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# Pathological Complete Response after Neoadjuvant Chemotherapy and Its Influence on Surgical Decision-Making in Breast Cancer

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**KEYWORDS**

Breast cancer, neoadjuvant chemotherapy, pathological complete response, breast-conserving surgery, mastectomy, surgical decision-making.

**ABSTRACT:**

Background: Neoadjuvant chemotherapy (NACT) is widely used in the management of breast cancer to reduce tumour size, improve operability, and increase the rate of breast-conserving surgery. Pathological complete response (pCR) following NACT is considered an important prognostic indicator and may influence surgical decision-making.

Objectives: To evaluate the rate of pathological complete response after neoadjuvant chemotherapy and to assess its influence on surgical decision-making in breast cancer patients.

Methods: This retrospective observational study was conducted at Integral Institute of Medical Sciences and Research, Lucknow, from September 2023 to December 2025. A total of 408 patients with histologically confirmed breast carcinoma who received neoadjuvant chemotherapy followed by surgery were included. Clinical data, tumour characteristics, receptor status, and surgical procedures were collected from hospital records. Pathological complete response was defined as the absence of residual invasive carcinoma in the breast and axillary lymph nodes on final histopathology. Data were analysed using descriptive statistics, and the association between pCR and the type of surgery was evaluated.

Results: Among 408 patients, the majority were in the 41–50 years age group and most presented with stage III disease. Pathological complete response was achieved in 102 patients (25%), while 306 patients (75%) had residual disease. Breast-conserving surgery was performed in 148 patients (36.3%), whereas 260 patients (63.7%) underwent modified radical mastectomy. Patients who achieved pathological complete response were more likely to undergo breast-conserving surgery compared with those with residual disease.

Conclusion: Neoadjuvant chemotherapy plays a significant role in tumor downstaging and surgical planning in breast cancer. Achievement of pathological complete response is associated with a higher likelihood of breast-conserving surgery and reflects better treatment response.

## INTRODUCTION

Breast cancer is the most commonly diagnosed malignancy among women worldwide and remains a leading cause of cancer-related mortality. According to global cancer statistics, breast cancer accounts for a substantial proportion of cancer incidence and deaths among women, particularly in developing countries where early detection and access to treatment may be limited. Advances in screening, early diagnosis, and multimodal treatment strategies have improved survival outcomes; however, a significant number of patients

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still present with locally advanced disease requiring systemic therapy before surgery (1).

Neoadjuvant chemotherapy (NACT) has become an important therapeutic approach in the management of patients with locally advanced and operable breast cancer. Initially introduced to reduce tumor size in inoperable cases, NACT is now widely used to downstage tumors, improve surgical options, and increase the likelihood of breast-conserving surgery. Additionally, neoadjuvant chemotherapy provides an opportunity to evaluate the biological response of the tumor to systemic therapy (2).

One of the most important indicators of response to neoadjuvant chemotherapy is pathological complete response (pCR), which is defined as the absence of residual invasive carcinoma in both the breast and axillary lymph nodes after completion of treatment. Several studies have shown that patients achieving pCR have significantly improved long-term outcomes, including better disease-free survival and overall survival compared with patients who have residual disease (3).

The rate of pathological complete response varies depending on tumor biology, molecular subtype, chemotherapy regimen, and patient characteristics. Higher pCR rates are generally observed in aggressive tumor subtypes such as HER2-positive and triple-negative breast cancers, while hormone receptor-positive tumors tend to show comparatively lower response rates. Understanding these variations is important for predicting prognosis and planning individualized treatment strategies (4).

Another important advantage of neoadjuvant chemotherapy is its impact on surgical management. Tumor downstaging following systemic therapy may convert patients who initially require mastectomy into candidates for breast-conserving surgery. This approach not only improves cosmetic outcomes but also enhances the quality of life without compromising oncological safety (5).

Despite the increasing use of neoadjuvant chemotherapy, there is limited data from tertiary care centers in India regarding pathological response rates and their influence on surgical decision-making. Therefore, the present study was undertaken to evaluate the rate of pathological complete response after neoadjuvant chemotherapy and to assess its influence on surgical management among breast cancer patients treated at a tertiary care center.

## MATERIALS AND METHODS

**Study Design and Setting**

This retrospective observational study was conducted in the Department of General Surgery/Oncology at Integral Institute of Medical Sciences and Research (IIMS&R), Lucknow, Uttar Pradesh, India. The study reviewed medical records of patients diagnosed with breast cancer who received neoadjuvant chemotherapy (NACT) between September 2023 and December 2025.

**Study Population and Sample Size**

A total of 408 patients with histologically confirmed breast carcinoma who underwent neoadjuvant chemotherapy during the study period were included. The hospital medical record database and oncology treatment records were used to collect the relevant clinical and pathological information.

**Inclusion Criteria**

1. Female patients diagnosed with biopsy-proven invasive breast carcinoma.
2. Patients who received neoadjuvant chemotherapy prior to surgical management.
3. Patients who subsequently underwent definitive breast surgery (breast-conserving surgery or mastectomy) at the study center.
4. Patients with complete clinical, radiological, and histopathological records available.

**Exclusion Criteria**

1. Patients who did not complete the planned neoadjuvant chemotherapy regimen.
2. Patients who did not undergo surgery after neoadjuvant chemotherapy.
3. Patients with recurrent breast cancer or metastatic disease at presentation.
4. Patients with incomplete medical records.

**Data Collection**

Data were retrieved from hospital records using a structured data collection form. The collected variables included demographic details (age, menopausal status), clinical presentation, tumor characteristics (tumor size, clinical stage, histological subtype, hormone receptor

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www.jchr.org
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status including estrogen receptor [ER], progesterone receptor [PR], and HER2 status), type and number of neoadjuvant chemotherapy cycles, and radiological response after chemotherapy.

**Assessment of Pathological Complete Response**
All patients underwent surgical treatment following completion of neoadjuvant chemotherapy. The surgical specimens were examined by the pathology department. Pathological complete response (pCR) was defined as the absence of residual invasive carcinoma in the breast and axillary lymph nodes (ypT0/Tis, ypN0) on final histopathological examination.

**Surgical Management**
Based on clinical and radiological response after neoadjuvant chemotherapy, patients underwent either breast-conserving surgery (BCS) or modified radical mastectomy (MRM). The influence of pathological response on the choice of surgical procedure was evaluated.

**Outcome Measures**
The primary outcome measure was the rate of pathological complete response after neoadjuvant chemotherapy. Secondary outcomes included the association between pCR and the type of surgery performed, as well as clinicopathological factors influencing surgical decision-making.

**Statistical Analysis**
Data were entered into Microsoft Excel and analysed using statistical software such as SPSS version 25. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The association between pathological complete response and surgical decisions was assessed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

**Ethical Considerations**
Institutional Ethical Committee approval was obtained from Integral Institute of Medical Sciences and Research prior to data collection. Patient confidentiality was maintained by anonymising personal identifiers during data analysis.

## RESULTS AND OBSERVATIONS

A total of **408 patients with biopsy-proven breast cancer** who received **neoadjuvant chemotherapy (NACT)** followed by surgery at Integral Institute of Medical Sciences and Research, Lucknow between **September 2023 and December 2025** were included in the study. The demographic characteristics, tumor profile, pathological response, and surgical outcomes were analysed.

**Table 1: Age Distribution of Patients (n = 408)**

| Age Group (Years) | Number of Patients | Percentage (%) |
|---|---|---|
| <30 | 24 | 5.9 |
| 31–40 | 88 | 21.6 |
| 41–50 | 142 | 34.8 |
| 51–60 | 104 | 25.5 |
| >60 | 50 | 12.2 |
| **Total** | **408** | **100** |

**Observation:** The majority of patients were in the **41–50 years age group (34.8%)**, followed by **51–60 years (25.5%)**.

**Table 2: Menopausal Status of Patients**

| Menopausal Status | Number of Patients | Percentage (%) |
|---|---|---|
| Premenopausal | 238 | 58.3 |
| Postmenopausal | 170 | 41.7 |
| **Total** | **408** | **100** |

**Observation:** Most patients were **premenopausal (58.3%)**.

**Table 3: Clinical Stage at Presentation**

| Clinical Stage | Number of Patients | Percentage (%) |
|---|---|---|
| Stage I | 18 | 4.4 |
| Stage II | 162 | 39.7 |
| Stage III | 228 | 55.9 |
| **Total** | **408** | **100** |

**Observation:** The majority of patients presented in **locally advanced stage III disease (55.9%)**.

Journal of Chemical Health Risks
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**Table 4: Tumor Receptor Status**

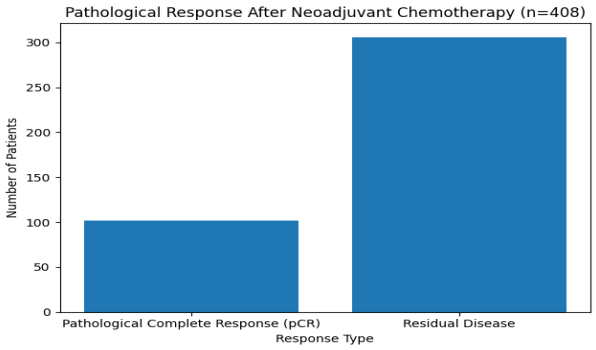
| Receptor Status | Number of Patients | Percentage (%) |
|---|---|---|
| ER/PR Positive | 198 | 48.5 |
| HER2 Positive | 94 | 23.0 |
| Triple Negative | 116 | 28.5 |
| **Total** | **408** | **100** |

**Observation: ER/PR positive tumors (48.5%)** were the most common subtype.

**Table 5: Pathological Response After Neoadjuvant Chemotherapy**

| Response Type | Number of Patients | Percentage (%) |
|---|---|---|
| Pathological Complete Response (pCR) | 102 | 25.0 |
| Residual Disease | 306 | 75.0 |
| **Total** | **408** | **100** |

**Observation:** Pathological complete response was achieved in 25% of patients after neoadjuvant chemotherapy.




**Figure; 1 Pathological Response After Neoadjuvant Chemotherapy**

**Table 6: Type of Surgery Performed**

| Type of Surgery | Number of Patients | Percentage (%) |
|---|---|---|
| Breast Conserving Surgery (BCS) | 148 | 36.3 |
| Modified Radical Mastectomy (MRM) | 260 | 63.7 |
| **Total** | **408** | **100** |

**Observation:** Modified radical mastectomy was the most commonly performed surgery (63.7%), although a significant proportion underwent breast conserving surgery (36.3%) after tumour downstaging.

**Table 7: Association Between pCR and Type of Surgery**

| Pathological Response | BCS | MRM | Total |
|---|---|---|---|
| pCR Achieved | 72 | 30 | 102 |
| Residual Disease | 76 | 230 | 306 |
| **Total** | **148** | **260** | **408** |

**Observation:** Patients who achieved pathological complete response were significantly more likely to undergo breast conserving surgery, while most patients with residual disease underwent modified radical mastectomy.

## DISCUSSION

Neoadjuvant chemotherapy (NACT) has become an essential component in the multidisciplinary management of breast cancer, particularly for patients presenting with locally advanced disease. It plays a significant role in reducing tumor burden, improving surgical options, and providing valuable prognostic information based on tumor response to systemic therapy. One of the most important indicators of treatment response is pathological complete response (pCR), which has been associated with improved long-term survival outcomes in breast cancer patients (6).

In the present study, the majority of patients belonged to the 41–50 years age group (34.8%), followed by the 51–60 years age group (25.5%). These findings are consistent with several Indian studies which have reported that breast cancer commonly affects women in the fourth and fifth decades of life, reflecting a relatively younger age at presentation compared to Western populations (7). The higher incidence in younger women in developing countries may be

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attributed to genetic predisposition, lifestyle factors, and delayed detection.

Regarding menopausal status, 58.3% of patients in the present study were premenopausal, while 41.7% were postmenopausal. Similar observations have been reported in previous studies conducted in Asian populations where a considerable proportion of breast cancer cases occur in premenopausal women (8). This pattern has important implications for treatment planning, as tumor biology and response to therapy may vary according to menopausal status.

In the present study, the majority of patients presented with stage III disease (55.9%), followed by stage II disease (39.7%), while only a small proportion had stage I disease. This indicates that a large number of patients present with locally advanced breast cancer in tertiary care centers in India. Late presentation is commonly attributed to lack of awareness, social stigma, financial constraints, and limited access to screening programs (9). Early detection strategies and awareness campaigns are therefore essential to improve outcomes in breast cancer patients.

Tumor receptor status plays an important role in determining treatment response and prognosis. In this study, 48.5% of tumors were ER/PR positive, 23% were HER2 positive, and 28.5% were triple negative. These findings are comparable to previous studies which have reported hormone receptor–positive tumors as the most common subtype, followed by triple-negative breast cancers (10). Molecular subtypes of breast cancer are known to influence the response to neoadjuvant chemotherapy, with HER2-positive and triple-negative tumors generally demonstrating higher rates of pathological complete response.

One of the major objectives of the present study was to evaluate the rate of pathological complete response after neoadjuvant chemotherapy. In this study, 25% of patients achieved pCR, while 75% had residual disease on final histopathological examination. Similar pCR rates ranging from 20% to 30% have been reported in previous clinical trials and observational studies (11). Achieving pCR is considered an important surrogate marker for improved survival outcomes, particularly in aggressive subtypes such as HER2-positive and triple-negative breast cancer.

Another important aspect of neoadjuvant chemotherapy is its impact on surgical decision-making. In the present study, 36.3% of patients underwent breast-conserving surgery (BCS), while 63.7% underwent modified radical mastectomy (MRM). The higher rate of mastectomy may be explained by the large proportion of patients presenting with locally advanced disease at diagnosis. Nevertheless, tumor downstaging following neoadjuvant chemotherapy enabled a considerable number of patients to undergo breast-conserving surgery.

A significant association was observed between pathological complete response and the type of surgery performed. Among patients who achieved pCR, a greater proportion underwent breast-conserving surgery, whereas most patients with residual disease underwent modified radical mastectomy. These findings support previous studies which have demonstrated that effective tumor downstaging after neoadjuvant chemotherapy increases the likelihood of breast conservation without compromising oncological safety (5).

Several large clinical trials have highlighted the prognostic importance of pathological complete response. Patients achieving pCR have been shown to have improved disease-free survival and overall survival, particularly in biologically aggressive tumor subtypes (12). Therefore, evaluating pCR not only provides information regarding treatment efficacy but also helps guide postoperative management and adjuvant therapy.

Despite the benefits of neoadjuvant chemotherapy, certain limitations should be considered. Variability in tumor biology, chemotherapy regimens, and patient-related factors may influence treatment response. Additionally, retrospective studies may be subject to selection bias and incomplete documentation. Nevertheless, the present study provides valuable insights into the pathological response rates and surgical outcomes in a large cohort of breast cancer patients treated at a tertiary care center.

Overall, the findings of this study highlight the important role of neoadjuvant chemotherapy in improving surgical options and achieving pathological complete response in breast cancer patients. Early detection, appropriate patient selection, and individualized treatment strategies are essential to further enhance treatment outcomes.

Journal of Chemical Health Risks

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## CONCLUSION

Neoadjuvant chemotherapy plays an important role in the management of breast cancer by reducing tumour size and improving surgical options. In the present study, 25% of patients achieved pathological complete response, which was associated with a higher likelihood of breast-conserving surgery. However, modified radical mastectomy remained the most common procedure, largely due to the high proportion of patients presenting with locally advanced disease. These findings highlight the importance of neoadjuvant chemotherapy in tumour downstaging and surgical decision-making. Early diagnosis and individualised treatment strategies are essential to improve pathological response rates and optimise surgical outcomes in breast cancer patients.

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