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Resection margins and local recurrences in breast cancer: Comparison between conventional and oncoplastic breast conserving surgery

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ABSTRACT

Background: This retrospective cohort study aims to compare surgical margins, reoperations and local recurrences after conventional or oncoplastic breast conservation surgery (BCS). Furthermore, we aim to investigate differences between various oncoplastic techniques.

Material and methods: We reviewed 1800 consecutive patients with primary invasive breast cancer (N = 1707) or ductal carcinoma in situ (N = 93) who underwent BCS at Helsinki University Hospital between 2010 and 2012.

Results: Conventional BCS was performed in 1189 (66.1%) patients, oncoplastic BCS in 611 (33.9%). Various oncoplastic techniques were used. Patients with oncoplastic BCS had more often multifocal ($p < 0.001$), larger ($p < 0.001$), palpable tumours ($p < 0.001$) with larger resection specimens ($p < 0.001$). The amount of resected tissue varied substantially depending on the oncoplastic technique. Patients treated with oncoplastic BCS were younger ($p < 0.001$) and their tumours were more aggressive according to histological grade ($p < 0.001$), T-stage ($p < 0.001$), Ki-67 ($p < 0.001$) and lymph node status ($p < 0.001$).

There was no difference, however, in surgical margins ($p = 0.578$) or reoperation rates ($p = 0.430$) between the groups. A total of 152 (8.4%) patients were reoperated because of insufficient margins, 96 (8.1%) in the conventional, 56 (9.2%) in the oncoplastic BCS group.

The median follow-up time was 75 (2–94) months. There was no difference in local recurrence-free survival between the conventional and oncoplastic BCS groups (log-rank test, $p = 0.172$).

Conclusions: Oncoplastic BCS was used for larger, multifocal and more aggressive tumours. Nevertheless, no difference in reoperation rate or local recurrences were found. Oncoplastic BCS is as safe as conventional BCS enabling breast conserving for patients who otherwise were candidates for mastectomy.

Introduction

Breast conserving surgery (BCS), instead of mastectomy, has long since established its role as the standard of surgical care in the treatment of early-stage breast cancer. Oncoplastic BCS techniques have further extended the possibilities of BCS into the treatment of larger and multifocal tumours as well as extensive ductal carcinoma in situ (DCIS), without compromising the oncological safety or aesthetic outcome [1]. Oncoplastic BCS allow resections of up to 50% of breast volume without causing deformity.

Adequate surgical margins are decisive in reducing the risk of local recurrence (LR) [2]. Positive surgical margins are generally thought to necessitate a reoperation, either a re-excision, or a mastectomy [3]. A second operation can cause discomfort and stress to the patient, lead to an increased risk of surgical complications and to poor aesthetic outcome, delay adjuvant therapy and increase health care costs [2,4–6]. Furthermore, the patients who undergo a re-excision may have an increased risk of developing LR, compared to patients with only one operation [7].

There are several studies reporting short- and even long-term outcomes after oncoplastic BCS, mainly after reduction mammoplasty techniques [3,8–12]. Oncoplastic BCS, however, includes

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Abbreviations

BCS	Breast conserving surgery
DCIS	ductal carcinoma in situ
LR	local recurrence
RT	radiotherapy
CNB	core needle biopsy
FNAC	fine needle aspiration cytology
ROLL	radioguided occult lesion localization
MRI	magnetic resonance imaging
SNB	sentinel node biopsy
MDT	multidisciplinary team
CT	computed tomography scan
LRFS	local recurrence free survival

several different techniques [1], which differ substantially regarding the amount of resected tissue.

This retrospective cohort study aims to compare surgical margins, reoperations and LR after conventional or oncoplastic BCS. In addition, we aim to investigate differences between various oncoplastic BCS techniques.

Patients and methods

Consecutive patients with primary invasive breast cancer or DCIS who underwent BCS at Breast Surgery Unit of Helsinki University Hospital between the January 1st, 2010 and December 31st, 2012 were included in this retrospective cohort study. We excluded the patients who underwent merely a tumourectomy with neither adjuvant treatment nor axillary surgery due to comorbidities (N = 29). In addition, we excluded the patients who had been diagnosed by surgical biopsy (N = 45) and those whose breast cancer was found unexpectedly in reduction mammoplasty specimen (N = 2). Remaining 1800 cases were categorized into two groups, conventional or oncoplastic BCS. None of the patients had received neoadjuvant treatment.

The data was collected from electronic patient records: patient and tumour characteristics, surgical technique, excision margins and specimen weight, re-excision rate, lymph node status, adjuvant systemic treatment, postoperative radiotherapy (RT), time to local, regional or distant recurrence, date and cause of death and date of last follow-up. Patients with bilateral cancer were regarded as two separate cases with possibly different BCS techniques.

Imaging

All patients underwent mammography as well as breast and axillary ultrasound. Core needle biopsy (CNB) was taken from breast lesion(s) and fine needle aspiration cytology (FNAC) from suspicious axillary lymph nodes. The patients who had an invasive lobular carcinoma diagnosed on CNB underwent magnetic resonance imaging (MRI) (N = 270).

Surgical technique

All breast and axillary operations were performed or supervised by an experienced breast surgeon. Impalpable lesions were localized either with radioguided occult lesion localization (ROLL), hooked wire or radioactive seed. Surgeon had chosen the most suitable operation technique individually depending on the location and size of the tumour, as well as on the size and the glandular density of breast, in agreement with the patient. In this study, conventional BCS stands for resection of the tumour with adequate mobilization and closure of breast tissue. Oncoplastic BCS instead refers to other level 1 and level 2 oncoplastic procedures [1].

The patients who had been diagnosed with axillary lymph node metastasis in ultrasound guided FNAC underwent axillary lymph node dissection. Sentinel node biopsy (SNB) was performed in patients with invasive breast cancer, node negative in axillary ultrasound. The patients with DCIS but a suspicion of invasion in CNB underwent SNB likewise.

Reoperation due to inadequate margins was either a re-excision or a mastectomy depending on breast size, glandular density and aesthetic result after the first operation, with patient's preference taken into account. The guidelines for adequate surgical margins changed at the beginning of the study period in 2010 and new recommendations were adopted in our unit gradually. Previously 5 mm microscopical histological margins were required for invasive cancer and 10 mm for DCIS. Consensus symposium in 2010 recommended that no ink on tumour is adequate for invasive cancer and 2 mm for DCIS with or without concomitant invasive tumour [13].

Histopathological examination

Histopathological analyses from surgical specimens were performed by experienced breast pathologists. The breast and lymph node specimens were handled and examined as described in our earlier study [14].

Adjuvant treatment

All cases were discussed at a multidisciplinary team (MDT) meeting after surgery in order to recommend adjuvant treatments. All patients received postoperative RT except those who underwent mastectomy as a second operation and those whose general condition was not suitable for RT. The patients who had distant metastasis identified on postoperative whole body computed tomography scan (CT) did not receive RT either. Adjuvant chemotherapy and endocrine treatment were recommended according to the Finnish national evidence-based guidelines [15]. The patients with DCIS or with luminal T1a-b invasive, node negative breast cancer do not receive adjuvant systemic treatment. The RT and adjuvant systemic treatment protocols used at our institution are described in our earlier study [16].

Follow-up

The first clinical checkup took place within three weeks after the operation. After adjuvant chemotherapy and/or radiotherapy the patients were followed-up for five years. Very young women and women with hereditary breast cancer were followed-up for ten years at the Department of Oncology of Helsinki University Hospital. The follow-up consisted of visits at one, three and five years after the operation. In addition, a phone service operated by a breast cancer nurse practitioner was available for patients who needed counselling about symptoms related to side-effects of treatments or potential recurrence. The patients had a possibility for further visits if needed.

Mammography was performed yearly and combined with ultrasound in women ≤45 years or older with high density of breast in mammography or if needed as further diagnostic investigation. Annual MRI of the breasts was performed in women with high risk hereditary breast cancer. Additionally, MRI, whole body CT or bone isotope scan were done whenever indicated for instance due to symptoms which might indicate local or distant recurrence.

After the first five years or in some patients after ten years the

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follow-up continued at primary health care.

Statistics

Statistical analyses were performed using IBM™ SPSS™ Statistics version 22 software (SPSS Inc., Chicago, IL). Frequency tables were analyzed with chi-squared test and continuous distributions with Mann-Whitney *U* test.

For LR survival analysis and for other breast cancer events, we excluded the patients with bilateral disease (N = 87), earlier breast cancer (N = 69), other malignancy within five years (apart from DCIS or basal cell carcinoma, N = 105), distant metastasis diagnosed within 12 months after primary operation (N = 18) and those who underwent a completion mastectomy (N = 80). In addition, we excluded the patients who were followed-up for less than three years due to relocation to other hospital district (N = 30). The remaining 1411 patients went through a Kaplan-Meier survival analysis for local recurrence-free survival (LRFS), the conventional and oncoplastic BCS groups were compared with the log-rank test. Other breast cancer events were assessed with Fisher's exact test simply comparing event counts.

This retrospective study did not require an ethics committee permission, but was approved by the institutional research board of Helsinki University Hospital.

Results

The patient and tumour characteristics are summarized in Table 1. 1707 patients had invasive breast cancer and 93 had DCIS. Conventional BCS was performed in 1189 patients (66.1%) and

Table 1
Patient and tumour characteristics for conventional and oncoplastic breast conserving surgery.

		Conventional BCS N = 1189		Oncoplastic BCS N = 611		p-value
		N	%	N	%	
Tumour	Impalpable	750	63.1%	255	41.7%	<0.001
	Palpable	439	36.9%	356	58.3%	
Reoperation due to insufficient margins	No	1093	91.9%	555	90.8%	0.430
	Yes	96	8.1%	56	9.2%	
Reoperation	Re-excision	42	43.8%	17	30.4%	0.102
	Mastectomy	54	56.3%	39	69.6%	
Histology	DCIS	64	5.4%	29	4.7%	0.877
	Invasive ductal carcinoma	826	69.5%	424	69.4%	
	Invasive lobular carcinoma	136	11.4%	76	12.4%	
	Other invasive	163	13.7%	82	13.4%	
Pathological T stage	pTis	64	5.4%	28	4.6%	<0.001
	pT1	990	83.3%	415	67.9%	
	pT2	132	11.1%	164	26.8%	
	pT3	2	0.2%	3	0.5%	
	pT4	1	0.1%	1	0.2%	
Multifocal tumour	No	1066	89.7%	512	83.8%	<0.001
	Yes	123	10.3%	99	16.2%	
EIC	0	1077	90.6%	538	88.1%	0.094
	1	112	9.4%	73	11.9%	
Tumour grade	1	416	35.0%	175	28.6%	<0.001
	2	500	42.1%	237	38.8%	
	3	272	22.9%	198	32.4%	
	NA	1	0.1%	1	0.2%	
ER	Negative	100	8.4%	68	11.1%	0.171
	Positive	1028	86.5%	512	83.8%	
	NA	61	5.1%	31	5.1%	
PR	Negative	303	25.5%	184	30.1%	0.108
	Positive	825	69.4%	396	64.8%	
	NA	61	5.1%	31	5.1%	
Ki-67	0–15%	680	57.4%	291	47.6%	<0.001
	16–30%	260	22.0%	155	25.4%	
	>30%	183	15.5%	134	21.9%	
	NA	61	5.1%	31	5.1%	
HER	Negative	1032	86.8%	505	82.6%	0.016
	Positive	96	8.1%	75	12.3%	
	NA	61	5.1%	31	5.1%	
Lymph node status	pN0	891	74.9%	415	67.9%	<0.001
	pN1mic	85	7.1%	36	5.9%	
	pN1mac	213	17.9%	160	26.2%	
Radiotherapy	No	63	5.3%	31	5.1%	0.839
	Yes	1126	94.7%	580	94.9%	
Adjuvant treatment	No	317	26.7%	85	13.9%	<0.001
	Endocrine treatment	512	43.1%	234	38.3%	
	Chemotherapy	61	5.1%	62	10.1%	
	Both	299	25.1%	230	37.6%	
	Median (range)	Median (range)				
Age (years)		62 (35–93)	61 (37–86)	<0.001		
Tumour size (mm)		12 (1–86)	16 (1–80)	<0.001		
Smallest lateral surgical margin (mm)		10 (0–40)	10 (0–56)	0.578		
Specimen weight (g)		56 (8–507)	77 (10–1893)	<0.001		

Abbreviations: BCS, breast conserving surgery; DCIS, ductal carcinoma in situ; EIC, extensive intraductal component; ER, estrogen receptor; PR, progesterone receptor; Ki-67, proliferation marker; HER, Human Epidermal Growth Factor Receptor; NA, Not available.

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oncoplastic BCS in 611 (33.9%). Various oncoplastic techniques were used, these are provided in Table 3. The percentage of patients with pure DCIS was similar in conventional BCS group (5.4%) and in oncoplastic BCS group (4.7%) ($p = 0.877$).

Patients with oncoplastic BCS had more often multifocal ($p < 0.001$), larger ($p < 0.001$), and palpable tumours ($p < 0.001$) with larger resection specimens ($p < 0.001$). The amount of resected tissue varied substantially depending on the oncoplastic technique. Median specimen weight was 56 g in conventional BCS group and 77 g in oncoplastic group ($p < 0.001$). The range of specimen weight was wide in the oncoplastic group (10–1893 g).

Patients treated with oncoplastic BCS were slightly younger ($p < 0.001$) and their tumours were more aggressive according to histological grade ($p < 0.001$), T-stage ($p < 0.001$), Ki-67 proliferation index ($p < 0.001$) and lymph node status ($p < 0.001$).

Reoperations

There was no difference, however, in surgical margins ($p = 0.578$) or reoperation rates ($p = 0.430$) between the groups (Table 2). A total of 152 (8.4%) patients were reoperated because of insufficient margins, 96 (8.1%) in the conventional BCS group and 56 (9.2%) in the oncoplastic BCS group.

Risk factors for reoperations were multifocality of the tumour ($p < 0.001$), larger tumour size and high pathological T-stage ($p < 0.001$) and extensive intraductal component (EIC) ($p < 0.001$).

Of 222 patients with multifocal tumours 67 (30.2%) underwent a reoperation, compared to 85 out of 1578 (5.4%) patients with unifocal tumours. The median size of the tumours, in patients undergoing a reoperation, was 16 mm (1–80 mm). Of 185 patients with EIC, 37 (20.0%) underwent a reoperation compared to 115 (7.1%) of 1615 without EIC.

Table 2
Patient and tumour characteristics for reoperations due to inadequate margins.

		Reoperation due to inadequate margins				
		Yes N = 152 (8.4%)		No N = 1648 (91.6%)		p-value
		N	%	N	%	
Surgery	Conventional BCS	96	8.1%	1093	91.9%	0.430
	Oncoplastic BCS	56	9.2%	555	90.8%	
Tumour	Impalpable	73	7.3%	932	92.7%	0.043
	Palpable	79	9.9%	716	90.1%	
Reoperation	Re-excision	59	38.8%	0	0.0%	
	Mastectomy	93	61.2%	0	0.0%	
Histology	DCIS	14	15.1%	79	84.9%	0.007
	Invasive ductal carcinoma	98	7.8%	1152	92.2%	
	Invasive lobular carcinoma	26	12.3%	186	87.7%	
	Other	14	5.7%	231	94.3%	
Multifocal tumour	No	85	5.4%	1493	94.6%	<0.001
	Yes	67	30.2%	155	69.8%	
EIC	No	115	7.1%	1500	92.9%	<0.001
	Yes	37	20.2%	148	80.0%	
Tumour grade	1	36	6.1%	555	93.9%	0.066
	2	67	9.1%	670	90.9%	
	3	49	10.4%	421	89.6%	
	NA	0	0.0%	2	100.0%	
ER	Negative	11	6.5%	157	93.5%	0.097
	Positive	128	8.3%	1412	91.7%	
	NA	13	14.8%	79	85.9%	
PR	Negative	39	8.0%	448	92.0%	0.131
	Positive	100	8.2%	1121	91.8%	
	NA	13	14.1%	79	85.9%	
Ki-67	0–15%	66	6.8%	905	93.2%	0.016
	16–30%	45	10.8%	370	89.2%	
	>30%	27	8.5%	290	91.5%	
	NA	13	14.1%	79	85.9%	
HER	Negative	124	8.1%	1413	91.9%	0.125
	Positive	15	8.8%	156	91.2%	
	NA	13	14.1%	79	85.9%	
Lymph node status	pN0	89	6.8%	1217	93.2%	<0.001
	pN1mic	9	7.4%	112	92.6%	
	pN1mac	54	14.5%	319	85.5%	
Radiotherapy	No	60	63.8%	34	36.2%	<0.001
	Yes	92	5.4%	1614	94.6%	
Adjuvant treatment	No	23	5.7%	379	94.3%	<0.001
	Endocrine treatment	50	6.7%	696	93.3%	
	Chemotherapy	9	7.3%	114	92.7%	
	Both	70	13.2%	459	86.8%	
		Median (range)		Median (range)		
Age (years)		59 (35–85)		62 (35–93)		0.003
Tumour size (mm)		16 (1–80)		13 (1–86)		<0.001
Smallest lateral surgical margin (mm)		0.5 (0–10)		10.0 (0–56.0)		<0.001
Specimen weight (g)		57 (12–660)		62 (8–1893)		0.231

Abbreviations: BCS, breast conserving surgery; DCIS, ductal carcinoma in situ; EIC, extensive intraductal component; ER, estrogen receptor; PR, progesterone receptor; Ki-67, proliferation marker; HER, Human Epidermal Growth Factor Receptor; NA, Not available.

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After oncoplastic BCS, reoperation seemed to be more often mastectomy (69.6%) compared to conventional BCS group (56.3%), but the difference was not statistically significant ($p = 0.102$).

Oncoplastic BCS techniques

Eleven different oncoplastic BCS techniques were used (Table 3). Racket mammoplasty (30.1%) and round block (28.0%) were the most common methods. Only 55 patients were operated using reduction mammoplasty techniques, superior or inferior pedicle mammoplasty or wise-pattern reduction with resection of nipple-areolar complex (wise-amputation). The reoperation rate ranged from 5.0% (J-mammoplasty) to 29.4% (batwing mammoplasty), but was similar in the most of the groups (7.7–10%). The number of batwing-mammoplasty procedures ($N = 17$) was small in this series.

Breast cancer recurrence

Altogether 1411 patients remained for survival analysis of LRFS, 940 in the conventional group and 471 in the oncoplastic BCS group (Table 4). The median follow-up time was 75 (2–94) months. There was no difference in LRFS between the conventional and oncoplastic BCS groups in the Kaplan-Meier analysis (log-rank test, $p = 0.172$, Fig. 1). The five-year LRF survival estimates for conventional and oncoplastic BCS groups were 98.0% and 98.9%, respectively.

Contralateral breast cancer recurrence and regional lymph node recurrences are summarized in Table 4. Distant metastases were detected in 29 (3.1%) patients in the conventional BCS group and in 16 (3.4%) patients in the oncoplastic BCS group (Fisher's test, $p = 0.750$). Eight of the 32 (25.0%) patients with ipsilateral LR developed distant metastasis as well. Six of them were diagnosed with ipsilateral LR concomitantly with distant disease, one had ipsilateral LR as a primary event and one distant metastasis first.

In total, 73 patients died during the follow-up, 56 (6.0%) in the conventional BCS group and 17 (3.6%) in the oncoplastic BCS group (Fisher's test, $p = 0.074$). Eighteen (1.9%) patients in the conventional group and seven (1.5%) in the oncoplastic BCS group died from breast cancer (Fisher's test, $p = 0.672$).

Discussion

Main message

Our study indicates that oncoplastic BCS is as safe as conventional BCS even though oncoplastic techniques were used for larger, multifocal and more aggressive tumours. We found no difference in surgical margins, reoperation rates nor LR rates between the groups.

In this study, we wanted to put a special focus on evaluating results between different oncoplastic techniques. The concept of oncoplastic BCS includes a broad range of varying surgical techniques; some techniques are appropriate for small sized tumours and breasts and others for multifocal and large tumours or for large breasts. There are many studies assessing results after oncoplastic reduction mammoplasty surgery, but only few reports on other oncoplastic BCS techniques.

Resection margins and reoperations

In our series, reoperation rate was low (8.4%). Tumour size, multifocal disease and EIC proved to be predictors of inadequate margins. This is consistent with several other previous studies [8,17–19]. A trend towards a higher risk of reoperation in the DCIS group (15.1%) and in the invasive lobular carcinoma group (12.3%) was observed, as reported earlier [8,11,20], yet this did not reach statistical significance ($p = 0.007$).

The reoperation rate after oncoplastic BCS was 9.2% and it was similar in most of the oncoplastic BCS groups, although the amount of resected tissue ranged considerably. We decided not to compare each oncoplastic BCS technique statistically against each other, as the number of patients in many of the groups is very small.

The positive margin rate in our study is comparable to the rates reported earlier in the studies of oncoplastic BCS by Clough et al. (12.6%) [8], De La Cruz et al. (10.8%) [3], Hillberg et al. (9.3%) [10], Romics et al. (10.4%) [11] and Losken et al. (12.3%) [12]. Rietjens et al. [9] reported a lower positive margin rate (5.4%) and Wijgman et al. a higher rate (22.6%) [20] compared to our study. In all of these studies the margins were heterogeneously classified and not analyzed according to different oncoplastic techniques. On the other hand, the tumours were larger in diameter in most of these studies (15–27 mm) compared to our results.

The median specimen weight in our series was 77 g. Not surprisingly, it was highest in patients with reduction mammoplasty techniques. The lowest median specimen weight resulted after round block, J-mammoplasty and batwing techniques. The specimen weights in previous studies were often higher (168–249g). They reported, however, mainly breast reduction and flap techniques [3,8,9,12].

In cases of inadequate surgical margins, the reoperation was more often a completion mastectomy in the oncoplastic BCS group than in the conventional BCS group. Oncoplastic technique was chosen primarily for larger or multifocal tumour in order to avoid mastectomy. After the oncoplastic BCS a re-excision might have compromised the aesthetic result. Thus, mastectomy was performed more often as the second procedure in the oncoplastic BCS group.

Table 3
Oncoplastic breast conserving surgery techniques.

	N	Smallest lateral surgical margin (mm)	Specimen weight (g)	Reoperation due to insufficient margins
		Median (range)	Median (range)	N (%)
Racket	184	10.0 (0–45.0)	80 (15–707)	18 (9.8)
Round block	171	10.0 (0–30.0)	54 (10–183)	14 (8.2)
Upper rotation	67	10.0 (0–30.0)	121 (23–392)	6 (9.0)
Lower rotation	50	10.0 (0–20.0)	66 (28–726)	4 (8.0)
Superior pedicle	37	12.0 (0–35.0)	331 (12–1180)	3 (8.1)
inferior pedicle	10	14.0 (2.0–20.0)	495 (168–1546)	1 (10)
Mastopexy	26	7.5 (1.0–30.0)	80 (16–256)	2 (7.7)
S-plasty	21	10.0 (0–56.0)	538 (44–1255)	2 (9.5)
J-plasty	20	12.5 (0.3–30.0)	55 (24–312)	1 (5.0)
Batwing	17	5.0 (0–15.0)	58 (18–288)	5 (29.4)
Wise-amputation	8	26.5 (9.0–50.0)	1604 (110–1893)	0 (0)

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Table 4
Breast cancer events observed during follow-up.

Event	Conventional BCS (N = 940)	Oncoplastic BCS (N = 471)	p-value (Fisher)
	N (%)	N (%)	
Ipsilateral breast recurrence	25 (2.7%)	7 (1.5%)	0.188
Contralateral breast recurrence	12 (1.3%)	4 (0.8%)	0.599
Regional lymph node recurrence	10 (1.1%)	3 (0.6%)	0.562
Ipsilateral axilla[a]	4 (0.4%)	2 (0.4%)	
Contralateral axilla[b]	2 (0.2%)	0	
Supraclavicular node	4 (0.4%)	1 (0.2%)	
Distant metastasis[c]	29 (3.1%)	16 (3.4%)	0.750
Death from breast cancer	18 (1.9%)	7 (1.5%)	0.672
Death from any cause	56 (6.0%)	17 (3.6%)	0.074

[a] Five patients had concomitant LR.
[b] Both of the patients had concomitant LR.
[c] Eight patients had ipsilateral LR concomitantly with distant disease, one had ipsilateral LR as a primary event and distant metastasis later, one had distant metastasis first and LR later.

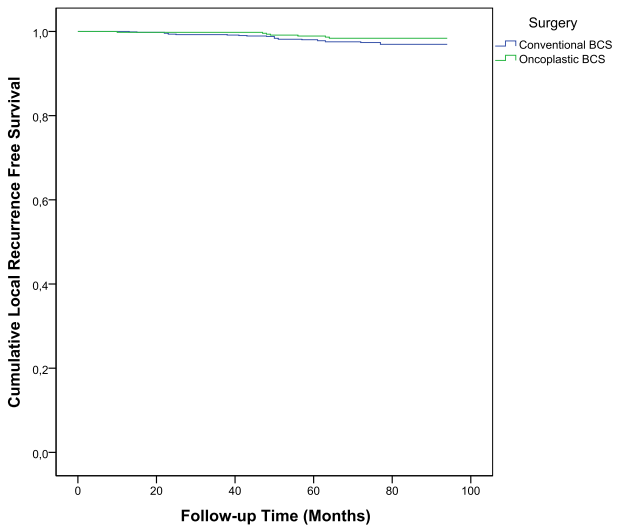

Fig. 1. Kaplan-Meier survival analysis for local recurrence-free survival after conventional and oncoplastic breast conserving surgery.

Waiting time for adjuvant treatment is discussed in our previous study, which included patients who underwent BCS in 2010 at our institution [21]. There was no difference in median waiting time between conventional and oncoplastic surgery (47 vs. 48 days).

Local recurrences

In our study, the ipsilateral LR rate during a median of 75 months follow-up was 2.3%. This is comparable to other studies. Romics et al. [11] reported a LR rate of 2.7% during a median of 30 months follow-up, Clough et al. a LR rate of 2.2% during a median of 55 months follow-up [8] and Rietjens at al. [9] a LR of 3.4% during a median of 74 months follow-up. In a systematic literature review [3] the LR rate was 3.2% during a mean of 50.5 months follow-up and 6.0% if the follow-up was more than five years. Contralateral breast cancer recurrences and regional lymph node recurrences were rare in our series.

Strengths and limitations of the study

Our study examined a large number of patients and it was carried out in a single institution. Our examination and treatment protocols including surgical practice are standardized. We report here several different oncoplastic techniques, both level 1 and level 2, not merely oncoplastic reduction mammoplasty techniques. Thereby, our study displays the entire spectrum of various oncoplastic techniques used in our center in real-life clinical practice and in an unselected cohort of breast cancer patients.

Limitation of this study is the retrospective design. The guidelines for adequate surgical margins changed at the beginning of year 2010 and the new margin recommendation 'no ink on tumour' was adopted gradually, therefore the indication for reoperation is not standard throughout the study period. Furthermore, the indications for reoperations are not similar in different units, which hinders the comparison with other studies.

We did not assess the aesthetic outcome of BCS in this study, as it is reported in our earlier study [22]. We did not record postoperative complications either.

Conclusion

Oncoplastic BCS was used for larger, multifocal and more aggressive tumours. Nevertheless, no difference in reoperation rate or LR rate were found. Oncoplastic BCS is as safe as conventional BCS enabling breast conserving for patients who otherwise were candidates for mastectomy.

Declaration of interest

All authors decline any conflict of interest regarding to the specific topic of this article.

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