2 (0,7 %) patientes, respectivement. La survie globale a été de 99,3 %.

Conclusion : Les conclusions de cette étude se comparent aux résultats recensés dans la littérature au sujet de la COP et démontrent que cette dernière est une solution de rechange attrayante à la tumorectomie standard pour les chirurgiens généraux qui soignent le cancer du sein au Canada.

Oncoplastic surgery (OPS) was developed in the 1980s in an attempt to improve upon the original surgical techniques used in standard breast-conserving surgery (BCS).¹⁻⁴ Breast conservation consists of partial mastectomy or lumpectomy in conjunction with adjuvant radiotherapy to treat the cancer while preserving the breast. Breast-conserving surgery has been shown to be comparable to mastectomy in terms of overall survival.^{5,6} It was developed to avoid the deformity of mastectomy; however, the early approaches to BCS were poorly designed, resulting in poor cosmesis and deformity that could be even more difficult to deal with than a mastectomy scar.¹⁻⁴ Such surgical results have been shown to negatively affect quality of life as well as psychosocial and sexual function.^{7,8} Oncoplastic surgery is the next iteration of those techniques. It is intended to optimize the outcomes that have always been deemed most important (i.e., to produce less physical deformity and to increase survival) as well as to improve margin control.¹⁻⁴ It combines oncologic breast conservation with tissue displacement techniques to immediately reshape the breast during closure of the defect.¹⁻⁴ This allows for more favourable breast contouring and cosmesis while maintaining the oncologic principle of complete tumour excision to clear margins.¹⁻⁴ This approach has gained wide acceptance in Europe for larger tumours or tumours in a cosmetically challenging location where volume loss may affect overall cosmesis; however, it has been adopted more slowly by the majority of breast surgeons in Canada, even though studies have demonstrated the oncologic safety of this technique and it has been endorsed by major surgical societies such as the American Society of Breast Surgeons.^{3,9,10}

To date, there have been very few studies reporting on OPS outcomes in Canada. This study aims to assess the incidence of immediate and delayed surgical complications, such as infection, bleeding, need for reoperation and interference with adjuvant treatment, and oncologic outcomes such as local and distal recurrence over a 5-year period in a Canadian community setting.

METHODS

This study was reported according to the PROCESS (preferred reporting of case series in surgery) guidelines, found at www.processguideline.com.¹¹ Ethics approval for this study was obtained through the RVH Research Ethics Board at the Royal Victoria Regional Health Centre.

Design and selection criteria

This study is a retrospective case series of female patients (aged > 18 yr) diagnosed with invasive or in situ mammary carcinoma who underwent OPS at the Royal Victoria Regional Health Centre, an advanced-level community hospital and regional cancer centre in Barrie, Ontario, between 2009 and 2015. Male patients, patients younger

than 18 years, patients with benign disease and patients undergoing mastectomy or non-BCS were excluded from the study. All OPS procedures were performed by a single surgeon (R.H.). The patients were identified and included in a consecutive fashion.

Outcomes

The primary outcomes of interest were oncologic outcomes, including disease-free survival, local and distant recurrence-free survival and overall survival. Secondary outcomes included tumour characteristics, such as histopathology, grade, size, lymphovascular invasion, biomarkers, nodal status and stage; margin status and re-excision rates for positive or close margins; immediate postoperative complications, such as hematoma, seroma and edema (or swelling in the breast), infection, delayed wound healing, nipple necrosis and skin-flap necrosis; and delayed or long-term complications, including fat necrosis, inclusion cyst, inappropriate scarring affecting cosmesis and the possible need for reoperation for cosmetic reasons. Data on any delay to adjuvant therapy owing to complications were also collected.

Statistical analysis

All statistical tests were performed using Excel or SPSS Statistics version 21. Most of the results are presented as descriptive statistics; analysis of variance (ANOVA) was used for continuous variables and χ^2 or Fisher exact tests were used for categorical variables. A *p* value less than 0.05 was considered statistically significant.

RESULTS

Patients and tumour characteristics

A total of 295 women met the inclusion criteria. Twenty patients were excluded from the analysis because of missing data. Patient and tumour characteristics are reported in Table 1. The mean patient age at diagnosis was 60.8 (standard deviation [SD] 10.0) years. Average specimen weight was 155 g (SD 146 g; range 15–1132 g) and mean tumour size was 17 mm (SD 13 mm; range 0–110 mm). Invasive ductal carcinoma was the most common diagnosis (86.2% of tumours), followed by ductal carcinoma in situ (6.6%), invasive lobular carcinoma (5.5%), invasive mucinous carcinoma (0.7%), phyllodes (0.7%) and invasive papillary carcinoma (0.4%). There were a total of 255 invasive cancers. The majority of the invasive cancers were stage I (53.3%); 41.2% were stage II and 3.9% were stage III. There were no patients with stage IV invasive cancer. Sentinel lymph node biopsy (SLNB) was performed in 237 (86.2%) of the 275 patients in the analysis: 229 (89.8%) of the 255 patients with invasive cancer underwent SLNB, as

well as 8 patients with ductal carcinoma in situ. Of the patients who underwent SLNB, 38 went on to have a completion axillary lymph node dissection (cALND). Sixteen had an upfront axillary lymph node dissection (ALND). A total of 22 patients did not have the axilla assessed; 13 of these patients had invasive cancer. The lymph node positivity rate was 67 out of 255 (26.3%).

Margin status

A positive margin was recorded for 37 (13.5%) of the 275 patients included in the analysis. Re-excisions for positive or close margins were done in 43 (15.6%) patients. The reason these numbers differ is that 19 patients with a negative margin had a re-excision and 14 patients with a positive margin did not have a re-excision for various reasons; for instance, the positive margin was the posterior margin and the muscle fascia had already been taken or

the patient received a targeted radiation boost to the cavity. There was a change in the definition of a clear margin in 2014 to “no tumour at inked edge,” which may also have affected data collection.

Immediate and long-term complications

Immediate postoperative complications included seroma combined with postoperative edema/swelling, which occurred in 90 (32.7%) of the 275 patients in the analysis; wound infection, which occurred in 35 (13.1%) patients; hematoma, which occurred in 24 (8.7%) patients; delayed wound healing, which occurred in 18 (6.5%) patients; skin-flap necrosis, which occurred in 3 (1.1%) patients; and nipple necrosis, which occurred in 2 (0.7%) patients (Table 2). The rates of some of the immediate postoperative complications, such as wound infection and delayed wound healing, were higher in patients who had re-excisions (Table 3). The seroma rate was also higher in patients who had an SLNB alone compared with no axillary surgery or an ALND (Table 4).

Table 1. Patient and tumour characteristics of 275 patients

Characteristic	No. (%)*
Age, yr, mean ± SD	60.8 ± 10.0
Tumour size, mm, mean ± SD, median (range)	17 ± 13, 15 (0–110)
Specimen weight, g, mean ± SD, median (range)	155 ± 146, 110 (15–1132)
Histology	
Invasive ductal carcinoma	237 (86.2)
Invasive lobular carcinoma	15 (5.5)
Ductal carcinoma in situ	18 (6.6)
Other invasive (mucinous and papillary)	3 (1.1)
Phyllodes	2 (0.7)
Histologic subtype (invasive, n = 255)	
Luminal A	215 (84.3)
ER/PR positive, HER2 positive	11 (4.3)
ER/PR negative, HER2 positive	7 (2.7)
Triple negative	22 (8.6)
SBR grade (invasive, n = 255)	
I	92 (36.1)
II	102 (40.0)
III	52 (20.4)
Missing	9 (3.5)
Pathologic T stage (invasive, n = 255)	
pT1	168 (65.9)
pT2	81 (31.8)
pT3	4 (1.5)
pT4	2 (0.8)
Overall TMN stage (invasive, n = 255)	
I	140 (54.9)
II	105 (41.2)
III	10 (3.9)
Nodal status (invasive, n = 255)	
Negative	175 (68.6)
Positive	67 (26.3)
Not assessed	13 (5.1)

ER = estrogen receptor; HER2 = human epidermal growth factor receptor 2; PR = progesterone receptor; SBR = Scarff–Bloom–Richardson; SD = standard deviation.
*Unless indicated otherwise

Table 2. Postoperative complications among 275 patients

Complication	No. (%)
Immediate	
Edema/swelling	90 (32.7)
Wound infection	35 (13.1)
Hematoma	24 (8.7)
Delayed wound healing	18 (6.5)
Skin-flap necrosis	3 (1.1)
Nipple necrosis	2 (0.7)
Long-term/delayed	
Reoperation for cosmesis	46 (16.7)
Fat necrosis	14 (5.1)
Inclusion cyst	3 (1.1)
Inappropriate scarring	3 (1.1)

Table 3. Complication rates in patients with and without re-excisions

Complication	Patients without re-excision n = 232	Patients with re-excision n = 43	p value
Seroma/edema	78 (33.6%)	12 (27.9%)	0.60
Wound infection	26 (11.2%)	10 (23.3%)	0.046
Hematoma	21 (9.1%)	3 (7.0%)	1.00
Delayed wound healing	13 (5.6%)	5 (11.6%)	0.17

Table 4. Seroma rates by axillary procedure

Complication	Procedure; no. (%)			p value
	No axillary surgery n = 22	SLNB n = 237	ALND n = 16	
Seroma/edema	5 (22.7)	82 (34.6)	3 (18.8)	0.25

ALND = axillary lymph node dissection; SLNB = sentinel lymph node biopsy.

Long-term or delayed complications included fat necrosis, which occurred in 14 (5.1%) patients, inclusion cyst, which occurred in 3 (1.1%) patients, and inappropriate scarring affecting cosmesis, which occurred in 3 (1.1%) patients (Table 2). Seventy-three patients (26.5%) needed reoperation for cosmetic reasons such as asymmetry and breast mound revision; however, 27 (9.8%) of the 275 patients in the analysis had a delayed contralateral balancing procedure as their second surgery to match the nonaffected breast with the affected breast, and only 46 of 275 (16.7%) had surgery for an issue with cosmesis of the already treated breast over the 5-year period.

Adjuvant treatment

Two hundred and seventeen (78.9%) patients received adjuvant radiotherapy. The mean radiotherapy dose administered was 4479.9 (SD 407.6) cGy. The mean number of radiotherapy sessions was 18.6 (SD 4.2). A delay to adjuvant therapy occurred in 12 patients; however, the delay was because of postoperative complications in only 7 of 217 (3.2%) patients. If there was a delay to adjuvant therapy, the mean time that adjuvant therapy was delayed was 22.6 (SD 27.6) days, with the minimum and maximum delays being 4 and 84 days, respectively.

Recurrence and survival

There was a median follow-up of 18 months (range 1–82 mo) and a mean follow-up of 24 (SD 19) months. Local recurrence occurred in 9 of 275 (3.3%) patients, distant recurrence occurred in 2 of 275 (0.7%) patients and overall survival was 99.3% (Table 5).

DISCUSSION

To our knowledge, this is the first study to report on OPS outcomes in a Canadian setting. Our findings demonstrate that OPS is an attractive alternative to standard lumpectomy for Canadian surgeons who treat breast cancer. We acknowledge that this study is limited by the lack of a comparator group, a situation that arose because the general surgeon at our institution performed mainly OPS procedures between 2009 and 2015. As such, we compare our oncologic outcomes and complication rates for OPS with those for standard lumpectomy procedures that are well established in the published literature.

The published literature has demonstrated that OPS is comparable to standard lumpectomy and may even show some favourable advantages in terms of improved cosmesis, the treatment of symptomatic macromastia and the ability to resect larger tumours with BCS.^{3,9,12}

In terms of tumour characteristics our study was quite comparable with the literature. The average tumour size was 17 mm and the average specimen weight was 155 g in this study. Clough and colleagues⁹ recently reported on their experience with OPS and summarized more than 10 studies looking at OPS outcomes. The mean size of the tumours was 26 mm, with tumour sizes in the other studies ranging from 15 to 32 mm, and the mean specimen weight was 177 g.⁹ In a meta-analysis by Losken and colleagues³ of studies using standard lumpectomy, average tumour size was 12.3 mm and average specimen weight was 64 g in patients who underwent BCS. This is interesting as it would suggest we are treating cancers of comparable sizes with the 2 techniques; however, we are able to resect larger volumes of breast parenchyma with OPS while still maintaining cosmesis as well as appropriate re-excision rates and local recurrence rates. Our study also demonstrated a wide range of specimen weights, from very small to very large (15–1132 g). Other OPS studies have also reported wide ranges of weights, from 67 to 430 g.⁹ It has been shown that if more than 20% of the breast volume has to be removed, it will create a deformity that is reported by patients and independent observers.¹ The smaller volumes seen in our study, as well as in other studies, may reflect the increased use and importance of these techniques for smaller breasts, for sensitive zones of the breast such as the upper inner quadrant and for recentralization of the nipple areolar complex; these techniques are not just being used in situations where larger volume tumours need to be removed. The larger excision volumes seen in this study were for patients who chose to reduce the volume of their breasts during surgery, a request that can be accommodated by some of the advanced oncoplastic techniques such as a reduction mammoplasty.

In terms of immediate postoperative complications, Meretoja and colleagues¹³ reported an infection rate of 13% and a hematoma rate of 3.3%; our infection rate was comparable at 13.1% and our hematoma rate was slightly higher (8.7%). Vitug and colleagues¹⁴ summarized complications in breast surgery and reported a wound infection rate of 3.4% to 18.3% and a hematoma rate of 2% to 10%. As expected, in our study, rates of wound infections and delayed wound healing were in patients who had to undergo a re-excision. We had very low rates of nipple necrosis and skin-flap necrosis (0.7% and 1.1%, respectively), comparable with the rates reported in the literature (0.4% and 0.5%, respectively).⁴

Another clinical factor that is important in determining OPS safety is the delay to adjuvant therapies. Our study

Table 5. Recurrence rates and overall survival among 275 patients

Outcome	No. (%)
Local recurrence	9 (3.3)
Distant recurrence	2 (0.7)
Overall survival	273 (99.3)

demonstrated that adjuvant therapy was delayed because of postoperative complications in 3.2% patients, a rate that is comparable to rates reported in the literature (2%–5%).^{9,13} This indicates that in our Canadian community setting the delay to treatment is minimal.

The one complication that occurred more frequently in our study than in the literature was seromas and edema; however, in contrast to other authors, we intentionally reported swelling as both breast and axilla seroma rates and the rate of postoperative breast edema combined, as both affect patient outcomes. Moreover, the seromas that were identified may be more representative of axilla seromas than in-breast seromas, which may have contributed to the higher rates seen in our study. We also noted that seromas were seen more frequently in patients who had an SLNB than in those who either had no axillary surgery or had an ALND. All of the patients who had an ALND had a postoperative drain placed in the axilla, which helps to prevent seroma formation. Axillary surgery, even SLNB, will interrupt those lymphatics and affect breast drainage. Given that most studies do not report postoperative breast edema/swelling independently, it is underrepresented in the literature, making it difficult to report the true breast lymphedema rate following OPS. Our elevated rates of seroma/edema may be suggestive of both processes rather than seroma formation alone. Our patients with significant breast edema are referred for complete decongestive therapy, which is usually used to treat arm lymphedema, and the majority had resolution with limited therapy. This may be an interesting area for further research in terms of both postoperative breast edema and the use of complete decongestive therapy for treatment.

Long-term complications, including inappropriate scarring affecting cosmesis, occurred in 1.1% of our study population. One OPS study reported fat necrosis in 3.3% of patients, which is comparable to our finding of fat necrosis in 5.1% of patients.⁴ Many of the OPS studies published to date have not specifically reported on reoperation rates for cosmetic reasons; however, 1 study commented on poor cosmesis outcomes in standard BCS, with rates as high as 30%. In our study, 16.7% of patients had another procedure to help correct issues with cosmesis. These results related to cosmesis suggest that OPS may be associated with improved cosmetic outcomes; however, the increased reoperation rate among OPS patients may be because cosmesis is emphasized and prioritized more now among women having partial mastectomies whereas in the past the attitude was to “just get the cancer out.” Some of the philosophies around OPS are that if you are going to leave the breast and do BCS, then the goal should be a good cosmetic appearance.¹ Approximately 10% of the patients in our study chose to have a second elective procedure to correct breast asymmetry resulting from the contralateral ablative surgery, further emphasizing the importance of cosmesis.

A limitation of this study is that we did not report on the frequency of use of the various oncoplastic techniques. In OPS, there are different degrees of difficulty depending on the volume of tissue taken and the techniques used for closure.¹ The higher levels usually require more advanced tissue mobilization and are based on mammoplasty techniques.¹ We are currently working on a study that will investigate whether there is an association between oncoplastic technique level and complications.

The most important outcome, and the only controllable one, when looking at BCS is the ability to achieve a clear margin. Our study had a positive margin rate of 13.5%, which is comparable to the rates reported in other studies on OPS (approximately 12%–16%).^{3,4,9,13} The positive margin rate for standard BCS was reported to be between 15% and 47% in 1 systematic review of the literature.⁴ The definition of a close or positive margin, along with management, has been a moving target in breast cancer research. The consensus guideline on margins for BCS of the Society of Surgical Oncology and the American Society for Radiation Oncology published in 2014 indicated that margins wider than “no ink on tumour” were not necessary.¹⁵ This change in margin definition should not affect the rate of positive margins as the surgeon would know the definition of negative margins and be aiming for that when excising the tumour. However, it may have affected the management of positive margins, as it was historically thought that a re-excision should be done to obtain a wider margin.

The oncologic outcomes in our study were comparable with those in the literature. In our study the local recurrence rate was 3.3%, the distant recurrence rate was 0.7% and overall survival was 99.3%. Local recurrence rates in the OPS literature range from 2% to 9%; distant recurrence rates in the literature are slightly higher than our rate, at 7%–14%.¹⁶ Overall survival in OPS studies has been reported at 86%–96%.^{4,9} The numbers in our study may be slightly different as our follow-up period was shorter than in some of these other studies. Most of the follow-up periods in the literature ranged from 3 to 5 years.^{4,9} Our study is limited by the fact that some follow-up data were missing and our median length of follow-up was just under 2 years.

CONCLUSION

The findings of this study demonstrate that OPS is an attractive alternative to standard lumpectomy in the treatment of breast cancer for Canadian general surgeons who have participated in additional training in OPS.¹⁷ The short- and long-term outcomes and complication rates in this study are comparable with those of other OPS studies, as well as studies of standard BCS. The findings of this study should encourage other Canadian breast and general surgeons to learn OPS and integrate it into their breast practice.

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Competing interests: M. Brackstone is an associate editor of *CJS*. She was not involved in the review of this paper nor in the decision to accept it for publication. No other competing interests were declared.

Contributors: J. Maxwell and R. Hanrahan designed the study. J. Maxwell, A. Lumsden, L. Pearson, J. Puhlin, J. McLean and R. Hanrahan acquired the data, which S. Knowles, J. Maxwell, A. Lumsden, L. Pearson, J. McLean, M. Brackstone and R. Hanrahan analyzed. S. Knowles, J. Maxwell, J. McLean and R. Hanrahan wrote the article, which all authors reviewed and approved for publication.

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