



Oncoplastic Breast Reconstruction in Breast Conservation Surgery: Improving the Oncological and Aesthetic Outcomes

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Abstract

Breast conservation surgery (BCS) is now the standard of care for patients with early breast cancer. The main contraindications for BCS besides the presence of multicentricity and diffuse microcalcifications are inadequate tumour size to breast size ratio. With the advent of oncoplastic techniques, the indications of BCS may be further extended to patient with larger tumour size and or small volume breast. We prospectively assessed 42 patients undergoing oncoplastic breast conservation surgery for cosmetic and oncologic outcomes. Cosmetic outcome assessment was done by comparison of operated breast to contralateral breast by an independent surgeon, nurse and patient's attendant at 6 months post-surgery. Risk factors for compromised oncologic outcomes included grades II/III tumours and non-ductal histology. Intraoperative margin assessment with frozen section analysis proved to be important in order to achieve negative surgical margins on final histopathology. By univariate analysis, tumours located in central quadrant and medial half of the breast had similar cosmetic outcomes comparable to tumours located in other quadrants. Majority of our patients (90%) had overall good to excellent cosmetic outcomes on Harvard scale. Oncoplastic breast conservation surgery techniques allow for larger parenchymal resections without compromising oncologic and cosmetic results. It further allows extension of BCS to patients otherwise denied for the same based on earlier recommendations for mastectomy. Oncoplastic techniques and intraoperative margin assessment with frozen section are vital in attaining adequate margins and also decrease chance of local recurrence and revision surgery for positive margins.

Keywords Breast conservation surgery · Oncoplasty · Cosmetic outcome · Oncologic outcome

Introduction

According to GLOBOCON (IARC WHO) 2012, breast cancer is the most common cancer diagnosed in women and the second leading cause of cancer-related deaths in developing countries, with a 5-year overall survival of 89.7% (SEER DATA 2012). In India, breast cancer is the most common cancer diagnosed in women especially in urban areas. Over the years, breast conservation surgery (BCS) along with radiation therapy has been established as a safe surgical option for most women with early stage breast cancer; with no significant difference in disease-free

survival in patients undergoing mastectomy alone or breast conservation surgery with radiation therapy [1]. The principle of breast conservation surgery is complete removal of tumour with adequate surgical margin, preserving the natural shape and contour of the breast. Until the advent of breast oncoplasty and partial breast reconstruction, the deformities resulting from poorly planned breast conservation approaches and incisions were often severe, difficult to manage and associated with complications and a lot of patient dissatisfaction.

This study was undertaken with the objectives to describe the various oncoplastic techniques combined with BCS and to extend the application of BCS in treating breast cancers with large operable tumours, with >20% volume resected, central quadrant tumours and tumours located in medial half of the breast. The aim of the study was to analyse final outcome with respect to cosmetic outcomes and oncological outcomes in patients undergoing BCS at a tertiary cancer centre.

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Materials and Methods

We conducted a prospective observational study including 42 patients who underwent oncoplastic breast conservative surgery from June 2015 to June 2016. The follow-up period was between 12 and 24 months. The inclusion criteria were breast cancer patients with age > 18 years, ECOG performance status 0–2, cT1 to cT3 with N0 or N1 with no evidence of distant metastases. Patients with recurrent breast cancers, cT4 tumours and N2 or more nodal status, multi-centric disease, diffuse micro-calcifications on mammography, patients with neoadjuvant chemotherapy, ECOG performance status 3 or more and patients with other contraindications for radiation therapy were excluded from the study. All patients were subjected to a thorough clinical history and physical examination with baseline blood and biochemical work-up, FNAC/TRUCUT biopsy as initial work-up and staging with chest X-ray, ultrasound abdomen, bilateral digital mammography, bone scan and breast MRI if clinically indicated.

The volume of the breast was measured by anatomic (anthropometric) measurement [2]. The resected tissue volume was calculated using water displacement method in cubic millilitres. The percentage of resected volume was then calculated using the above parameters.

Calculation of Breast Volume

Anatomic (anthropometric) measurement.

Breast volume = $\pi/3 \times MP^2 \times (MR + LR + IR - MP)$.

MP = mammary projection, MR = medial breast radius, LR = lateral breast radius, and IR = inferior breast radius.

Surgery was conducted by a team of surgical oncologist and onco-reconstructive surgeon. The incision and type of reconstruction were planned and marked on the breast by the surgical team. Patients with positive axillary lymph nodes (clinical or radiological) were subjected to formal axillary lymph node dissection (ALND), while node-negative patients underwent sentinel lymph node biopsy (SLNB). All patients underwent wide local excision of lesion with gross tumour margin of 1 cm. The tumour bed was marked by surgical clips to help radiation planning. All resected primary specimens were oriented and sent for frozen section evaluation for margin assessment as a routine. All patients with either positive or close margins (< 1 mm) on frozen section examination were revised intraoperatively. The plan regarding type of reconstruction was based on location of tumour, consistency of breast tissue, percentage of volume resection, presence of comorbidities, age of patient and degree of symmetry desired by the patient.

Various techniques of partial breast reconstruction performed included:

- 1) Tissue displacement—breast tissue advancement flaps wherein adipofacial flaps from the breast itself were mobilised and repositioned to fill the defects created after wide local excision; to include oncoplastic surgery (OPS) types 1 and 2 (Fig. 1).
- 2) Tissue replacement—breast defects were given a fill by local transposition flaps; including latissimus dorsi myocutaneous flap, mini latissimus dorsi myofascial flap, inframammary fasciocutaneous flap, Wise pattern flaps and Grissoti's flap (Figs. 2 and 3).

During follow-up, oncologic and cosmetic outcomes were analysed with respect to shape, symmetry, mobility, consistency and appearance of inframammary fold of the reconstructed breast and was graded on Harvard scale given by J Harris et al. Assessment of cosmetic outcome was done by comparing operated breast to contralateral breast by an independent surgeon, nurse and patient's attendant at 6 months after surgery. The qualitative variables were expressed as frequencies/percentages and analysed using chi-square tests. Correlation of various variables with cosmetic score were analysed with Pearson's correlation coefficient. *p* value < 0.05 was assumed statistically significant. Statistical Package for Social Sciences (SPSS) version 16.0 was used for analysis.

Results

During a period of 1 year, we enrolled a total of 42 patients, out of which 39 were unilateral breast cancers and three had bilateral breast cancers, i.e., 45 oncoplastic breast conservation surgeries. More than 50% of our patients were above the age of 50 years old (mean age 48.57 ± 10.01 years). Majority of tumours were located in upper outer quadrant (68.9%), 17.8% were in upper inner quadrant, 6.67% in central quadrant, 4.45% in lower inner quadrant and 2.23% in lower outer quadrant. SNLB was done in five patients and ALND in 35 patients. Axilla was not addressed in two patients as they were phyllodes tumour.

The mean volume of excision was 213 ml and the mean percentage of breast volume excision was 26.6%. Majority of patients had cT2 tumours (71%), cT1 tumours in 12 patients (26%) and cT3 in one patient (2.2%). Four patients underwent central quadrant resection while seven had medial quadrant tumours (28%). Two patients had positive margins while 13 patients (31%) had close margins on frozen section assessment and were revised intraoperatively before reconstruction. No patient had to undergo reoperations for inadequate margin on final histology as we use frozen section for margin assessment in all patients as a routine. A total of 31 breasts (69%) were reconstructed by volume displacement methods and 14 breasts (31%) by volume replacement methods. The volume

Fig. 1 Reconstruction by OPS technique. (1) Tumour marked. (2) Defect after WLE. (3) Reconstruction by OPS. (4) Postoperative appearance



displacement methods consisted of OPS type I in 19 breasts (42.3%) and OPS type II in 12 breasts (26.7%). Volume replacement methods included LD flap in two breasts (4.4%), mini LD flap in eight (17.8%), Wise pattern flap in three (6.6%) and Grissoti's flap in one (2.2%) breast. (Table 1).

Using Harvard scale grading, 42/45 reconstructions (93%) gave us excellent to good cosmetic outcomes. Cosmetic outcomes were based on cosmetic scores depending upon five variables to include shape, symmetry, mobility, consistency and inframammary crease; each variable had 1 point if it resembles the opposite breast. Mean cosmetic score achieved was 4.5 out of 5. The postoperative complications include seroma in 13 patients (28%), arm lymphedema in four patients

(8.8%), marginal skin necrosis in two patients and wound infection in one patient only. Only two patients (4.4%) required debridement and re-suturing for margin necrosis.

Discussion

Clough et al.[3] had identified three elements that would benefit from an oncoplastic BCS, i.e., the excision volume, tumour location and breast glandular density. If less than 20% of the breast volume is excised, a level I OPS procedure is adequate. Anticipation of 20–50% breast volume excision would require a level II OPS. We have classified the percentage of

Fig. 2 Reconstruction by LD flap. (1) Tumour marked. (2) LD flap harvested according to the defect size. (3) Flap inset. (4) Final appearance



Fig. 3 Reconstruction by Wise pattern flap. (1) Tumour and flap marked. (2) Defect after the WLE. (3) Flap inset done. (4) Follow-up picture



volume loss into three categories: breasts with volume loss less than 20%, breasts with volume loss between 20 to 30% and breasts with volume loss more than 30%. In our study, breast reconstruction by volume displacement techniques in majority of patients in 31 out of 45 breasts (69%).

Both Clough et al. [3] and G. Franceschini et al. [4] mentioned that reconstruction technique not only depends on the percentage of breast volume loss but also the volume of the breasts. In our study, the mean volume of the breast was 908 ml in OPS I, 760 ml in OPS II, 427 ml in mini LD flap, 846 ml in LD flap, 468 ml in Wise pattern flap and 720 ml in Grissoti's flap. This implies that even though the percentage volume loss may be the same in different breasts, the total volume loss depends on the original breast size and hence the reconstruction methods differ.

Kaur et al. [5], and Giacalone et al [6] demonstrated larger resection weights (200 vs 118 g) in their study which resulted in fewer close or positive margins (16.7 vs 43.3%) and (12 vs

21%) respectively in the oncoplastic group. In our study, the mean volume of the excision specimen was also 213 ml and mean percentage of breast volume excision was 26.6%. These observations highlight that oncoplastic breast reconstructions allow for larger breast volume resection safely.

Studies by Saadai P et al. [7], Kurniawan ED et al. [8], Cabioglu N et al. [9] and Lovrics P J et al. [10] have identified specific factors that independently predict the risk of positive margins in breast conservation surgery; young patients (< 50 years), large-sized primary tumours (> 20 mm), multifocal tumours, diffuse microcalcifications on mammography, DCIS and lobular histology.

In our study, grades II/III tumours and histology other than ductal carcinoma were the only risk factors for close or positive margins. Age, size of tumour, volume of breasts, presence of DCIS and the ER, PR and Her2neu receptor status had no significant correlation with margins status by Pearson correlation coefficient.

Table 1 Techniques of breast reconstruction

Percentage of resected volume	Number of patients	Percentage of total patients	Reconstruction methods
Less than or equal to 20%	10	22.3%	Displacement = 8 Replacement = 2
Between 21 to 30%	24	53.3%	Displacement = 23 Replacement = 1
Between 31 to 50%	11	24.4%	Displacement = 0 Replacement = 11
Total	45	100%	Displacement = 31 Replacement = 14

Giacalone et al. [6] found that patients who underwent oncoplastic surgery were more likely to achieve 5- or 10-mm free margins. In our study, the mean margins were 1.39 ± 0.74 cm which is adequate from oncologic point of view.

Caruso et al. [11] evaluated the utility of intraoperative frozen section in breast conservation surgery. They found frozen section to have a sensitivity of 83% and accuracy of 94% in assessment of margins and therefore advocated for routine intraoperative frozen section assessment of margins as a means of improving local control in a single stage, thereby reducing the need for secondary re-excisions. As such, use of frozen section is cost-effective as it reduces the number of reoperations, although it increases surgical time marginally and is unreliable in tumours smaller than 10 mm and in DCIS as reported by Osborn JB et al. [12] and Oslon TP et al. [13]. In our study, the use of intraoperative frozen section allowed us to revise close or positive margins and hence negated the need for repeat surgery or any conversion to mastectomy to achieve better oncologic outcomes. It also gave a better cosmetic outcome and patient satisfaction and prevented any delay in starting adjuvant therapy.

Tumour location did not show any correlation with cosmetic results reported by Clarke et al. [14]; Rose et al. [15]. Although according to Sacchini et al., [16] tumours located in the lateral breast region had better results. In our study, the tumours located in the central quadrant had scores lower than the other location tumours. The tumours located in the upper outer quadrant and inner lower quadrant had best cosmetic scores.

Most of the studies also reported better results with lower patient age. In our study, cosmetic outcomes in the form of cosmetic scores had no correlation with age of the patients. Cochrane et al. [17] showed when resection percentage was less than 10%, 83.5% of patient were satisfied, whereas if > 10% was excised, only 37.0% were satisfied. In our study, when volume excised was less than 20%, patient satisfaction with cosmetic outcomes was 90 to 100% and 91 to 94% when excision was > 20%. Taylor et al., [18] proved adverse cosmetic outcomes when > 100 cm³ of the breast tissue was removed. In our study, the mean volume of the breast excised was 213 cm³. The cosmetic scores are not affected by percentage of the breast volume resected ($p = 0.6703$). When the percentage of resected volume increases compared to the total breast volume, reconstruction of defect is done by volume replacement techniques and not by volume replacement techniques and therefore maintaining final reconstructed breast volume and symmetry.

The cosmetic outcomes are overall inferior in a large breast compared to smaller breasts as shown by Tolga Ozmen et al [19]. In our study, the mean breast volume was 795.19 ml and there was no association with cosmetic outcomes on comparing with tumour size ($p = 0.8409$) or total breast volume ($p = 0.9116$). The tumours located in the medial half of the breasts

and in central quadrant locations 13/45 (28% of total tumours) had comparable oncologic and cosmetic outcomes.

In a study by Patterson et al., [20] appearance of the treated breast was rated good to excellent by 94%. Losken A et al. [21] found overall satisfaction in BCT alone group to be 80%, compared to 90% in oncoplastic BCS group. Patient dissatisfaction was correlated with postoperative complications and breast asymmetry. In our series, 42 reconstructions (93%) gave us good to excellent cosmetic outcomes on Harvard scale. Mean objective cosmetic score was 4.5 out of 5 (90%) in our study population. Hence, both by subjective and objective assessment of cosmetic outcomes, there were more than satisfactory outcomes.

The local wound complication rates in oncoplastic surgery ranges from 16 to 26.7% as shown by Losken A et al. [21] and Ho et al. [22]. Thirteen patients in our series developed wound morbidity (30%), seroma in 14%, arm lymphedema in 9.2%, flap margin necrosis in 4.7% and wound infection in 2.3%. Out of these, only two patients (4.7%) required debridement and re-suturing for margin necrosis. Surgical intervention for complications in our study was 4.7%, compared to 6.7% by Ho et al. [22]. Although a follow-up period of 12–24 months is short, we did not see any local or regional recurrences in our study population.

Conclusions

Oncoplastic breast conservation surgery techniques allow for larger parenchymal resection without compromising oncologic and cosmetic outcomes. Intraoperative margin assessment with frozen section analysis has proved to be vital in attaining negative and adequate margins in final histopathology. This translates into reduced recurrences, reduced reoperations and hence better oncologic outcomes, further preventing delay in initiation of adjuvant therapy. BCS with oncoplasty for tumours located in medial and central quadrants has given good to excellent cosmetic outcomes comparable to favourably located lateral tumours.

The decision regarding the type of reconstruction should be not just based on percentage of volume resected but also on location of tumour and the original breast volume. Oncoplasty allows us to extend our indications for breast conservation surgery to patients who were earlier denied for conservative surgery.

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