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Research Article

Assessment of Pathological Response in Locally Advanced Breast Cancer Following Neoadjuvant Chemotherapy: A Single-Institution Retrospective Study

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ABSTRACT

Introduction: Breast cancer is the most prevalent cancer among women in India, with approximately 200,000 new cases each year. Locally advanced breast cancer, classified as AJCC stages IIB to IIIC, accounts for 30 to 70 percent of these cases. This situation arises from delays in diagnosis, socioeconomic challenges, and issues in rural areas, contrasting with Western countries where early-stage breast cancer is more prevalent. These tumors are typically larger than 5 centimeters and often involve lymph nodes. They generally require neoadjuvant chemotherapy, usually consisting of doxorubicin and cyclophosphamide followed by taxanes, administered over six to eight cycles to reduce tumor size and facilitate surgery. The success rate of this treatment is between 70 to 90 percent, as reported in the NSABP B-18 study, which also evaluates tumor response to chemotherapy. A pathological complete response, defined as no remaining tumor in the breast or lymph nodes, occurs in about 10 to 20 percent of patients, with higher rates seen in those with HER2-positive or triple-negative breast cancer. This response strongly correlates with improved disease-free survival and overall survival, with hazard ratios ranging from 0.4 to 0.5 according to the CTNeoBC meta-analysis.

Objective: To Assess the Pathological Response in Locally Advanced Breast Cancer Following Neoadjuvant Chemotherapy

Methodology: This retrospective study looked at 176 patients who had biopsy-proven locally advanced breast cancer from the years 2020 to 2025. These patients completed neoadjuvant chemotherapy that was based on anthracycline and taxane before undergoing surgery, and there was post-neoadjuvant chemotherapy pathology data available which was categorized according to ypTNM as per the AJCC guidelines. Information was gathered on various factors including age, tumor side, number of treatment cycles, type of surgical procedure, tumor grade, and pathologic complete response, defined as ypT0 or Tis ypN0 or absence of residual tumor. This data was compiled using Excel and analyzed with SPSS version 16, with continuous variables reported as mean plus or minus standard deviation and categorical variables expressed as percentages.

Results: The results of our study on 176 patients with LABC (mean age: 53.7 ± 10.3 years) revealed that the tumor was equally likely to occur on either side and that the patients showed high compliance with neoadjuvant chemotherapy, with 85.2% completing 8 cycles and achieving 100% operability. The pathological characteristics showed that the majority of the patients had intermediate disease with T2 (31.8%) predominating over T1 and T3. The majority of the patients were node-negative with N0 (27.3%) and N1 (31.25%), indicating that the disease was in an early stage with respect to lymph node involvement. The pathological complete response was seen in 17.1%, which was slightly low in comparison with studies done in India.

Discussion: In our study of 176 LABC patients (mean age 53.7±10.3 years), high NACT compliance (85.2% completed 8 cycles) yielded 100% operability, intermediate pathology (T2 31.8%, ypN0 27.3%, N1 31.25%), and 17.1% pCR—slightly above Raina V6 et al. (2011; 7.8% pCR, 84.4% ORR, 58%/41% 5-year

OS/DFS in n=128 northern Indian cases) and NSABP B-18 (13% pCR), but below Balaji A7 et al. (21.4% cPR in n=56 with significant T/N downstaging, P=0.001) and below to Mallige S8 et al. (12.2% pCR in n=50, HER2+ enriched). This aligns with Indian meta-analyses (10-22% pCR, biology/delay-influenced) and underscores taxane-responsive grades (O+ 41%), though regimen optimization (e.g., Dhanushkodi's NACR +6% pCR edge) was needed pending survival data.
Conclusion: Despite a moderate 17.1% pCR rate, which is comparable to Indian norms (10–22%) in the face of intermediate pathology and resource limitations, neoadjuvant chemotherapy achieved considerable downstaging and 100% operability in 176 LABC patients. These results support the usefulness of NACT for surgical optimization and highlight the necessity of regular pathological auditing and regimen improvement in Indian settings.

Keywords*: Locally Advanced Breast Cancer, Neoadjuvant Chemotherapy, Pathological Response.*

INTRODUCTION

With an estimated 200,000 new cases each year and an increasing frequency brought on by westernization, better diagnostics, and population aging, breast cancer continues to be the most common cancer among Indian women. Locally advanced breast cancer (LABC, AJCC stages IIB-IIIC: T3-4/N1-3/M0) accounts for 30–70% of presentations in India—highest in rural/low-resource regions—unlike early-stage disease that is common in screened Western cohorts (80–90% stage I/II). This is caused by socioeconomic barriers, lack of awareness, and diagnostic delays longer than three to six months after the onset of symptoms. In 50–60% of cases, these tumors—which are frequently larger than 5 cm and have skin/nodal involvement or inflammatory features—make upfront surgery impractical, necessitating neoadjuvant systemic therapy for downstaging, operability assessment, and chemosensitivity evaluation[1].

Patients with established lymph node metastasis, big tumor but treatable breast cancer, or locally advanced breast cancer are frequently treated with neoadjuvant chemotherapy (NACT). NACT has the advantage of being able to downstage tumor size, raise the rate of breast-conserving surgery, and assess changes in tumor size to offer information on therapy response.[2] Although it is only attained in 10%–20% of cases, the pathological full response has consistently been linked to positive long-term outcomes. The prognosis is better for patients who attain a pathological full response than for those who do not.2 By choosing certain breast cancer subtypes and treatment plans, higher rates of pathological full response can be attained.[3]

Since NSABP B-18 (Wolmark4 et al., 2001), neoadjuvant chemotherapy (NACT), which is usually anthracycline-taxane based (e.g., AC-T: doxorubicin/cyclophosphamide followed by paclitaxel; 6-8 cycles), has become standard. It converts 70–90% inoperable LABC to operable while identifying poor responders for escalation. According to meta-analyses such as CTNeoBC (Cortazar 6 et al., 2014), pathological complete response (pCR)—no invasive residual cancer in breast/nodes (ypT0/Tis ypN0 per Miller-Payne/Chevallier systems)—emerges as the strongest surrogate for long-term outcomes, conferring 50-80% DFS/OS benefit (HR 0.4-0.5).

Aim and Objective:

To Assess the Pathological Response in Locally Advanced Breast Cancer Following Neoadjuvant Chemotherapy

MATERIALS AND METHODS

A retrospective review of 176 LABC patients who underwent surgery after receiving NACT (2020–2025). Biopsy-proven LABC, finished NACT (anthracycline/taxane-based), and available post-NACT pathology were the study's inclusion criteria. The study participants provided the following information: Age, Side, Cycles, Procedure, Grade (BG), and ypTNM (AJCC). pCR: "No Residual Tumor" or ypT0/Tis in YPT/PN is ypN0. Following data collection, the information was assembled and input into a Microsoft Excel spreadsheet. The statistical program SPSS version 16 was used for the analysis. The mean and standard deviation were used to express all continuous variables. Percentages and proportions were used to express all categorical variables.

RESULTS:

The mean age of 176 LABC patients in this study was 53.7 years (SD 10.3; range 26-75), which is typical for Indian populations where delayed presentation is more common. There were 88 (50.0%) left-sided tumors, 87 (49.4%) right-sided tumors, and one bilateral case (0.6%). NACT had a mean of 7.9 cycles (SD 0.9), with 150 patients (85.2%) finishing the recommended 8 cycles, 16 (9.1%) receiving 6, and the remaining patients receiving 4–13 cycles.

Following NACT, all patients had surgery and achieved 100% operability: 88 left MRM (50.0%), 87 right MRM (49.4%), and 1 bilateral MRM (0.6%), demonstrated successful downstaging. O+ was the most common blood group in 72 instances (40.9%), followed by B+ (58, 33.0%), A+ (30, 17.0%), and AB+ (10, 5.7%). Rarely, there were negatives (O-/B-/A-: 6, 3.4%).

Table 1: Diagnosis of Study Participants:

Variables	Frequency	Proportion	Total
LABC Left	88	50	176(100%)
LABC Right	87	49.4	
Bilateral	1	0.6	

The majority of patients were in T2 stage (31.8%), showing a predominance of moderately advanced tumors, according to the research participants' T stage distribution. This was followed by T3 stage (14.8%) and No residual tumor (17.1%), indicated that a significant percentage of patients either had locally progressed disease or no identifiable tumor. With T1 (8%), T1A (4.5%), T1B (2.3%), and T1C (5.1%) patients, early-stage cancers were less common. Tis, or very early lesions, were comparatively rare (2.3%). With T4 (1.1%) and T4B (4%) patients, advanced phases were underrepresented. Overall, the results show that the majority of patients had intermediate-stage disease, with fewer cases at the extremes of very early or very advanced stages (Table 2).

Table 2; Pathological response-T Stage:

T Stage	N	%
No Residual Tumor	30	17.1
pTiS	4	2.3
pT1	14	8
pT1A	8	4.5
pT1B	4	2.3
pT1C	9	5.1
pT2	56	31.8
pT3	26	14.8
pT4	2	1.1
pT4B	7	4

According to the study participants' N stage distribution, 55 patients (31.25%) were in the N1 stage, whereas 48 patients (27.3%) were in the N0 stage. Only a very small percentage of patients (2 patients, 1.13%) were in the N3 stage, whereas a smaller percentage (30 patients, 17%) were in the N2 stage. This suggests that only a small percentage of individuals developed severe nodal disease, with the majority presenting with early to moderate nodal involvement. (Table 3)

Table 3: Pathological response-N Stage:

N Stage	N	%
pN0	48	27.3
pN1	55	31.25
pN2	30	17
pN3	2	1.13

DISCUSSION:

Nearly comparable tumor laterality and high neoadjuvant chemotherapy compliance were seen in our analysis of 176 LABC patients (mean age 53.7 ± 10.3 years), with 85.2% completing 8 cycles and reaching 100% operability. Nodal status was primarily N0 (27.3%) and N1 (31.25%), indicating little lymph node involvement; pathologically, the majority of patients had intermediate disease, with T2 (31.8%) predominating. The pathological complete response rate was 17.1%, which is comparable to more stringent criteria of complete response but marginally lower than some Indian studies. Overall, this suggests effective downstaging with a moderate disease burden at presentation.

Raina V [6] et al. (2011), for example, reported a 7.8% pCR rate in 128 northern Indian LABC cases using anthracycline-based NACT, with an 84.4% overall response rate (ORR) and a 5-year OS/DFS of 58%/41%. These results closely mirror our operability (100%) and demographics (mean age 53.7 years), although our nodal downstaging (ypN0 27.3% flagged) suggests similar prognostic potential pending survival data.

Fifty-six patients receiving NACT for LABC were examined, according to Balaji A[7] et al. Tumor features, such as size, hardness, and fixity to the skin or muscle, considerably improved after NACT ($P<0.05$), and the frequency of patients with axillary and supraclavicular lymphadenopathy dramatically decreased ($P<0.05$). A notable downstaging of the tumor ($P=0.001$) following NACT was indicated by a significant increase in the number of patients in T0-T2 and N0-N1 stages and a decrease in the number of participants in T3-T4 and N2-N3 stages. The tumor's grading showed a notable improvement ($P=0.001$). Twelve (21.4%) of the 56 patients had a complete pathological response (cPR) of the tumor, although the ER/PR and HER2-neu receptor status remained unchanged in the other forty-four patients. The highest cPR rate for triple-negative breast cancer (TNBC) was 12.5%.

According to Mallige S[8] et al., 50 women had breast cancer surgery after NACT. 56.5 years was the average age. Stage IIIB accounted for the majority (59.1%), with Stage III A coming in second (30.6%). Clinical partial response was seen in 73.4% of cases, no response in 14.2%, and pathological complete response (pCR) in 12.2%. The factors that were substantially correlated with pCR were ER and PR negative and Her 2 positive status.

While Indian meta-analyses estimate 10–22% pCR impacted by biology and delays, NSABP B-18 (Wolmark4 et al., 2001) reported 13% pCR with AC NACT globally, similar to our result. While lower pCR highlights the need for regimen modification, as in Dhanushkodi's NACR superiority (6% pCR edge), our grade distribution (O+ 41%) matches intermediate-high grade LABC responsive to taxanes.

Table 4: Comparison of Our Study Findings with Other Study:

Parameter	Our Study (n=176)	Raina/Prasad (2011, n=128)	Balaji (n=56)	Mallige (n=50)	NSABP B-18 (2001)
Mean Age	53.7 years	~53 years	Not specified	56.5 years	Not specified
pCR Rate	17.1%	7.8%	21.4% (cPR)	12.2%	13%
Operability/ORR	100%	84.4% ORR	Significant downstaging (P=0.001)	73.4% cPR	Nodal downstaging 58%
Nodal Status Post-NACT	ypN0 27.3%, N1 31.25%	Not detailed	Reduced axilla/supraclavicular (P<0.05)	Not detailed	Path neg nodes 58%
5-yr OS/DFS	Pending	58%/41%	Not reported	Not reported	Improved with Pcr

CONCLUSION:

In summary, this study showed that neoadjuvant chemotherapy significantly reduced tumor stage in LABC patients, allowing for 100% surgical operability. A mild disease burden at presentation is indicated by the preponderance of intermediate T stage and little nodal involvement. Even while the pathological complete response rate of 17.1% was low, it is nevertheless in line with more stringent criteria that have been documented in identical circumstances. Overall, these results confirm that neoadjuvant treatment was a useful strategy for enhancing surgical results in patients with LABC. For LABC management to be optimized in resource-constrained Indian settings, routine pathological audits is still crucial.

Limitations

There are a number of limitations to this retrospective research that are specific to single-institution study. First, subtype-stratified pCR analysis was not possible in the absence of biomarker data (ER/PR/HER2 status, Ki-67). Prognostic correlations were limited by the absence of survival endpoints (DFS/OS). Generalizability was limited to a specific postsecondary institution, where cohorts from northern and western India may differ in terms of age and grade distribution. Future iterations would be strengthened by prospective designs that include comprehensive pathology, biomarkers, and follow-up.

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