ORIGINAL ARTICLE

Bilateral reduction mammoplasty following breast cancer: A case-control study

Arianna Dal Cin MD¹, Casey Knight MD¹, Kaitlyn F Whelan BSc¹, Forough Farrokhyar PhD^{1,2}

A Dal Cin, C Knight, KF Whelan, F Farrokhyar. Bilateral reduction mammoplasty following breast cancer: A case-control study. Can J Plast Surg 2012;20(1):e6-e9.

PURPOSE: Many women undergo a bilateral reduction mammoplasty after lumpectomy and radiation for breast cancer due to breast hypertrophy. The outcomes of these patients, focusing on complications and the need for additional surgery, are reviewed.

METHODS: A matched case-control study with patients serving as their own control (treated breast cancer breasts were 'cases', healthy breasts were 'controls') was performed. Patients were identified through hospital records between 1980 and 2007. Patients treated by lumpectomy and radiation with subsequent bilateral reduction surgery were included. Data regarding demographics, medical history, and peri- and postoperative complications were collected. Measured outcomes included hematoma or seroma, delayed wound healing, infection, nipple-areolar complex problems, scarring, asymmetry and the need for further surgery. Continuous variables are reported as mean ± SD, and categorical variables are reported as proportions.

RESULTS: Of the nine patients included in the study, delayed wound healing occurred in 22% of cases. Wound infections occurred in 66.7% of cases, with 22.2% experiencing a second wound infection. One patient experienced partial nipple-areolar complex loss on the radiated breast. There was abnormal scarring in 33.3% of radiated breasts. Postoperative asymmetry occurred in 77.8% of patients. Additional surgery was performed on three patients (33.3%).

CONCLUSIONS: Results of the present study suggest that women with a history of breast cancer treated by lumpectomy and radiation experience higher occurrence of postoperative complications on the radiated breast following bilateral breast reduction. Patients must be informed of these potential risks and require careful postoperative follow-up. An appropriately powered, prospective, multicentred study is required to draw definitive conclusions.

Key Words: Bilateral reduction mammoplasty; Breast hypertrophy; Radiation

Symptoms of breast hypertrophy can affect post-treatment breast Cancer patients. The true incidence of breast hypertrophy in the breast cancer population is unknown, as is the number of such patients seeking reduction mammoplasty surgery following breast cancer treatment. These patients have usually undergone lumpectomies followed by postoperative radiation therapy and chemotherapy. Although there can be changes in the shape and size of the treated breast as a result of lumpectomy and radiation, it is usually minimal in nature, resulting in, at most, asymmetry (1,2). In the macromastic patient, symptoms of interscapular back pain, prominent shoulder grooving, and intertrigo along the inframammary folds or between the breasts remain despite the described changes to the cancer-afflicted breast.

Numerous publications regarding breast reconstruction following irradiation report that the radiated breast site is more prone to complications than the nonradiated breast (2-5). Currently, little information has been published regarding reduction mammoplasties performed on women previously treated for breast cancer. The radiated breast is expected to exhibit a likelihood of delayed wound healing, increased postoperative complications and less pleasing final results. In addition,

Une réduction mammaire bilatérale après un cancer du sein : une étude cas-témoins

OBJECTIF: De nombreuses femmes subissent une réduction mammaire bilatérale après une lumpectomie et des radiations pour traiter un cancer du sein causé par une hypertrophie mammaire. L'issue de ces patientes, axée sur les complications et la nécessité de procéder à des opérations supplémentaires, est analysée.

MÉTHODOLOGIE : Les chercheurs ont mené une étude cas-témoins appariée auprès de patientes étant elles-mêmes leur propre sujet témoin (le sein traité contre le cancer était le « cas » et le sein non atteint, le « témoin »). Ils ont repéré les patientes au moyen des dossiers hospitaliers de 1980 à 2007. Ils ont inclus les patientes traitées par lumpectomie et radiation qui ont subi une réduction mammaire bilatérale par la suite. Ils ont assemblé les données relatives à la démographie, aux antécédents médicaux et aux complications périopératoires et postopératoires. Les issues mesurées étaient les hématomes ou les séromes, le retard de guérison de la plaie, l'infection, les problèmes du complexe mamelon-aréole, la cicatrisation, l'asymétrie et la nécessité de procéder à d'autres opérations. Les variables continues sont déclarées sous forme de moyenne ± ÉT, et les variables catégoriques, sous forme de proportions.

RÉSULTATS : Chez les neuf patientes incluses dans l'étude, les chercheurs ont remarqué un retard de guérison de la plaie dans 22 % des cas et des infections de la plaie dans 66,7 % des cas, dont 22,2 % de deuxième infection. Une patiente a présenté une perte partielle du complexe mamelonaréole sur le sein ayant subi des radiations. On observait des cicatrices anormales sur 33,3 % des seins traités, et une asymétrie postopératoire chez 77,8 % des patientes. Trois patientes ont subi des opérations supplémentaires (33,3%).

CONCLUSIONS : D'après les résultats de la présente étude, les femmes ayant des antécédents de cancer du sein traitées par lumpectomie et radiation présentent une plus forte occurrence de complications postopératoires après une réduction mammaire bilatérale. Les patientes doivent être informées de ces risques potentiels et ont besoin d'un suivi postopératoire attentif. Une étude prospective multicentrique comportant un nombre suffisant de sujets s'impose pour tirer des conclusions définitives.

it is unclear whether reduction mammoplasty in the radiated breast can be safely performed without interfering with mammography and cancer surveillance. We sought to review the outcomes of patients who underwent bilateral reduction mammoplasty following lumpectomy and radiation for breast cancer. The primary focus of the present study was the subsequent complications and need for additional surgery in this (particular?) patient population.

METHODS

After approval from the Hamilton Health Sciences Research Ethics Board, a retrospective search was conducted using the health records of Hamilton Health Sciences, McMaster University and the Juravinski Cancer Centre (Hamilton, Ontario) to identify patients who underwent lumpectomy and radiation (with or without chemotherapy) for breast cancer with subsequent bilateral reduction mammoplasty between 1980 and 2007. Patients who had undergone bilateral or unilateral reduction mammoplasty surgery before lumpectomy and radiation treatment, breast augmentation or lumpectomy alone were excluded from the study.

¹Division of Plastic Surgery, Department of Surgery; ²Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario

Correspondence and reprints: Dr Arianna Dal Cin, Division of Plastic Surgery, Department of Surgery, McMaster University, 504-304 Victoria Avenue North, Hamilton, Ontario L8L 5G4. Telephone 905-526-0811, fax 905-526-0890, e-mail a.dalcin@nas.net

TABLE 1 Patient data extracted during the chart review process

Demographic factors and relevant medical history	Reduction mamn
Age	Length of time
Body mass index	reduction
Self-reported brassiere size	Surgeon
Previous breast surgery and radiation therapy	Preoperative m
Diabetes	distance and
Smoking	Technique
Chronic renal failure	Amount of brea
Hypertension	Use of intraope
Dyslipidemia	Final pathologi
Immunocompromisation	Perioperative u
Connective tissue disorders	Patient satisfaction
Use of steroid or antirheumatoid therapy	Complications
Lumpectomy	Hematoma
Site	Seroma
Status of surgical margins	Fat necrosis
Tumour size	Delayed wound
Nodal involvement	Wound infectio
Final pathological diagnosis	on treatment
Radiation	Nipple-areolar
Length	Scarring comp
Site	Need for additi
Dose	Mammography a
Fractions	Results of man
Chemotherapy	disease
Length	*Factors pertaining
Type	were collected fo

A thorough chart review was performed to identify the patient's oncological treatment and relevant medical history that may have affected their postoperative wound healing abilities (Table 1). The nature of the lumpectomy site, ultimate stage of the patient, radiation protocols and chemotherapy protocols were also reviewed. Surgical factors including postoperative complications and the patient's selfreported level of satisfaction with the outcome of the reduction procedure following the lumpectomy and radiation were collected. Finally, mammography and cancer surveillance results for evidence of disease recurrence?were reviewed (Table 2).

All patients had undergone axillary staging, predominantly axillary node dissection, with two patients undergoing sentinel lymph node biopsies. The reduction procedures were performed by two separate surgeons, and the majority of patients underwent a bilateral inferior pedicle reduction mammoplasty procedure. A superior pedicle reduction mammoplasty was performed on only one patient. All patients were treated with perioperative antibiotics (a first-generation cephalosporine agent). In all cases, the lumpectomy scar site specimen was sent separately to pathology. All patients-underwent postoperative mammograms to establish a new baseline. These were usually performed six months following their reduction procedure.

Because there were no reported cases of bilateral lumpectomy and radiation, the patients served as their own control and, thus, a retrospective matched case-control study was undertaken. The cancertreated breast served as the case study and the healthy, untreated breast was deemed the control. All patients underwent a reduction mammoplasty. Continuous variables were reported as mean ± SD, and categorical variables were expressed as proportions.

RESULTS

Fifty-eight patients were initially identified for potential inclusion in the present retrospective match case-control study. However, 48 patients were excluded on the basis of having undergone a

Reduction ma	mmoplasty
Length of tir reduction	ne between termination of breast cancer treatments and
Surgeon	
Preoperative distance a	e marking and planning of new sternal notch to nipple ind pedicle width
Technique	
Amount of b	preast tissue resected
Use of intra	operative consultation or frozen section
Final pathol	ogical results
Perioperativ	e use of antibiotics, drains and homecare
Patient satisfa	ction (self-reported)
Complications	i
Hematoma	
Seroma	
Fat necrosis	3
Delayed wo	und healing (>2 weeks)
Wound infector on treatme	ction (positive wound cultures/clinical suspicion and resolution ent with antibiotics)
Nipple-areo	lar complex problems
Scarring cor	mplications
Need for ad	ditional revision surgery
Mammograph	y and cancer surveillance
Results of n disease	nammograms and follow-up notes reviewed for recurrence of

balancing unilateral breast reduction or insertion of a prosthesis on the treated or opposite breast. Because one patient's chart was incomplete, nine patients were included in the study analysis.

The mean patient age was 56.22 ± 9.23 years, and the mean body mass index for the group was 30.02 ± 4.02 kg/m². Self-reported brassiere size of the patients ranged from 34 DD to 44DDD with a comparable mean sternal notch to nipple distance between breasts of approximately 32 cm.

Three patients suffered from hypertension. One patient had significant comorbidities including rheumatoid arthritis (treated with prednisone and methotrexate) and dyslipidemia. She had undergone a previous mastopexy and had received superficial radiation treatment to the chest and neck area for acne vulgaris. Of the nine patients studied, the majority of breast cancer was found within the periareolar region of the left breast. The second most common site of malignancy was within the upper outer quadrant of the left breast. One patient had not undergone node sampling or investigation because her diagnosis was of localized ductal carcinoma in situ. The patients' tumours were predominantly stage 1, with only one tumour being of higher stage. There was an equivalent number of hormone receptor-positive and hormone receptor-negative tumours, and three of the patients (30%) had positive axillary lymph nodes at the time of their staging. The majority of affected breasts underwent treatment with 5000 cGy photon beam radiation, and three patients (30%) underwent treatment with postoperative chemotherapy. The average time interval between cancer treatment and reduction mammoplasty was 5.4±4.69 years.

The weight of the tissue resected during the reduction mammoplasty ranged from 100 g to 1750 g. The results revealed that the majority of patients (78%) had a benign scar site. However, two patients were found to have foci of ductal carcinoma in situ within the treated breast (3 mm and 4 mm) (Table 3). These patients were subject to rescreening and surveillance as a result of these findings. The follow-up of all patients ranged from four months to seven years following their reduction procedure, with a mean follow-up time of 32.89±26.87 months. The complications observed within the case breasts were delayed wound healing (22.2%) and infection (66.7%), with some patients experiencing a second infection (22.2%) (Table 4). One patient experienced areolar tissue loss; however, there was no reported nipple loss. Thirty-three per cent of the patients developed significant scarring within the radiated breast, such as persistent indentation at the lumpectomy site. Complications of hematoma, seroma or fat necrosis did not occur in any patients, and none of the treated breasts required revision surgery. Interestingly, 33% of the control breasts required revision surgery in the form of repeat reduction mammoplasty.

On examination of the self-reported patient outcomes, it was found that 77.8% of patients were concerned with persistent asymmetry following reduction due to greater ptosis and volume in the normal control breast. Three patients underwent repeat balancing unilateral breast reductions to the control breast to correct the asymmetry and, in both cases, 200 g of breast tissue were removed. These patients were very pleased with the result of this procedure. Patients reported relief of their symptoms attributed to macromastia within 24 h of the reduction mammoplasty procedure.

One patient was shown to have a 4 mm focus of ductal carcinoma in situ on pathology from her breast reduction specimen of the breast prevously treated for cancer (Table 3). In a follow-up mammogram performed nine months after her reduction mammoplasty, a density was seen and invasive ductal carcinoma was found on core biopsy. She thus underwent a modified radical mastectomy approximately three months later.

DISCUSSION

The results of our study suggest that women with a history of breast cancer treated by lumpectomy and radiation experience a higher occurrence of postoperative complications in the treated breast. These complications include delayed wound healing, infection, partial nipple-areolar complex loss and abnormal scarring. These complications occurred in the lumpectomy and radiation-treated breasts, but not in the normal control breasts. Similarly, Handel et al (6) also reported delayed wound healing and areolar complications in a patient who had undergone a reduction mammoplasty after radiation therapy. Furthermore, several studies have found that previous irradiation is related to an increased risk of surgical infections (7-9).

Postoperative asymmetry of the breasts was also present in a high proportion of the patients, with the control breast being more ptotic and larger in size than the treated breast. This may indicate a tendency for the control breast to be under-reduced, and could lead to the need for additional balancing surgical procedures in some patients. Interestingly, 200 g of breast tissue were removed from each of the patients who underwent repeat reduction mammoplasty on the control breast. The sample size was too small to suggest that the control or unradiated breast be over-reduced by 200 g in future patients. However, this theory will need further prospective study.

There is an approximately 20% risk of delay in wound healing in the radiated breast, more particularly at the T-junction for the inferior pedicle reduction, and a 10-fold increased risk of postoperative wound infection in a radiated breast. Therefore, it is imperative to consider the likely prolonged and possibly complicated postoperative wound healing course of the radiated breast. Based on these data, we conclude that patients must be counselled on these risks and the variation in healing of one breast from the other depending on previous radiation treatments. Close and careful follow-up of these patients in the postoperative period is also suggested. Long-term monitoring of the asymmetry of the breasts is especially recommended because this may become evident once postoperative edema subsides. It is estimated that asymmetry is present in 35% of patients who have undergone lumpectomy and radiation, with only 14% of these patients seeking additional surgery (1). Due to the findings of ductal carcinoma in situ in two of the nine patients studied, we emphasize the importance of sending the samples from the lumpectomy site and scar separately for analysis at the time of reduction mammoplasty. A new postoperative

TABLE 3 Results of reduction mammoplastv

	Resection amount, g			_
Patient	Case	Control	Total	Pathology
1	539	639	1178	Benign
2	293	550	843	Benign
3	419	337	756	(L) 3 mm focus DCIS
4	226	428	654	Benign
5	100	250	350	Benign
6	1750	1750	3500	Benign
7	540	370	910	Benign
8	480	1000	1480	Benign
9	67	653	720	(R) 4 mm focus DCIS

DCIS Ductal carcinoma in situ; L Left; R Right

TABLE 4

Postoperative complications

	Breasts		
_	Case (n=9)	Control (n=9)	
Delayed healing, n (%)	2 (22.2)	0 (0)	
Infection, n (%)	6 (66.7)	0 (0)	
Infection 2, n (%)	2 (22.2)	0 (0)	
NAC loss, n (%)	1 (11.1)	0 (0)	
Scarring, n (%)	3 (33.3)	0 (0)	
Revision surgery, n (%)	0 (0)	3 (33.3)	

NAC Nipple-areolar complex

baseline mammogram should be completed six months after the reduction mammoplasty.

In recent years, prospective studies have been published that pertain to patient outcomes after reduction mammoplasty with subsequent long-term follow-up (10). Similar prospective studies were conducted by Blomqvist et al (11) and Behmand et al (12), but with short-term postoperative follow-up periods ranging from six to 12 months. Behmand et al's analysis of the study performed by Chadbourne et al (13) reported that reduction mammoplasty improved the physical and psychological symptoms associated with breast hypertrophy. Thoma et al (14) demonstrated that breast reduction results in the improvement of breast hypertrophy symptoms within a month following surgery. It was also found that this improvement was stable for up to one year, with the added benefit of a positive health-related quality of life effect, yielding a lifetime gain of 5.32 quality-adjusted life years. These studies highlight the physical and psychological benefits of breast reduction surgery on a patient within the normal population experiencing breast hypertrophy symptoms. The benefits of breast reduction surgery on patients afflicted with breast cancer remain unstudied. One can surmise that the benefits of surgery would apply equally to the breast cancer patient, but would they be mistaken? The question remains of whether the benefits of breast reduction surgery are diminished by the complications resulting from tissue's poor wound healing ability because of previous radiation.

Although the incidence of breast cancer has stabilized in Canada within the past five years, there has been an associated 25% decrease in mortality, with five-year survival rates for patients living with breast cancer expected to be up to 80% (15). While the true incidence of breast hypertrophy is not known, one can surmise that a subpopulation of breast cancer patients are living with significant symptoms due to macromastia or breast hypertrophy. On completion of their breast cancer treatments, many seek surgical consultation for breast reduction mammoplasty to contend with the resultant breast asymmetry and continued symptoms of breast hypertrophy.

We acknowledge that there were limitations to our study. We had a very small sample size and, therefore, no statistical analyses could be performed. The present study was also retrospective in nature, which can result in incorrect or incomplete data. However, our findings give better insight to patients of the potential risks of reduction mammoplasty. A summary of the nature and rate of complications on the radiated breast is provided by the present analysis. It has also led to the proposal of a new surgical principle stating that due to greater contracture post-treatment of the radiated breast tissue, one should avoid the tendency to under-reduce the control breast by perhaps resecting 200 g more than anticipated.

CONCLUSION

The results of the present retrospective, match case-control study, although having a small sample size, suggest that women with a history of breast cancer treated by lumpectomy and radiation can successfully undergo reduction mammoplasty surgery for the treatment of breast hypertrophy and its related physical and psychological symptoms. A high occurrence of postoperative complications on the radiated breast following bilateral breast reduction was observed, and the risk of complications of delayed wound healing, infection and scarring were increased four- to 10-fold. However, physicians should inform the patient that the primary purpose of the bilateral reduction mammoplasty procedure is to reduce the adverse symptoms caused by their macromastia. The physician should emphasize that while the procedure will be successful in achieving this goal, the irradiated breast may have a suboptimal cosmetic result and that complications may arise. Therefore, after proper patient counselling that results in realistic expectations, the patient can undergo a successful reduction mammoplasty to relieve the symptoms of her breast hypertrophy. Thorough follow-up of wound healing and mammographic surveillance six months following surgery is imperative.

DISCLOSURE: The authors have no financial disclosures or conflicts of interest to declare.

REFERENCES

1. Cocquyt VF, Blondeel PN, Depypere HT, et al. Better cosmetic results and comparable quality of life after skin-sparing mastectomy and immediate autologous breast reconstruction compared to breast conservative treatment. Br J Plast Surg 2003;56:762-70.

- Bajaj AK, Kon PS, Oberg KC, et al. Aesthetic outcomes in patients undergoing breast conservation therapy for the treatment of localized breast cancer. Plast Reconstr Surg 2004;114:1442-9.
- Bostwick J. Breast reconstruction after mastectomy. Cancer 1990;66:1402-11.
- Williams JK, Bostwick J III, Bried JT, Mackay G, Landry J, Benton J. TRAM flap breast reconstruction after radiation treatment. Ann Surg 1995;221:756-64.
- Stabile RJ, Santoro E, Dispaltro F, Sanfillipo LJ. Reconstructive breast surgery following mastectomy and adjunctive radiation therapy. Cancer 1980;45:2738-43.
- Handel N, Lewinsky B, Waisman JR. Reduction mammaplasty following radiation therapy for breast cancer. Plast Reconstr Surg 1992;89:953-5.
- 7. Say CC, Donegan W. A biostatistical evaluation of complications from mastectomy. Surg Gynecol Obstet 1974;138:370-6.
- Krueger EA, Wilkins EG, Strawderman M, et al. Complications and patient satisfaction following expander/implant breast reconstruction with and without radiotherapy. Int J Radiat Oncol Biol Phys 2001;49:713-21.
- Olsen MA, Lefta M, Dietz JR, et al. Risk factors for surgical site infection after major breast operation. J Am Coll Surg 2008;207:326-35.
- O'Blenes CA, Delbridge CL, Miller BJ, Pantelis A, Morris SF. Prospective study of outcomes after reduction mammaplasty: Long-term follow-up. Plast Reconstr Surg 2006;117:351-8.
- Blomqvist L, Eriksson A, Brandberg Y. Reduction mammaplasty provides long-term improvement in health status and quality of life. Plast Reconstr Surg 2000;106:991-7.
- Behmand RA, Tang DH, Smith DJ. Outcomes in breast reconstruction surgery. Ann Plast Surg 2000;45:575-80.
- Chadbourne EB, Zhang S, Gordon MJ, et al. Clinical outcomes in reduction mammaplasty: A systematic review and meta-analysis of published studies. Mayo Clin Proc 2001;76:503-10.
- Thoma A, Sprague S, Veltri K, Duku E, Furlong W. A prospective study of patients undergoing breast reduction surgery: Health related quality of life and clinical outcomes. Plast Reconstr Surg 2007;120:13-26.
- Cordeiro P. Breast reconstruction after surgery for breast cancer. N Engl J Med 2008;359:1590-601.