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Original Article

Evaluation of surgical outcomes following oncoplastic breast surgery in early breast cancer and comparison with conventional breast conservation surgery

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ARTICLE INFO

Article history:

Received 25 October 2014

Accepted 1 November 2015

Available online 13 December 2015

Keywords:

Oncoplastic surgery

Breast conservation

Surgical margins

ABSTRACT

Background: The aim of this study was to determine whether oncoplastic breast surgery (OBS) ensures better tumour resection than conventional breast conservation surgery (BCS). **Methods:** A prospective comparative study, conducted over a 3-year period, enrolled patients with early breast cancer who underwent OBS. The total volume of glandular resection, tumour volume resection and width of the margins obtained were noted. The incidence of complications, requirement of revision surgery and locoregional recurrence during follow-up period were also noted. The data were compared with matched controls who had undergone convention BCS in the past.

Results: Thirty-three patients underwent oncoplastic surgery and the data was compared with 46 patients of conventional breast conservation. The mean volume of specimen was higher in the oncoplastic group (173.5 cm³ vs 101.4 cm³, $p = 0.03$) though the tumour volume excised was similar (43.2 cm³ vs 36.4 cm³, $p = 0.14$). The mean margin widths were larger in the oncoplastic group (14 mm vs 6 mm, $p = 0.01$). There were more instances of close and positive margins seen in conventional BCS groups. The incidence of complication rate was similar. Median follow-up 18 months for oncoplasty group showed no cases of locoregional recurrence while in median follow-up of 38 months for conventional BCS group, six cases of locoregional relapse were noted.

Conclusions: Oncoplastic surgery results in excision of larger volume of breast tissue and correspondingly obtain wider surgical margins as compared to conventional BCS. Longer follow-up is required to determine if wider resection translates into better locoregional control.

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E-mail address: bolubonkey@rediffmail.com (A. Chauhan).<http://dx.doi.org/10.1016/j.mjafi.2015.11.001>

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Introduction

Breast-conserving treatment (BCT) is the standard treatment in early-stage breast cancers.^{1,2} The primary goal of tumour excision using breast conservation surgery (BCS) is to achieve tumour-free resection margins; to provide a treatment as effective as mastectomy, with the added benefit of a preserved breast. However, despite the best surgical efforts, tumour involved surgical margins still occur in 12–40% of all tumours undergoing BCS.^{3,4} Conventional BCS entails removal of tumour volume with a clinically appreciated one cm gross margin along with axillary lymph node dissection. Many localised tumours can be successfully treated by the standard wide local excision just described, but some lesions are difficult to excise without the risk of cosmetic deformity and/or margin involvement. In some cases, cosmetically favourable results can be difficult to obtain as in large breast tumours in relation to breast size, ill-defined or poorly situated tumours.⁵ Oncoplastic breast surgery (OBS), which combines a plastic surgical procedure with BCS, is a new surgical approach that allows wide excisions and prevents breast deformities by immediate reconstruction of large resection defects. Status of surgical margins is one of the prime considerations in determining oncological safety in BCS. It is assessed as a marker for residual disease after primary surgery. It is known that pathologic margin status is one of the most important risk factors associated with ipsilateral breast tumour recurrences.⁶ Residual breast carcinoma at the resection margins may also be a source of systemic spread and, ultimately, disease-specific mortality.^{3,7} We performed a prospective study to analyse surgical margins obtained in the resected specimens obtained at the time of oncoplastic surgery. The parameters studied were volume of specimen resected, the mean of the margins obtained, the mean of closest margin and incidence of margin involvement. We compared these surgical outcomes of OBS with similar outcomes obtained from conventional BCS procedure done in historical controls.

Material & methods

This was a single centre prospective, observational study carried out over a three-year period (Jan 2012–Dec 2014) at a tertiary care, teaching hospital.

Consecutive patients of early breast cancer (T1/T2, N0/N1, AJCC TNM Classification 2010) presenting to this centre during the study period and who were deemed candidates for breast conservation were enrolled in the study. Following patients were excluded from this study:

- (i) Patients unwilling for BCS
- (ii) Patients of locally advanced breast cancers who had undergone neoadjuvant chemotherapy.
- (iii) Patients unwilling to follow-up at this centre
- (iv) Patients who had undergone conventional BCS previously at outside centre and whose medical records were incomplete.

Pre-operative work-up: All patients being considered for OBS underwent a trucut biopsy and digital mammography

accompanied with sonomammography. They underwent standard baseline hematologic and biochemistry work-up. The tumour site and planned skin flaps were marked with indelible ink on the patient breast evening prior to surgery. Decision to offer a particular oncoplastic procedure in each patient was done on individual basis and was based on the following factors:

- (i) Tumour site (quadrant) and size
- (ii) Tumour:breast ratio
- (iii) Position of tumour in relation to nipple areolar complex
- (iv) Degree of ptosis of ipsilateral breast as well as contralateral breast

The patient underwent one of the well-described oncoplastic procedures which could either be volume displacement or volume replacement technique⁵ (Figs. 1 and 2). Tumour excision was performed with the aim of including the tumour with at least 1 cm of healthy tissue far from the macroscopic margins. Patients were not offered symmetrisation surgery for contralateral breast at same sitting. The same was offered after completion of adjuvant therapy.

Pathologic analysis

The pathologic assessment of specimen obtained from BCS was carried out in the laboratory as per a standardised routine. All specimens were inked before cutting. The volume of specimen mass resected and the volume of the tumour mass within the same was measured in fresh specimens only. The volume of each tumour was calculated using the following formula: tumour volume = $(3.14/6) \times (\text{histological size})$ and the volume of each specimen was calculated by multiplying measurements of the length, width and height.⁸ Formalin-fixed and paraffin-embedded sections were stained with haematoxylin and eosin for routine examination. The margins were assessed by a standardised *radial (perpendicular) margin assessment* technique in which six margins were taken (superior, inferior, medial, lateral, posterior, anterior). Negative margin was defined as tumour >2 mm from cut edge. Close margin was deemed if tumour was <2 mm but not involving the cut edge and positive

Fig. 1 – Oncoplasty volume displacement technique: A 3.5 cm upper outer quadrant tumour addressed by lateral mammoplasty incision.

Fig. 2 – Oncoplasty volume replacement technique: A 2.5 cm central quadrant tumour addressed by wide local excision and mini LD flap inset.

margin was reported when tumour cell nests were identified at cut edge. The mean of the length of the six margins was designated as mean margin in each case. The closest margin obtained in each case was noted separately.

Adjuvant therapy

Patients with node negative, ER/PR positive, Her2 neu negative disease received six cycles of FEC (Inj 5 FU 500 mg/m², Inj epirubicin 50 mg/m², Inj cyclophosphamide 500 mg/m²). All others received four cycles of AC (Inj adriamycin 60 mg/m², cyclophosphamide 600 mg/m²) followed by twelve cycles of weekly Inj paclitaxel 80 mg/m². Inj trastuzumab was given if patients were Her2 neu positive. Patients also received standard adjuvant radiation therapy to the chest wall by bilateral tangential field 50 Gy/25#/42 days. Tumour boost was given by direct anterior field 10 Gy/5#/5 days.

Post-operative assessment

Patients were followed up at 3 monthly intervals for first two years and then at 6 monthly intervals. Clinical assessment was done at each visit and mammogram at 6 monthly intervals.

Control group

The control group was historical and included patients who had undergone conventional BCS previously. This included patients who had undergone lumpectomy with a gross 1 cm margin or a formal quadrantectomy along with axillary lymph node dissection. As the pathologic assessment of lumpectomy specimen is done as per a standardised format explained earlier, the tumour and specimen volume as well as surgical margins obtained were duly retrieved from database. Only those patients for whom complete medical records were available have been included in this study.

Outcome measure

Primary outcome measures include volume of specimen resected, tumour size, mean margins and the mean closest

margin. The secondary outcome measures include incidence of revision surgery done, incidence of complications and incidence of local recurrence.

Statistical analysis

Outcome analysis has been carried out by SPSS Ver 20.0. Statistical analysis for significance between variables was performed by unpaired Student's t-test, Fishers exact test and chi-square test.

Results

During the study period, 33 cases of early breast carcinoma underwent oncoplasty breast surgery. Complete records were available for 46 cases of early breast carcinoma who had previously undergone conventional BCS.

Patient and tumour characteristics

The groups were similar in terms of age profile as well as clinical TNM stage at the time of presentation. Relatively greater proportion of tumours in central and lower quadrants were addressed by oncoplasty than traditional BCS (35% vs 15%, $p = 0.02$) (Table 1). Depending upon factors previously enumerated, a range of oncoplasty procedures was done (Table 2). No patient agreed for symmetrisation procedure for

Table 1 – Patient and tumour characteristics.

Variable	Group 1 (N = 33)	Group 2 (N = 46)	p Value
Mean age in years (±SD)	39.4 (±6.7)	42.1 (±7.2)	0.18 ^a
Clinical staging			
T1	12 (36%)	20 (44%)	0.15 ^a
T2	21 (64%)	26 (56%)	
N0	16 (48%)	19 (41%)	0.11 ^a
N1	17 (52%)	27 (59%)	
Tumour location ^c			
Upper outer	16 (48%)	32 (69%)	0.02 ^b
Upper inner	6 (17%)	7 (16%)	
Central	5 (15%)	1 (2%)	
Lower outer	4 (12%)	4 (8%)	
Lower inner	2 (8%)	2 (5%)	

^a Chi square test.

^b Fishers exact test.

^c Quadrants.

Table 2 – Oncoplasty procedures.

Procedure	N = 33
Lateral mammoplasty	9
Medial mammoplasty	4
Radial excision and glandular rotation	5
Grisstis flap	2
Superior pedicle based reduction mastopexy	5
Inferior pedicle based reduction mastopexy	4
Donut mastopexy	3
Mini LD flap	1

Table 3 – Clinicopathologic characteristic of resected specimen.

Variable	Group 1 (N = 33)	Group 2 (N = 46)	p Value
Mean volume of specimen (in cm ³)	173.5 (range, 90–252)	101.4 (range, 43–146)	0.02 ^a
Mean volume of tumour (in cm ³)	43.2 cc (range 16– 76)	36.4 cc (range 15–62)	0.14 ^a
Margin status			
Negative	30 (91%)	35 (75%)	0.02 ^b
Close	3 (9%)	6 (13%)	
Positive	Nil	5 (12%)	
Mean margin (in cm)	1.4 (±0.5)	0.6 (±0.2)	0.03 ^a
Mean closest margin (in cm)	0.9 (±0.3)	0.3 (±0.15)	0.02 ^a
^a Chi square test.			
^b ANOVA.			

contralateral breast when it was offered at end of adjuvant therapy.

Volume of the specimen and tumour margins

The mean volume of the breast tissue resected was 173.5 cc (range, 90–252 cc) in the OBS group and 101.4 cm³ (range, 43–146 cm³) in conventional BCS group. Thus, a significantly larger volume of breast tissue was excised during oncoplastic procedures compared with standard BCS ($p = 0.03$). The mean tumour volume (pT) excised in the former was more than in the latter though it was not statistically significant (43.2 cc vs 36.4 cc, $p = 0.14$) (Table 3).

In OBS group, 30 patients (90%) had negative margins while 3 patients (10%) had close margins (2 patients with DCIS and 1 with infiltrating ductal carcinoma). In conventional BCS group, it was seen that 6 patients (13%) had close margins (3 patients with DCIS, 2 with IDC and 1 with lobular carcinoma) and 5 patients (11%) had positive margins (3 patients with DCIS and 2 with IDC) (Table 3). These patients had to undergo revision surgery. Two patients underwent scar revision while three underwent simple mastectomy. Hence, incidence of revision surgery in the traditional BCS group was 11% which was significantly more than the oncoplasty group where no patient required revision surgery. The average length of surgical margins obtained in oncoplasty group was more than that obtained in conventional BCS and the difference is statistically significant (14 mm vs 6 mm, $p = 0.01$). It was also seen that the mean closest margin was also significantly more in the oncoplasty group as compared to the conventional BCS group (Table 3).

Complication

There were 3 cases (9%) of peri-operative complication in OBS group. Amongst them, there was one incidence each of haematoma, surgical site infection and partial necrosis of nipple areolar complex. All of these resolved by conservative measures. In conventional BCS, peri-operative complication was recorded in 5 patients (11%). Amongst these, two cases had surgical site infection, two had infection of seroma cavity and one had skin flap necrosis. There was no statistical difference between the two groups in terms of incidence of complication.

Follow-up and local recurrence

The median follow-up of patients in Group 1 is 18 months (range: 6–30 months) while those for Group 2 is 38 months (range: 12–64 months). There were no cases of local-regional recurrence noted in the former group while there have been 6 cases (13%) of locoregional relapse in the latter group.

Discussion

The principle of oncoplasty is to combine the use of plastic surgical techniques in order to remodel the remaining breast after wide excision of the breast cancer. During recent years, growing evidence has been published concerning the oncologic safety of this technique in the primary surgery setting.^{9,10} It is seen that the residual cavity in the breast after a conventional BCS fills with seroma initially. However, the resorption of the same over period of time leads to cosmetic deformity in the operated breast. Volume displacement techniques of OBS are essentially glandular rotation, a method of parenchymal redistribution, and these prevent the aforesaid cosmetic deformity. It is well recognised that glandular resection more than 20% of breast volume in conventional wide local excisions is associated with poor cosmetic results. The volume replacement techniques of OBS utilise mini latissimus dorsi (LD) flap or transverse rectus abdominus (TRAM) flap. These pedicled flaps can be fashioned quickly and efficiently to replace the volume loss. This permits large volumes to be resected and yet maintain acceptable cosmesis.

Tumours of central quadrant and inferior quadrants result in poor cosmesis if addressed by conventional BCS (Fig. 3). It can be seen from our study that tumours in all locations can be addressed by oncoplastic surgery. It can also be seen in our study that relatively more number cases of central as well as lower quadrant tumours could undergo breast conservation by oncoplasty procedure than by conventional BCS technique (Table 1). Superior pedicle reduction mammoplasty, the inferior pedicle reduction mammoplasty, round block mastopexy, Grisotti technique and LD flap are some oncoplasty surgery options for these tumours.^{11–14}

Our comparative study showed the clear advantage of oncoplastic surgery compared to conventional BCS in terms of the volume of the resected breast specimen, the width of the

Fig. 3 – Conventional breast conservation surgery: bad cosmetic results seen after surgery in (a) a central quadrant tumour, (b) a upper inner quadrant tumour, (c) lower inner quadrant tumour and (d) lower outer quadrant tumour.

cut margin obtained and the frequency of clear margins obtained. Critics may argue that wider glandular excisions in OBS procedures are necessary to achieve symmetry with the contralateral breast and not necessarily to obtain wider surgical margins. This observation is true to some extent as is demonstrated in this study. The pathological tumour size resected was not significantly more in the oncoplasty group. But the total volume of breast tissue excised was indeed much more in the oncoplasty procedure when compared to the conventional BCS. This is because of the large glandular exposure created by oncoplastic surgery which allows larger subcutaneous dissection, and provides larger tissue resection laterally and greater margin width. The mean cut margin width thus obtained is significantly more as demonstrated in this study as well as in published studies.^{8,9,21} Perhaps a more precise indicator of tumour clearance would be the mean closest margin, i.e. one of the margins in the six dimensions analysed which is closest to tumour edge. The mean closest margin was also seen to be significantly more in specimen obtained after OBS as compared to specimens obtained after conventional BCS.

In our study, it is seen that some patients had close margins for in situ lesions (2 and 3 cases, respectively, in OBS and conventional BCS groups). Another three patients who had undergone conventional BCS had positive margin for in situ lesion. This result can be explained by the histopathologic nature of the intraductal lesions. It is known that while most small lesions involve only a single duct, they can spread along several branches of the same duct. Skip lesions (areas of DCIS interspersed with areas of normal tissue) are not unusual. Thus, depending on the plane of sectioning, it may be difficult

to determine whether a margin that is histologically negative really signifies complete excision of DCIS. Moreover, because DCIS is multifocal, it has been suggested that a very large margin may be necessary to ensure low rates of local recurrence. Negative margins as large as 10–15 mm have been proposed.¹⁵ The wide margins obtained by OBS may result in better tumour clearance.

Patients undergoing BCS after neoadjuvant chemotherapy deserve special attention. These patients were not included in our study but they are also candidates for larger excisions afforded by oncoplasty procedures. This is because studies have amply demonstrated that pathologic examination of the excised glandular tissue after neoadjuvant therapy shows multiple foci of scattered residual tumour cells interspersed with areas of marked fibrosis after tumour regression.^{16,17}

The incidence of peri-operative complications is seen to be similar between the two groups. Oncoplasty breast surgery does not seem to add additional morbidity over and above conventional BCS.

Locoregional control is an important oncological outcome measure. The median follow-up of 18 months in our series is admittedly too short a period to derive any meaningful conclusion about advantage of OBS over conventional BCS. Some studies have proposed that as the size of the microscopically tumour-free resection margin is unrelated to local recurrence or overall survival, there is no need to excise a large volume of adjacent breast tissue with a tumour.^{18,19} Hence, it may be argued that large specimen volumes do not guarantee tumour-free surgical margins and OBS may result in only a slight improvement of clear margins

when compared to the historical data on BCT.²⁰ Some authors point out that there is no evidence that ipsilateral breast tumour recurrences are reduced by obtaining wider margins in tumours of unfavourable biology, lobular carcinoma and tumours with extensive intraductal carcinoma.²¹

However, the general consensus in the published literature agrees to the fact that, irrespective of other variable, positive or close margins are a definite risk factor for ipsilateral breast tumour recurrence as well as systemic recurrence. In studies that have described tumour recurrence after OBS with mean and median follow-up periods of more than 24 months, local recurrences have been identified at rates ranging from 0% to 7%.^{8,22,23} At this juncture, evidence is insufficient to conclude if OBS is indeed better than conventional BCS in terms of long-term local control. It is unlikely that conclusive level I evidence will be available to answer this question, as a randomised trial is unlikely to be designed. Certain tumours such as lower and central quadrant tumours or tumours with unfavourable tumour:breast ratio cannot be addressed by conventional BCS but can be addressed by OBS. Also, with a large body of evidence available citing better cosmesis after OBS, it would be unethical not to offer the patient OBS, and rather randomise them to conventional BCS. It is more likely that multivariate analysis and longer follow-up of larger series similar to ours will yield information about impact of the wide margins obtained in OBS on the long-term oncologic outcomes such as ipsilateral breast tumour recurrence, disease-free survival and overall survival.

An aspect, not part of this study, but which deserves a mention is related to adjuvant radiotherapy. OBS might theoretically present a problem for radiotherapy boost in terms of volume delineation as translation or rotation of the boundaries of the surgical cavity is often performed. We routinely place surgical clips at the time of tumour resection, marking the boundaries of the surgical cavity. But it has been stated that the position of surgical clips can be misleading in cases where oncoplastic surgical techniques are used, especially where the boost region is not the entire surgical cavity but the rim of residual breast tissue that surrounded the primary tumour. This often results in larger boost volumes than actually necessary and potentially leading to greater fibrosis and poorer cosmetic results.^{24,25}

Presently, there is no evidence available to compare OBS with conventional BCS in terms of quality of adjuvant RT received.

Conclusions

Oncoplastic surgery adds to the oncological safety of BCS. A much larger volume of breast tissue can be excised, and wider surgical margins can be achieved than conventional BCS. However, it will require longer follow-up to determine if this wider resection translates into better locoregional control.

Conflict of interest

The authors have none to declare.

Acknowledgement

Ms Harleen Chhabra, Translational Psychiatry Lab, NIMHANS, Bangalore for statistics support.

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