

Evaluating cosmetic outcome and surgical safety in oncoplastic management of breast cancer

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Abstract: *Background:* Breast-conserving treatment (BCT) is the gold standard for early breast cancer; however, achieving oncological safety and satisfactory cosmesis in large tumors (≥ 5 cm) remains challenging. Oncoplastic breast surgery (OBS) integrates plastic surgery techniques to allow wider resections while maintaining breast shape and symmetry. *Objectives:* This study evaluated the cosmetic and oncological outcomes of OBS in patients in breast carcinoma patients. The Primary objective was to assess short-term (4 weeks post-surgery) and long-term (12 weeks post-radiotherapy) cosmetic scores and measuring oncological safety through margin status and complication rates. *Methodology:* A prospective observational study was conducted at a tertiary care center in Lucknow on 30 patients with breast cancer. Patients underwent volume displacement or replacement techniques based on tumor location, breast size, and ptosis. Cosmetic outcomes were evaluated by an independent blinded expert using a 5-point Likert scale for seven variables. *Results:* The mean patient age was 41.3 years. Volume replacement was the most common technique (76.6%), predominantly using Latissimus Dorsi flaps. At 4 weeks post-surgery, 69.9% of patients achieved "good to excellent" cosmetic outcomes; this figure was 66.6% at 12 weeks post-radiotherapy. Cosmetic scores significantly correlated with younger age ($P=0.038$) and a lower percentage of breast volume excised ($P=0.007$). The margin positivity and overall complication rates were 10%, 16.6% respectively. *Conclusion:* OBS is a safe and effective alternative to mastectomy for large operable breast cancers. It facilitates wider excision margins and preserves breast aesthetics, even in cases requiring significant tissue resections.

Keywords: Breast Neoplasms, Breast-Conserving Surgery, Mastectomy Segmental, Oncoplastic.

Introduction

Breast-conserving treatment (BCT) is the gold standard for the management of both early stage and selected locally advanced breast cancers. BCT combines breast conserving surgery (BCS) with postoperative radiotherapy offering equivalent survival rates and improved body image compared to traditional mastectomy. The primary goal of BCS is to achieve tumor-free resection margins while preserving the natural shape and appearance of the breast [1]. Maintaining oncological safety while achieving excellent cosmetic outcomes is often challenging. The status of surgical margins is a critical marker

for residual disease and remains one of the most significant risk factors for ipsilateral breast tumor recurrence and disease-specific mortality. Despite surgical advancements, tumor-involved margins still occur in 12–40% of cases [2-3].

Achieving these dual goals is particularly tough when the tumor volume is large compared to the breast volume. Conventional BCS involves wide local excision with a 1 cm gross margin, however certain lesions are difficult to excise without risking significant cosmetic deformity or margin involvement. In such cases, standard surgery may result in

unsatisfying aesthetic results [4]. Oncoplastic breast surgery (OBS) has developed as a novel method for immediate reconstruction tailored to specific tumors, offering an alternative solution to address these limitations. By integrating breast reduction and aesthetic reconstruction methods into cancer surgery, OBS allows for the removal of larger tissue volumes while ensuring excellent cosmetic results. Opting for immediate reconstruction is often favoured because using healthy, non-irradiated tissue can lead to fewer complications and better cosmetic outcomes compared to procedures that are delayed [5-6].

The most widely accepted classifications based on the Krishna B Clough Classification delineate into two levels of Oncoplastic Breast Surgery (OBS): Level I resection entails the excision of less than 20% of breast volume, whereas Level II involves a volume loss ranging more than 20% [7]. The Level II is further classified into volume displacement (recontouring adjacent parenchyma) and volume replacement (using local or pedicled flaps). While OBS is increasingly adopted for larger tumors (T2-T3), high-quality evidence supporting its benefits in these specific populations remains limited [8-9].

This prospective study aimed to analyze the oncological and cosmetic outcomes of oncoplastic surgery at a tertiary cancer center, specifically in patients with large operable breast carcinoma (LOBC). By evaluating parameters such as margin status, re-excision rates, and long-term cosmesis, this research seeks to determine the efficacy of OBS as an alternative to mastectomy in these patients.

Material and Methods

Study Setting and Design: The study prospective observational study was conducted over a period of 18 months at the Department of Surgical Oncology, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow. Study participants were selected using a convenient sampling technique between October 2019 and April 2021.

Inclusion Criteria:

- Breast tumor without skin involvement.
- Nodal staging of N0 or N1 with M0.

- Diagnosis confirmed via FNAC or biopsy, including intraductal and lobular carcinoma histology.

Exclusion Criteria:

- Multicentric disease with diffuse microcalcifications on mammography.
- Inflammatory breast carcinoma, skin involvement, satellite nodules, or more than one primary malignancy.
- History of previous radiotherapy to the chest or prior chemotherapy received before primary assessment.
- Breast carcinoma during pregnancy or lactation.

Study Protocol:

1. **Baseline Assessment:** Detailed clinical evaluation, radiological workup (bilateral mammography, chest X-ray, USG, and CECT/MRI), and cosmetic photographs were obtained at baseline.
2. **Neoadjuvant Therapy:** All patients received standard neoadjuvant chemotherapy (4# AC+ 4# T or 4# EC+ 4# T).
3. **Surgical Technique:** Oncoplastic BCS (OBS) was selected based on the percentage of breast volume excised, breast size, and degree of ptosis, according to the Krishna and Clough Classification.
4. **Adjuvant Treatment:** Patients received adjuvant radiotherapy (EBRT dose 45-50 Gy with a 10-16 Gy boost), along with Herceptin or hormonal treatment as per protocol.

Cosmetic Outcome Assessment: Cosmetic outcomes were evaluated using digital photographs taken at baseline, 4 weeks post-surgery, and 12 weeks post-radiotherapy. The cosmetic evaluation was based on seven criteria: shape, symmetry of opposite breast, condition of the NAC, degree of scarring, condition of the inframammary fold, degree of skin changes, and overall appearance. Each variable was scored from 1 to 5 on a Likert scale.

Calculating the Final Score: After scoring each of the four categories, Global Aesthetic Score was calculated:

1. *Excellent (31-35 points):* Nearly indistinguishable from the other side.
2. *Good (26-30 points):* Minor, non-distressing differences.
3. *Fair (16-25 points):* Obvious asymmetry or visible distortion.
4. *Poor (7-15 points):* Major deformity requiring secondary corrective surgery.

Statistical Analysis: The statistical analysis was performed using [SPSS v16]. Descriptive statistics were used to summarize patient demographics and clinicopathological characteristics. Continuous variables, such as age and excised breast volume, were expressed as mean $\pm$ standard deviation and analysed using the student's t-test for group comparisons. Categorical variables, including tumor site and breast ptosis grade, were analysed using the Chi-square test. The relationship between the percentage of breast volume excised and cosmetic scores was evaluated using Pearson's correlation

coefficient. A p-value of < 0.05 was considered statistically significant.

Results

The study included 30 study participants who underwent oncoplastic BCS between 2019-2021. The results were obtained with a minimum follow-up period of 3 months. The following findings were observed:

The mean age was 41.3 ± 6.5 years, with the majority were less than 45 years of (53.3%) age. Neoadjuvant chemotherapy (NACT) was administered to 26 patients (86.7%), while 4 patients (13.3%) underwent upfront surgery. The most common histological subtype was Invasive Ductal Carcinoma (IDC) (n=29, 96.6%), with most tumors being Grade 3 (n=20, 66.6%). The average Cosmetic outcome scores achieved by patients younger than 45 years age was found to be statistically significant [<0.05] at 4 weeks post-surgery as well as post 12 weeks of adjuvant radiotherapy (Table-1).

Table-1: Tumor Characteristics					
Tumor Size (pt Stage)	Tx: 4	T1: 3	T2: 17	T3: 5	T4: 1
Molecular Type	TNBC: 11	Luminal B: 8	Luminal A: 7	Her 2 like: 4	
Tumor Location	UOQ: 11	Central: 9	LOQ: 5	LIQ: 4	UIQ: 1

Surgical and Oncological Outcomes: The most frequently employed oncoplastic approach was volume replacement (n=23, 76.6%), with the Latissimus Dorsi (LD) flap being the most common technique (n=15). Volume displacement techniques were used in 7 patients (23.3%) (Table-2).

The mean volume of the excised specimen was 242 cc (range: 146–800 cc). Negative margins were achieved in 90% of cases; the three patients (10%) with involved or close margins underwent immediate re-excision guided by intraoperative frozen section analysis. No patients required conversion to mastectomy. The overall postoperative complication rate was 16.6% (n=5), which included partial flap necrosis (n=3), hematoma (n=1), and minor wound infection (n=1).

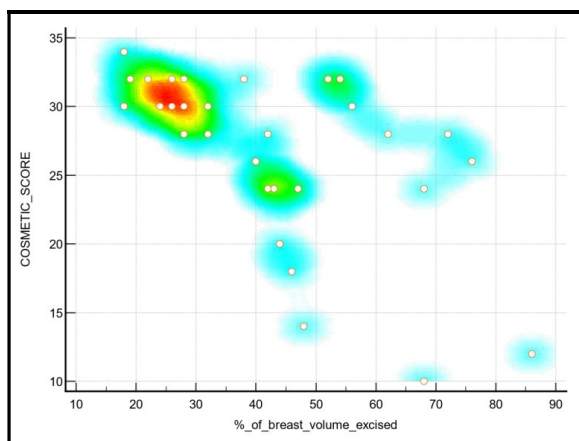
Table-2: Oncoplastic Techniques Employed		
Type of Oncoplasty	Technique	Number (%)
Volume Displacement	Total	7
	Round block	3 (42.8%)
	Grisotti	2 (28.5%)
	Batwing	1 (14.2%)
	Lollipop mastopexy	1 (14.2%)
Volume Replacement	Total	23
	LD Flap	15 (65.21%)
	LICAP Flap	4 (17.39%)
	TRAM Flap	2 (8.7%)
	MICAP Flap	2 (8.7%)

Cosmetic Assessment: The average cosmetic score was 26.66 at 4 weeks post-surgery and 24.2 at 12 weeks post-radiotherapy.

- **4 Weeks Post-Surgery:** 69.9% of patients (n=21) achieved "Good" to "Excellent" cosmetic outcomes.
- **12 Weeks Post-Radiotherapy:** This rate adjusted slightly to 66.6% (n=20).

Univariate analysis revealed that age ($p = 0.038$) and percentage of breast volume excised ($p = 0.007$) significantly impacted cosmetic scores (Fig-1). Patients younger than 45 years and those with $< 20\%$ breast volume excision consistently reported superior aesthetic results. Notably, tumor location, breast size, and degree of ptosis did not significantly influence the final cosmetic outcome ($p > 0.05$) (Table-3 & 4).

Fig-1: Cosmetic score according to percentage of breast volume excised



The average Cosmetic outcome scores achieved was found to be significantly better in patients with lesser percentage of breast volume excised at 4 weeks post-surgery as well as post 12 weeks of adjuvant radiotherapy.

Table-3: Comparative Cosmetic Outcomes		
Category (Post Score)	4 Weeks - Surgery (%)	12 Weeks Post-Radiotherapy (%)
Excellent (31–35)	8 (26.7%)	7 (23.3%)
Good (26–30)	13 (43.3%)	13 (43.4%)
Fair (16–25)	6 (20.0%)	7 (23.3%)
Poor (7–15)	3 (10.0%)	3 (10.0%)

Table-4: Cosmetic Score in Relation to Resected Volume			
% of Breast Volume Excised	4 Weeks Post-Surgery (Mean Score)	12 Weeks Post-RT (Mean Score)	P-Value
$< 20\%$	31.8	30.2	0.007
20–50%	28.6	26.4	0.001
$> 50\%$	22.8	18.2	
The percentage of breast volume excised was a primary determinant of aesthetic satisfaction.			

Discussion

In this study, the primary goal of oncoplastic breast surgery (OBS) was to ensure oncological safety specifically achieving tumor-free resection margins, while preserving the breast's natural shape. Oncoplastic breast surgery (OBS) is tumor-specific immediate reconstruction for breast conservation using plastic surgery techniques. Various classification systems, such as those by Clough, Urban, and Hoffmann, have been developed to categorize these procedures based on the volume of tissue resected and the complexity of the reconstruction. Despite the challenges associated with large tumor volumes (LOBC), our margin positivity rate was 10%. By utilizing intraoperative frozen section analysis, we were able to perform immediate re-excisions within the same surgical setting, ensuring that no patient in our study required a conversion to mastectomy. Large operable breast cancer (LOBC) typically includes tumors > 5 cm (T3), which historically needed large-volume tissue resection leading to poor aesthetic outcomes or mandatory mastectomies. However, the integration of oncoplastic surgical techniques allows for more extensive resections while maintaining good cosmetic outcomes through alternative incisions [8-10].

In our study, most patients (76.6%) underwent volume replacement-Type 2 oncoplasty because most required a large volume of breast tissue resection. The most common technique employed was the latissimus dorsi (LD) flap mobilized based on the thoraco-dorsal vascular pedicle. The election between

volume displacement and replacement was determined by factors including the amount of tissue excised (20–50%), breast size, presence of ptosis, and tumor location.

Analysis of Cosmetic Outcomes: While many studies have reported favorable cosmetic outcomes in approximately 90% of patients, this study found that 69.9% of patients achieved good to excellent results. This difference may be attributed to the high volume of tissue resected or the timing of the assessment. Univariate analysis in this study revealed that age ($P=0.038$) and percentage of breast volume excised ($P=0.007$) significantly affected cosmesis. A Systematic review evaluated the cosmetic outcomes of the patients who underwent OBCS showed excellent, good, fair, or poor outcomes in 55.2%, 31.0%, 9.4% and 4.4% of patients, respectively [11].

Age Factor: Better cosmetic results were observed in younger patients, potentially due to reduced fat content allowing for more homogenous mobilization and fewer instances of fat necrosis. Steeves et al., Touboul et al. have found similar results [12-13].

Volume Factor: Specimen volume negatively impacts the cosmesis. While some literature suggests satisfaction drops when >10% of volume is excised, the study participants in this study had a mean resected volume of 242cc [14].

Tumor Location: Unlike some studies suggesting poorer outcomes for central or inner quadrant tumors, this study found no significant difference across locations, likely due to the frequent use of tissue replacement and nipple-areola reconstruction.

Radiotherapy Impact: Cosmetic scores remained stable for patients with up to 50% volume resection but decreased post-radiotherapy for those with >50% resection, likely because a larger area received the radiotherapy boost dose [15].

The incidence of immediate complications was 16.6%. These complications, such as hematoma or partial flap necrosis, did not significantly delay the start of adjuvant treatment. The use of OBS allowed for significantly larger specimen volumes (mean 242 cc) and wider surgical margins

compared to traditional breast-conserving surgery. While concerns are often raised regarding the localization of the tumor bed for adjuvant radiotherapy due to parenchymal rearrangement, our use of intraoperative surgical clips ensured accurate delivery of the radiotherapy boost in all cases. Furthermore, the average time to initiate radiotherapy was 42 days, confirming that the added complexity of the oncoplastic reconstruction did not result in clinically significant delays to adjuvant treatment.

Conclusion

The study concluded that oncoplastic breast conserving surgery (OPBS) should be offered to all patients undergoing wide local excision of a breast tumor.

- *Feasibility:* Including OPBS techniques makes breast conservation possible even in patients with large tumors (>5cm) that would traditionally require a mastectomy.
- *Outcome:* The procedure provides adequate oncological margins while ensuring that many patients achieve acceptable to excellent cosmetic outcomes.
- *Clinical Advantage:* A major advantage of OBS over traditional BCS is the ability to resect larger volumes of parenchyma, allowing for better assessment of pathological response and wider margins.
- *Cosmetic Impact:* Only age and percentage of breast volume excised significantly affected cosmesis. Factors such as breast size and degree of ptosis did not have any significant impact in this study.

Study Limitations: While this study provides valuable prospective data on oncoplastic breast surgery (OBS) for large operable breast carcinoma in a tertiary care setting, several limitations must be acknowledged.

- *Short Follow-up Duration:* The final cosmetic assessment was conducted 12 weeks after the completion of radiotherapy. This timeframe may not fully capture the long-term effects of radiation-induced fibrosis, skin changes, or tissue contraction, which can continue

- to evolve for up to two years post-treatment.
- *Cosmetic Assessment:* A panel-based assessment or the inclusion of patient-reported outcome measures (PROMs) would provide a more comprehensive evaluation of satisfaction.
- *Single-Center Setting:* Conducted at a single tertiary cancer center in India, the findings may reflect specific patient demographics that might not be fully generalizable to other

clinical settings. A multicentric study would give a more generalizable result.

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