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Outcomes of Breast-Conserving Surgery in Triple-Negative Breast Cancer Patients: Insights from Institutional Practice

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Abstract: ***Background:*** Triple-negative breast cancer (TNBC) accounts for 10–15% of breast cancers worldwide but is associated with disproportionately high mortality due to its aggressive biology and limited targeted therapies. In Bangladesh, TNBC represents a higher proportion of cases, often affecting younger women who present with advanced-stage disease, highlighting a significant clinical burden and scarcity of regional outcome data. While breast-conserving surgery (BCS) with radiotherapy is established as equivalent to mastectomy in early breast cancer, its safety in TNBC has been debated. The study aim was to evaluate the oncological outcomes of breast-conserving surgery in patients with TNBC at the National Institute of Cancer Research and Hospital (NICRH) in Bangladesh. ***Methods:*** This prospective observational study was conducted at the Department of Surgery, Naogaon Medical College, Naogaon, Bangladesh, from May 2024 to December 2024, including 80 post-neoadjuvant chemotherapy (NACT) triple-negative breast cancer (TNBC) patients undergoing breast-conserving surgery (BCS). Eligible patients were selected through purposive sampling. Clinical, perioperative, and pathological data were prospectively recorded, and outcomes assessed included tumor response, surgical safety, cosmetic results, recurrence, disease-free survival, and patient satisfaction. Statistical analysis was performed using SPSS v26.0, with significance set at $p<0.05$. ***Results:*** Eighty post-NACT TNBC patients (mean age 44.4 years) were analyzed, with most presenting with Stage II, cT2 tumors, and nodal involvement. Following NACT, 21.3% achieved complete clinical response and 23.8% pathological complete response. Oncoplastic BCS (66.3%) showed superior cosmetic outcomes (87.5% vs. 51.9%, $p=0.007$) and no local recurrence compared to SBCS (14.8%, $p=0.041$), while complication rates, distant recurrence, and disease-free survival were comparable. Patient satisfaction favored OPBS, and overall, OPBS provided oncological safety with improved aesthetic outcomes. ***Conclusion:*** Oncoplastic breast-conserving surgery in TNBC patients post-NACT demonstrated excellent oncologic safety, superior cosmetic outcomes, and higher patient satisfaction compared to standard techniques. With no local recurrences and comparable survival outcomes, OPBS is a preferred surgical option for appropriately selected patients, supporting its integration into routine clinical practice.

Keywords: Triple-Negative Breast Cancer (TNBC), Breast-Conserving Surgery (BCS), Oncoplastic Surgery (OPBS), Neoadjuvant Chemotherapy (NACT) and Oncological Outcomes.

Original Researcher Article

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INTRODUCTION

Breast cancer is the most common malignancy among women globally, with an estimated 2.3 million new cases and 685,000 deaths reported in 2020.[1] Triple-negative breast cancer (TNBC), defined by the absence of estrogen receptor, progesterone receptor, and HER2 expression, accounts for approximately 10–15% of

breast cancers worldwide.[2, 3] Despite its relatively lower incidence compared to other molecular subtypes, TNBC contributes disproportionately to breast cancer–related mortality due to its aggressive biology and limited targeted treatment options.[2, 4] Demographically, TNBC tends to affect younger women and is more prevalent among patients of African and South Asian descent.[3, 5] In South Asia, and particularly Bangladesh, TNBC appears to represent a higher proportion of breast cancers than in Western populations. Breast cancer is now the most common cancer among Bangladeshi women, and hospital-based series suggest that TNBC accounts for approximately 25–30% of cases.[6-8] Some reports from specialized centers in Dhaka have even noted frequencies approaching 60%.[9] The median age of TNBC diagnosis in Bangladesh is around 43–45 years, nearly a decade younger than in high-income countries.[7] Moreover, Bangladeshi TNBC patients often present with advanced-stage disease; one cohort reported nodal involvement in nearly three-quarters of cases at diagnosis.[8] These factors suggest a higher clinical burden of TNBC in the region, yet population-based registries and molecular profiling studies remain limited. Thus, robust epidemiological and outcome data on TNBC from Bangladesh are scarce, representing a significant knowledge gap.[6, 9] Clinically, TNBC is characterized by high histological grade, rapid progression, and a strong tendency for early recurrence and visceral metastasis.[2, 4] Compared with luminal breast cancers, TNBC carries a significantly worse prognosis, with 5-year survival rates as low as 65–77% depending on stage.[10] Relapse risk peaks within the first 3–5 years after treatment, and recurrences are more likely to involve the lungs and brain.[4] While TNBC is initially chemosensitive, the absence of hormonal or HER2-targeted therapies limits long-term disease control.[11] Recent advances, such as immune checkpoint inhibitors and PARP inhibitors, have begun to improve outcomes in selected TNBC populations.[11, 12] However, access to these therapies is often restricted in low- and middle-income countries (LMICs), including Bangladesh. In this context, optimizing locoregional treatment strategies, including surgery and radiotherapy, remains a critical component of care.

Breast-conserving surgery (BCS), followed by adjuvant radiotherapy, is well established as equivalent to mastectomy for overall survival in early breast cancer.[13] However, concerns have historically been raised regarding the oncologic safety of BCS in TNBC, given its aggressive biology and lack of targeted systemic therapy.[14] Over the past decade, a growing body of evidence has specifically examined the outcomes of BCS in TNBC. Extensive database analyses have demonstrated that BCS with radiotherapy is at least equivalent, and sometimes superior, to mastectomy. For instance, a Surveillance, Epidemiology, and End Results (SEER) analysis of over 13,000 TNBC cases showed significantly improved overall and breast cancer–specific survival with BCS plus radiotherapy compared to mastectomy, even after adjustment for confounding factors.[15] Similarly, institutional studies and population-based cohorts from Europe and Asia confirm that BCS does not increase the risk of locoregional recurrence in TNBC patients.[16–18] A Korean multi-center study of patients with node-positive TNBC reported better 5-year locoregional recurrence-free survival and overall survival in the BCS group compared to mastectomy.[17] A 2025 systematic review and meta-analysis also reinforced that BCS is not inferior to mastectomy for TNBC and may, in fact, confer a survival advantage.[18] Despite this growing evidence base, most studies have originated from high-income countries. Data from LMICs remain extremely limited, where healthcare infrastructure, access to radiotherapy, and systemic treatment availability differ significantly from Western settings. Given the higher prevalence of TNBC in South Asia and the younger age of onset, it is uncertain whether international data can be directly extrapolated to Bangladesh. Local evidence is therefore necessary to guide clinicians in balancing oncologic safety with the benefits of breast conservation in TNBC patients. Reporting institutional experiences from Bangladesh will help to contextualize global findings and inform national treatment guidelines. The study aim was to evaluate the oncological outcomes of breast-conserving surgery in patients with TNBC at the National Institute of Cancer Research and Hospital (NICRH) in Bangladesh.

METHODOLOGY AND MATERIALS

This prospective observational study was conducted at the Department of Surgery, Naogaon Medical College, Naogaon, Bangladesh, from May 2024 to December 2024. The study population comprised post-neoadjuvant chemotherapy (NACT) patients diagnosed with triple-negative breast cancer (TNBC) who were admitted for breast-conserving surgery (BCS). A total of 80 patients were recruited through purposive convenience sampling; however, 4 of them missed the follow-up before the outcome was addressed. Inclusion was limited to post-NACT TNBC patients undergoing BCS. In contrast, those managed with mastectomy, those with estrogen receptor (ER)-, progesterone receptor (PR)-, or human epidermal growth factor receptor-2 (HER2)-positive or other molecular subtypes, and patients unwilling to participate were excluded. All participants provided written informed consent prior to enrollment, and ethical approval for the study was obtained from the institutional ethics review committee.

Operational Definitions

TNBC: Triple-negative breast cancer, defined as tumors negative for ER, PR, and HER2 expression, accounting for approximately 10–20% of all breast cancers.[15]

BCS: Breast-conserving surgery is of two types:

SBCS: Standard breast-conserving surgery, which involves removal of the tumor with surrounding breast tissue, preserving the breast shape without tissue transfer.[19]

OBCS: Oncoplastic breast-conserving surgery, which combines cancer excision with immediate reconstructive techniques to maintain both oncological safety and aesthetic outcomes.[19]

NACT: Neoadjuvant chemotherapy refers to systemic therapy given prior to surgery, initially for inoperable locally advanced disease, and later extended to operable cases.[20]

Outcome Measures

The primary and secondary outcomes were systematically evaluated to capture both clinical and patient-centered endpoints. Surgical quality was assessed by analyzing resection margin status and histopathological characteristics of the excised specimens. Tumor response to neoadjuvant chemotherapy (NACT) was evaluated both clinically and pathologically, while the cosmetic outcome of the breast was appraised using standardized aesthetic assessment criteria. Oncological safety was determined through surveillance of disease recurrence within one year of surgery, categorized as local, regional, distant, or combined recurrence. Additionally, patient-reported satisfaction with the surgical outcome was recorded to provide insight into quality-of-life perspectives alongside clinical effectiveness.

Data Collection Procedure

Data were collected prospectively using a structured approach to ensure completeness and accuracy. All patients underwent thorough preoperative evaluation, which included a detailed history, clinical examination, and review of pre-NACT investigations such as ultrasonography, mammography, core biopsy, and other relevant diagnostic reports. Tumor staging was performed according to the AJCC 8th edition. Sociodemographic variables and clinical characteristics were recorded using a predesigned questionnaire. Perioperative information including the type of breast-conserving surgery performed, and intraoperative details was systematically documented. Early postoperative outcomes, defined as events occurring within 30 days, such as complications and histopathological findings, were carefully evaluated. Follow-up data regarding cosmetic outcomes, adjuvant radiotherapy details, recurrence, mortality, and patient-reported satisfaction were assessed through scheduled clinical visits.

Data Processing and Analysis

All collected data were verified for accuracy, consistency, and completeness prior to entry into the Statistical Package for the Social Sciences (SPSS) software, version 26.0. Descriptive statistics were used to summarize the study population: quantitative variables were expressed as mean ± standard deviation (SD) for normally distributed data, while categorical variables were presented as frequencies and percentages. Inferential statistics were applied to explore associations between categorical variables using the Chi-square test, with Fisher's exact test employed when expected cell counts were small. A p-value of less than 0.05 was considered the threshold for statistical significance in all analyses.

RESULTS

The mean age of the patients was 44.4 ± 10.37 years, with the majority falling in the 41–50 years age group (38.8%), followed by 31–40 years (28.8%). A smaller proportion were younger than 30 years (11.3%) or older than 60 years (5%).

Table 1: Age Distribution of Patients (n = 80)

Age group (years)	Frequency (n)	Percentage (%)
20–30	9	11.3
31–40	23	28.8
41–50	31	38.8
51–60	13	16.3
61–70	4	5
Mean ± SD	44.4 ± 10.37	

Most tumors were located in the right breast (53.8%), with the upper outer quadrant (53.8%) being the most common site. The majority presented as cT2 tumors (66.3%), with Stage II disease (73.8%) at diagnosis. Nodal involvement was frequent, with N1 disease in 67.5% of patients.

Table 2: Pre-NACT Tumor Characteristics (n = 80)

Characteristics	Frequency (n)	Percentage (%)
Side of Tumor		
Right	43	53.8
Left	37	46.2
Site of Tumor		
Upper Outer	43	53.8
Upper Inner	10	12.5
Lower Outer	13	16.3
Lower Inner	9	11.3
Central	6	7.5
Clinical T Stage		
cT1	6	7.5
cT2	53	66.3
cT3	9	11.3
cT4	12	15
Clinical N Stage		
N0	19	23.8
N1	54	67.5
N2	6	7.5
N3	1	1.2
Clinical TNM Stage		
Stage II	59	73.8
Stage III	21	26.2

Following NACT, the most frequent tumor category was ycT1 (48.8%), and 67.5% achieved ycN0 status. In terms of response, 76.3% had partial response, while 21.3% achieved complete clinical response, and only 2.4% showed no response.

Table 3: Post-NACT Tumor Characteristics (n = 80)

Characteristics	Frequency (n)	Percentage (%)
Post-NACT T Stage		
ycT0	21	26.3
ycT1	39	48.8

ycT2	19	23.8
ycT3	1	1.3
Post-NACT N Stage		
ycN0	54	67.5
ycN1	26	32.5
Clinical Response		
Complete Response	17	21.3
Partial Response	61	76.3
No Response	2	2.4

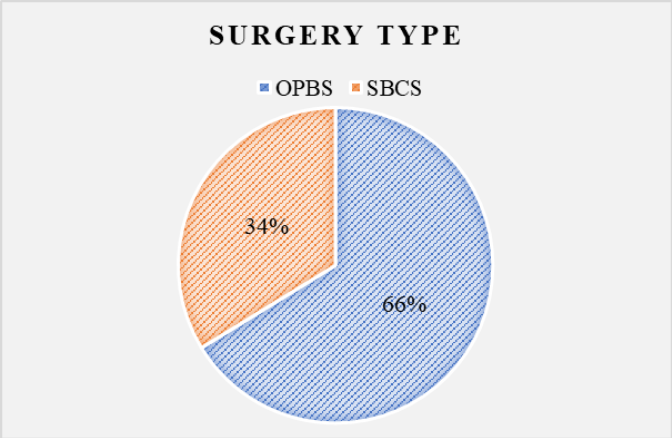

Figure 1: Types of Breast-Conserving Surgery (n = 80)

Among the surgical procedures, oncoplastic breast-conserving surgery (OPBS) was performed in two-thirds of cases (66.3%), while standard breast-conserving surgery (SBCS) accounted for 33.8%.

Residual tumor was present in 76.3% of patients. Pathological downstaging was observed, with 25% achieving ypT0 and 73.8% achieving ypN0. Most tumors were Grade II (77%), and lymphovascular invasion was absent in 78.7%. Pathological response assessment showed 23.8% complete, 63.8% partial, and 12.4% poor response.

Table 4: Post-Operative Histopathological Findings (n = 80)

Findings	**Frequency (n)**	**Percentage (%)**
Residual Tumor		
Present	61	76.3
Absent	19	23.7
Pathological T Stage		
ypT0	20	25
ypT1	31	38.8
ypT2	27	33.7
ypT3	2	2.5
Pathological N Stage		
ypN0	59	73.8
ypN1	17	21.2
ypN2	4	5
Pathological Grade (n=61)		
Grade I	3	4.9
Grade II	47	77
Grade III	11	18.1
Lymphovascular Invasion		

Present	17	21.3
Absent	63	78.7
Pathological Chemo Response		
Complete Response	19	23.8
Partial Response	51	63.8
Poor Response	10	12.4

Postoperative complication rates were comparable between groups (20.8% vs. 14.8%, p=0.732). Cosmetic outcome was significantly better in the OPBS group (87.5% excellent/good) compared to SBCS (51.9%, p=0.007). Local recurrence was absent in OPBS but occurred in 14.8% of SBCS cases (p=0.041). Distant recurrence rates were similar (8.3% vs. 14.8%, p=0.655). Patient satisfaction was higher with OPBS (87.5% vs. 74.1%), though not statistically significant (p=0.255).

Table 5: Association of Postoperative Outcomes with Type of Breast-Conserving Surgery (n = 80)

Variable	OPBS (n = 53)	SBCS (n = 27)	p-value
Postoperative complication (n = 80)			
Yes	11 (20.8%)	4 (14.8%)	0.732
No	42 (79.2%)	23 (85.2%)	
Cosmetic outcome (n = 76*)			
Excellent to Good	42 (87.5%)	14 (51.9%)	0.007
Fair to Poor	6 (12.5%)	13 (48.1%)	
Local recurrence (n = 76*)			
Yes	0 (0.0%)	4 (14.8%)	0.041
No	48 (100%)	23 (85.2%)	
Distant recurrence (n = 76*)			
Yes	4 (8.3%)	4 (14.8%)	0.655
No	44 (91.6%)	23 (85.2%)	
Patient satisfaction (n = 76*)			
Satisfied	42 (87.5%)	20 (74.1%)	0.255
Not satisfied	6 (12.5%)	7 (25.9%)	

At follow-up, disease-free survival was slightly higher in OPBS (84.90%) compared to SBCS (77.8%), though not statistically significant (p=0.378). Recurrence and death rates were also comparable between the two groups.

Table 6: Final Outcome (n = 76*)

Outcome	OPBS (n = 48)	SBCS (n = 27)	p-value
Disease-free survival	45 (84.90%)	21 (77.8%)	
Alive with recurrence	1 (1.9%)	3 (11.1%)	0.378
Death	3 (5.7%)	3 (11.1%)	

DISCUSSION

Our study evaluated breast-conserving surgery (BCS) outcomes in triple-negative breast cancer (TNBC) patients following neoadjuvant chemotherapy (NACT), comparing oncoplastic (OPBS) and standard BCS (SBCS) approaches. The mean age of 44.4 years, with most patients aged 41–50 (38.8%) and 31–40 (28.8%), aligns with prior reports indicating TNBC often affects younger women, especially in South Asian and LMIC populations.[6, 7] Tumor characteristics were notable: right breast involvement predominated (53.8%), and upper outer quadrant location (53.8%) echoed findings that TNBC often localizes in this region, which has implications for surgical planning.[21] Clinical staging revealed that most patients had cT2 tumors (66.3%) and Stage II disease (73.8%), with nodal involvement in 67.5%. This confirms an

aggressive disease presentation, consistent with data from Bangladesh and surrounding regions, which report late-stage presentations and high nodal positivity in TNBC.[6, 9] Following NACT, 48.8% were downstaged to ycT1 and 67.5% to ycN0, with 21.3% achieving clinical complete response (cCR) commensurate with published TNBC NACT response rates, where pathologic complete response (pCR) ranges around 20–40%.[22, 23] Our pathological findings 25% ypT0, 73.8% ypN0, pathological complete response (pCR) in 23.8%, and lymphovascular invasion (LVI) absent in 78.7% confirm effective NACT downstaging comparable to other institutional series.[22, 24]

OPBS was performed in 66.3% and SBCS in 33.8%. Complication rates were similar (20.8% vs. 14.8%, p=0.732), affirming literature that OPBS does not increase surgical morbidity compared to conventional BCS.[24, 25] Cosmetic outcomes were significantly better in the OPBS group (excellent/good 87.5% vs. 51.9%, p=0.007), in agreement with multiple studies noting superior aesthetic satisfaction with OPBS.[25-27] Importantly, local recurrence (LR) was absent in OPBS, compared to 14.8% in SBCS (p=0.041), suggesting improved local control with OPBS. This aligns with evidence that OPBS allows wider resection margins and reduced margin positivity, potentially reducing LR risk.[28, 29] A 2022 retrospective study with long-term follow-up found no significant differences in locoregional recurrence or disease-free survival (DFS) between OPBS and conventional BCS.[24] However, our results suggest a potential advantage for OPBS in aggressive subtypes, such as TNBC. Distant recurrence (DR) rates were similar (8.3% vs. 14.8%, p=0.655), and disease-free survival (DFS) trended higher in OPBS (84.9% vs. 77.8%, p=0.378), though not significantly different. These findings are consistent with broader meta-analyses of BCS vs mastectomy in TNBC, which often show equivalent or superior survival and recurrence outcomes with breast conservation.[18, 30, 31] For example, a 2021 meta-analysis including nearly 20,000 TNBC patients found lower odds of LR and distant metastasis and reduced mortality with BCS versus mastectomy.[30] A SEER-based study (2010–2013 TNBC cohort) likewise reported better breast cancer-specific and overall survival with BCS+RT compared to mastectomy.[31] These data suggest that when adequate systemic therapy and radiation are applied, BCS can be safely extended to TNBC.

Our findings extend this concept by suggesting that OPBS may offer additional benefits, combining oncologic safety with superior cosmetic outcomes, which are particularly important for younger TNBC patients. OPBS can facilitate larger tissue removal while achieving acceptable aesthetics, which may permit more adequate margins in high-risk tumors.[28, 29] However, our study also reflects that DFS differences between OPBS and SBCS were not statistically significant, likely due to limited sample size and relatively short-term follow-up. Nonetheless, the numerical advantage favors OPBS, consistent with larger retrospective cohorts and registry data (non-TNBC but analogous) showing better long-term DFS with BCS compared to mastectomy, especially when NACT downstages disease.[31, 32] A 2025 Italian series of 607 patients treated with NAT and surgery reported superior 10-year DFS, distant DFS, and overall survival with BCS versus mastectomy.[31] This highlights the crucial role of NACT in facilitating breast conservation without compromising survival. The similar rates of distant recurrence and death suggest that the choice of surgical technique (OPBS vs SBCS) may not significantly influence systemic disease outcomes, reaffirming that local surgical success must be accompanied by optimal systemic therapy to control micrometastasis.

Limitations of the Study

The relatively small sample size and short follow-up period limit the generalizability and ability to fully capture long-term survival and recurrence outcomes, particularly given the aggressive nature of triple-negative breast cancer. Potential selection bias in assigning patients to oncoplastic versus standard breast-conserving surgery may have influenced cosmetic and recurrence outcomes.

CONCLUSION

In conclusion, breast-conserving surgery, particularly the oncoplastic approach, demonstrated favorable oncological safety, cosmetic outcomes, and patient satisfaction in triple-negative breast cancer patients following neoadjuvant chemotherapy. While disease-free

survival and distant recurrence rates were comparable between oncoplastic and standard techniques, the absence of local recurrence and superior cosmetic results with oncoplastic surgery highlight its potential as a preferred surgical option in this patient population. These findings support the integration of oncoplastic breast-conserving surgery into standard practice for appropriately selected TNBC patients.

Recommendations

Based on the findings, it is recommended that oncoplastic breast-conserving surgery be considered the preferred surgical approach for eligible triple-negative breast cancer patients following neoadjuvant chemotherapy, as it ensures oncological safety while providing superior cosmetic and quality-of-life outcomes. Further large-scale, multicenter studies with longer follow-up are advised to strengthen the evidence base and guide national treatment protocols in resource-limited settings.

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