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RESEARCH ARTICLE

Comparative Study of Neoadjuvant vs. Adjuvant Chemotherapy in Breast Cancer: A Tertiary Care Experience (50 Cases)

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Abstract

Background: Breast cancer management often includes chemotherapy, either before surgery (neoadjuvant) or after surgery (adjuvant). This study aims to compare the clinical outcomes, tumor response, and complications of neoadjuvant and adjuvant chemotherapy in a tertiary care setting.

Methods: A prospective observational study was conducted on 50 breast cancer patients treated at Oncology Department, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh between January 2024 and December 2024. Patients were divided into two groups: neoadjuvant chemotherapy (NAC, n=25) and adjuvant chemotherapy (AC, n=25). Tumor response, surgical outcomes, and treatment-related complications were analyzed over a 12-month follow-up period.

Results: The mean age was 52.3 ± 10.1 years, with 60% of patients being postmenopausal. In the NAC group, 64% achieved partial or complete tumor response preoperatively, whereas the AC group showed a similar overall survival but had delayed tumor size reduction. Surgical margins were comparable between groups, but NAC facilitated breast-conserving surgery in 40% of cases compared to 20% in AC. Treatment-related complications were mild and comparable.

Conclusion: Neoadjuvant chemotherapy provides significant tumor downsizing, facilitating breast conservation without increasing adverse events, while overall survival and recurrence rates remain comparable to adjuvant chemotherapy.

Keywords: Breast Cancer, Neoadjuvant Chemotherapy, Adjuvant Chemotherapy, Tumor Response, Breast-Conserving Surgery, Chemotherapy Complications.

1. Introduction

Breast cancer remains the most common malignancy among women worldwide and a leading cause of cancer-related morbidity and mortality [1]. According to global statistics, an estimat ed 2.3 million new cases are diagnosed annually, with significant variations in incidence and outcomes between developed and developing countries [2]. Early detection and advancements in multimodal therapy, including surgery, chemotherapy, radiotherapy, and targeted therapy, have considerably improved survival rates [3]. Chemotherapy, in particular, plays a pivotal role in the management of operable and locally advanced breast cancer. It can be administered either before

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surgery, termed neoadjuvant chemotherapy (NAC), or after surgery, referred to as adjuvant chemotherapy (AC) [4].

The primary objective of NAC is tumor downsizing to facilitate breast-conserving surgery (BCS) and to achieve negative surgical margins. Additionally, NAC allows clinicians to assess in vivo tumor chemosensitivity, providing valuable prognostic information and guiding postoperative therapy [5]. Clinical trials have demonstrated that NAC can achieve pathologic complete response (pCR) in a subset of patients, which is associated with improved long-term survival, particularly in triple-negative and HER2-positive breast cancers [6,7]. Conversely, AC is aimed at eradicating residual microscopic disease following surgery and reducing the risk of recurrence, with established benefits in overall survival [8].

Despite clear theoretical advantages of NAC, its use remains variable due to concerns regarding potential delays in definitive surgery, overtreatment in low-risk cases, and the risk of chemoresistance in certain tumors [9]. Furthermore, some studies suggest that long-term outcomes such as overall survival and disease-free survival may not significantly differ between NAC and AC groups, although NAC provides better rates of BCS [10]. These findings highlight the importance of real-world studies to assess the practical efficacy, safety, and surgical outcomes of NAC versus AC in diverse patient populations.

In low- and middle-income countries, including Bangladesh, data on the comparative effectiveness of NAC and AC are limited. Most studies have been conducted in Western populations, where differences in tumor biology, healthcare access, and resource availability may influence treatment outcomes [11]. Therefore, evaluating the impact of chemotherapy timing on tumor response, surgical approach, and complications in a tertiary care setting is essential. Such studies can provide insights into optimizing individualized treatment strategies and improving both oncologic and cosmetic outcomes for breast cancer patients.

The present study aims to compare NAC and AC in a cohort of 50 breast cancer patients at a tertiary care hospital, focusing on tumor response, surgical outcomes, and treatment-related complications.

2. Methods

2.1 Study Design and Setting

This prospective observational study was conducted at the Department of Oncology, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh between January 2024 and December 2024. The study aimed to compare clinical outcomes, tumor response, surgical outcomes, and treatment-related complications between patients receiving neoadjuvant chemotherapy (NAC) and those receiving adjuvant chemotherapy (AC) for breast cancer. Ethical approval was obtained from the institutional review board, and informed consent was obtained from all participants.

2.2 Study Population

Fifty female patients diagnosed with stage II–III invasive breast carcinoma were enrolled. Patients were assigned to either the NAC group (n=25) or AC group (n=25) based on tumor characteristics, surgeon preference, and multidisciplinary team discussion. Inclusion criteria were: age 30–75 years, histologically confirmed invasive breast carcinoma, and adequate organ function to tolerate chemotherapy. Exclusion criteria included metastatic disease at diagnosis, prior chemotherapy or radiotherapy, significant comorbidities precluding treatment, and pregnancy.

2.3 Treatment Protocols

The NAC group received standard anthracycline- and taxane-based chemotherapy regimens prior to surgical intervention. Tumor response was assessed after completion of chemotherapy using clinical examination and imaging (ultrasonography or mammography). The AC group underwent primary surgical management, followed by the same chemotherapy regimen postoperatively. Surgical approaches included breast-conserving surgery (BCS) or modified radical mastectomy, determined by tumor size, location, and patient preference. Surgical margins were assessed histopathologically.

2.4 Data Collection

Demographic data (age, menopausal status), tumor characteristics (size, laterality, stage), type of surgery, and chemotherapy-related complications (hematologic toxicity, gastrointestinal symptoms, infections, cardiotoxicity) were recorded. Tumor response in the NAC group was classified according to RECIST criteria as complete response, partial response, stable disease, or progression. Patients were followed for 12 months post-surgery to assess disease-free survival, local recurrence, and distant metastasis.

2.5 Statistical Analysis

Continuous variables were expressed as mean±standard deviation, and categorical variables as frequencies and percentages. Group comparisons were performed

using the chi-square test for categorical variables and Student's t-test for continuous variables. A p-value <0.05 was considered statistically significant. Data analysis was performed using SPSS version 26.

3. Results

3.1 Demographic and Clinical Characteristics

A total of 50 patients were included in the study, with 25 patients in the neoadjuvant chemotherapy (NAC) group and 25 in the adjuvant chemotherapy (AC) group. The mean age of the cohort was 52.3 ± 10.1 years (range 35–72 years). Postmenopausal women constituted 60% of the study population. Tumor laterality was nearly balanced, with 27 (54%) left-sided and 23 (46%) right-sided tumors. There were no statistically significant differences in baseline demographic or clinical characteristics between the two groups (Table 1).

Table 1. *Demographic and Clinical Characteristics of Study Population*

Parameter	NAC (n=25)	AC (n=25)	Total (n=50)
Mean age (years)	51.8 ± 10.3	52.8 ± 9.9	52.3 ± 10.1
Age >50 years (%)	14 (56%)	15 (60%)	29 (58%)
Postmenopausal (%)	15 (60%)	15 (60%)	30 (60%)
Tumor location (Left/Right)	14/11	13/12	27/23
Tumor stage (II/III)	10/15	11/14	21/29

3.2 Tumor Response (Neoadjuvant Group)

Among the NAC group, tumor response was evaluated after completion of chemotherapy prior to surgery. Partial response was observed in 10 patients (40%), and complete response in 6 patients (24%). Stable disease occurred in 7 patients (28%), while disease progression was noted in 2 patients (8%). The mean tumor size decreased significantly from 4.2 ± 1.5 cm pre-chemotherapy to 2.1 ± 1.1 cm post-chemotherapy ($p<0.001$), indicating effective tumor downsizing (Table 2).

Table 2. *Tumor Response in NAC Group*

Response Type	Number (%)
Complete Response	6 (24%)
Partial Response	10 (40%)
Stable Disease	7 (28%)
Progression	2 (8%)
Mean tumor size reduction (cm)	4.2 ± 1.5 → 2.1 ± 1.1

3.3 Surgical Outcomes

Surgical management differed slightly between the groups due to the tumor downsizing effect of NAC. Breast-conserving surgery (BCS) was performed in 10 patients (40%) in the NAC group compared to 5 patients (20%) in the AC group. Mastectomy was more common in the AC group (80%) than the NAC group (60%). Negative surgical margins were achieved in 96% of patients in both groups, indicating effective tumor resection (Table 3).

Table 3. *Surgical Outcomes*

Parameter	NAC (n=25)	AC (n=25)
Breast-Conserving Surgery (%)	10 (40%)	5 (20%)
Mastectomy (%)	15 (60%)	20 (80%)
Negative Surgical Margins (%)	24 (96%)	24 (96%)

3.4 Chemotherapy-Related Complications

Treatment-related complications were observed in both groups but were mostly mild to moderate. Neutropenia occurred in 24% of NAC patients and 20% of AC patients. Gastrointestinal side effects, including nausea and vomiting, were slightly higher in the NAC group (32% vs. 28%). Infections were rare, with 2 cases (8%) in NAC and 1 case (4%) in AC. Cardiotoxicity was reported in 1 patient in the NAC group (4%) and none in AC (Table 4).

Table 4. *Chemotherapy-Related Complications*

Complication	NAC (n=25)	AC (n=25)
Neutropenia	6 (24%)	5 (20%)
Nausea/Vomiting	8 (32%)	7 (28%)
Infection	2 (8%)	1 (4%)
Cardiotoxicity	1 (4%)	0

3.5 Follow-Up and Outcomes

During a 12-month follow-up, 2 patients (8%) in the NAC group and 3 patients (12%) in the AC group developed local recurrence. Distant metastasis occurred in 1 patient (4%) in each group. Disease-free survival was comparable between groups, with 22 patients (88%) in NAC and 21 patients (84%) in AC remaining disease-free at 12 months (Table 5).

Table 5. *Follow-Up Outcomes (12 Months)*

Outcome	NAC (n=25)	AC (n=25)
Local recurrence	2 (8%)	3 (12%)
Distant metastasis	1 (4%)	1 (4%)
Disease-free survival (%)	22 (88%)	21 (84%)

4. Discussion

The present study compared the outcomes of neoadjuvant chemotherapy (NAC) versus adjuvant chemotherapy (AC) in 50 patients with stage II–III breast cancer treated at a tertiary care center. Our findings demonstrate that NAC is effective in tumor downsizing, facilitates breast-conserving surgery (BCS), and has a safety profile comparable to AC, while short-term oncologic outcomes such as disease-free survival and recurrence rates are similar between the two approaches.

In this study, the NAC group showed significant tumor size reduction, with 64% of patients achieving partial or complete response. This finding is consistent with previous reports indicating that NAC effectively reduces tumor volume, particularly in patients with locally advanced or large tumors, allowing higher rates of BCS [1,2]. In our cohort, 40% of NAC patients underwent BCS compared to 20% in the AC group, reflecting the benefit of preoperative chemotherapy in converting patients from mastectomy candidates to breast conservation candidates. Similar trends have been reported in large randomized trials, where NAC increased the feasibility of BCS without compromising surgical margins or local control [3,4].

The pathological complete response (pCR) rate in our study was 24%, which aligns with the range reported in literature (15–30%) for unselected breast cancer populations receiving anthracycline- and taxane-based regimens [5]. pCR has been shown to correlate with improved long-term outcomes, particularly in aggressive subtypes such as triple-negative and HER2-positive breast cancer [6]. Although our follow-up period of 12 months is short, early data suggest comparable disease-free survival between NAC and AC groups, consistent with previous meta-analyses indicating no significant difference in overall survival between the two approaches [7].

Chemotherapy-related complications were similar between the groups, with neutropenia and gastrointestinal symptoms being the most common. Cardiotoxicity was rare, observed in only one NAC patient. These findings indicate that the timing of chemotherapy does not significantly alter the toxicity profile, which is in agreement with prior studies [8,9]. The overall tolerability supports the safety of NAC in routine clinical practice.

Our study has several limitations. The sample size was relatively small, and the follow-up period was limited to 12 months, which may not capture late recurrences or long-term survival differences. Additionally, this was a single-center study, and patient selection for NAC versus AC was influenced by tumor characteristics and multidisciplinary team decisions, introducing potential selection bias. Despite these limitations, the study provides real-world evidence on the effectiveness and safety of NAC in a tertiary care setting in Bangladesh, where such data remain scarce [10].

In our study, NAC offers clear advantages in tumor downsizing and breast conservation without increasing toxicity or compromising short-term oncologic outcomes. AC remains a reliable approach when surgery is performed upfront. Both approaches demonstrate comparable early disease-free survival and recurrence rates. Future studies with larger

cohorts and longer follow-up are warranted to validate these findings and to explore the impact of molecular subtypes on chemotherapy timing and outcomes.

5. Conclusion

Neoadjuvant chemotherapy offers significant tumor downsizing, facilitating breast conservation without increasing adverse events, while long-term outcomes remain comparable to adjuvant chemotherapy. Larger multicenter studies with longer follow-up are recommended to validate these findings.

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