Pathological complete response rate in hormone receptor-negative breast cancer treated with neoadjuvant FEC, followed by weekly paclitaxel administration: A retrospective study and review of the literature

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Abstract. While tumor size, the presence of inflammatory carcinoma and lymph node involvement are the main prognostic factors of women with locally advanced breast cancer, the prognostic value of the estrogen receptor, progesterone receptor and human epidermal growth factor receptor 2 (HER2) status has not been fully clarified. The present study examined the therapeutic efficacy of a neoadjuvant fluorouracil, epirubicin and cyclophosphamide regimen (FEC), followed by weekly paclitaxel and/or trastuzumab administration, in the treatment of hormone receptor-negative breast cancer patients. Between April 2012 and February 2014, 14 patients with hormone receptor-negative local breast cancer (triple-negative type, 9 patients; HER2 type, 5 patients) were included in the study. In all cases, the histological type of the primary cancer was invasive ductal carcinoma. Among the 14 women who received the regimen, 5 presented with stage I cancer (35.7%), 3 with stage IIA (21.4%), 3 with stage IIB (21.4%), 1 with stage IIIB (7.1%) and 2 with stage IIIC (14.3%), according to the American Joint Committee on Cancer staging system. With regard to the tumor-node-metastasis classification, 5 patients were T1N0M0 (35.7%), 3 were T2N0M0 (21.4%), 3 were T2N1M0 (21.4%), 2 were T3N3M0 (14.3%) and 1 was T4N1M0 (7.1%). The pathological response was evaluated using resected tissue following neoadjuvant chemotherapy, according to the criteria established by the Japanese Breast Cancer Society. Patients were classified into pathological responders (grades 2 and 3, 71.4% of all patients) and non-responders (grade 1, 28.6% of all patients). A pathological complete response (pCR) was achieved in 50.0% of all cases (7/14); 44.4% of triple-negative-type cases (4/9) and 60.0% of HER2-type cases (3/5). Hematological and non-hematological toxicity was reversible and manageable. No patients withdrew from treatment, and favorable compliance was achieved. The present study demonstrated that neoadjuvant FEC followed by weekly administration of paclitaxel and/or trastuzumab induces a high pathological response and a high pCR rate in patients with hormone receptor-negative breast cancer. Due to the high clinical benefit rate and acceptable safety profile, this regimen should be considered an acceptable neoadjuvant treatment option for hormone receptor-negative breast cancer.

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Abbreviations: ER, estrogen receptor; FISH, fluorescence *in situ* hybridization; HER2, human epidermal growth factor receptor 2; pCR, pathological complete response

Key words: pathological complete response, fluorouracil, epirubicin and cyclophosphamide regimen, paclitaxel, breast cancer

Introduction

Neoadjuvant therapy is a standard treatment option for breast cancer (1). It has been suggested that taxane-based chemotherapy is closely associated with improved outcomes in hormone receptor-negative or human epidermal growth factor receptor 2 (HER2)-positive disease, and little, if any, benefit from taxane-based chemotherapy has been observed for the ≥50% of patients with hormone receptor-positive and HER2-negative disease (2).

Paclitaxel is considered a fundamental drug in the treatment of breast cancer (3). As a potent mitotic inhibitor, it used as an effective chemotherapeutic agent in the treatment of solid tumors. A randomized phase III trial reported that paclitaxel

administration was more effective when administered weekly compared with every 3 weeks in metastatic breast cancer (4). This study found that patients with breast cancer who received weekly neoadjuvant paclitaxel exhibited a higher pathological complete response (pCR) rate compared with patients who were treated every 3 weeks (5). The Intergroup E1199 study that compared weekly adjuvant paclitaxel treatment with administration every 3 weeks following 4 cycles of doxorubicin and cyclophosphamide, demonstrated significant improvements in disease-free survival for the patients administered weekly paclitaxel (6). Furthermore, those individuals on the weekly treatment schedule exhibited a higher incidence of grade 2, 3 or 4 peripheral neuropathy compared with those administered paclitaxel every 3 weeks (27 vs. 20%, respectively). Among the patients treated with paclitaxel, the patients with HER2-negative disease in the weekly treatment group showed an improvement in disease-free and overall survival; the same effects, however, were not observed in the patients with HER2-positive disease (6). In another study, patients with HER2-negative disease in the weekly treatment group also exhibited improved disease-free and overall survival, irrespective of their hormone receptor status (7).

While tumor size, the presence of inflammatory carcinoma and lymph node involvement are the main prognostic factors of women with locally advanced breast cancer, the prognostic value of estrogen receptor (ER), progesterone (PR) and HER2 status has not been fully clarified (8). In the present study, between April 2012 and February 2014, 14 hormone receptor-negative patients with local breast cancer (triple-negative type, 9 patients; HER2 type, 5 patients) were treated with a fluorouracil (5-FU), epirubicin and cyclophosphamide regimen (FEC), followed by weekly paclitaxel and/or trastuzumab administration. This study investigated the therapeutic efficacy of neoadjuvant FEC and weekly paclitaxel and/or trastuzumab.

Patients and methods

Ethics statement. Demographic patient data stored in the database of the National Hospital Organization Kure Medical Center and Chugoku Cancer Center were retrieved files manually, based on patient codes (Table I). Charts and discharge summaries were also examined. The present study was in accordance with the most recent version of the Declaration of Helsinki or the applicable guidelines on epidemiological studies issued by the Ministries of Health, Labor and Welfare, and Education, Culture, Sports, Science and Technology of Japan, whichever represented the greater protection of the individual (http://www.lifescience.mext.go.jp/files/pdf/n796_01.pdf). The analysis of the data was performed anonymously, without the requirement of individual patient consent due to the retrospective nature of the study. In addition, the National Hospital Organization Kure Medical Center and Chugoku Cancer Center Institutional Review Board Ethics Committee waived the requirement for individual informed consent and approved the study (approval no. 28-53; date, 01/06/15).

Table I. Characteristics of the 14 patients included in the study.

Patient characteristic	Value
Median age (range), years	57 (29-68)
Gender, n	
Male	0 (0.0)
Female	14 (100.0)
ECOG performance status, n (%)	
0	14 (100.0)
≥1	0 (0.0)
Molecular subtypes, n (%)	
Triple-negative	9 (64.3)
HER2	5 (35.7)
AJCC stage, n (%)	
I	5 (35.7)
IIA	3 (21.4)
IIB	3 (21.4)
IIIB	1 (7.1)
IIIC	2 (14.3)
TNM classification, n (%)	
T1N0M0	5 (35.7)
T2N0M0	3 (21.4)
T2N1M0	3 (21.4)
T3N3M0	2 (14.3)
T4N1M0	1 (7.1)
Cycles of FEC, n (%)	
3	2 (14.3)
4	12 (85.7)
Cycles of weekly paclitaxel, n (%)	
3	0 (0.0)
4	9 (100.0)
Cycles of weekly paclitaxel + trastuzumab, n (%)	
3	2 (40.0)
4	3 (60.0)
Pathological response of the tumor and dissected lymph nodes, n (%)	
Grade 0	0 (0.0)
Grade 1a	3 (21.4)
Grade 1b	1 (7.1)
Grade 2a	0 (0.0)
Grade 2b	3 (21.4)
Grade 3 (pCR)	7 (50.0)

AJCC, American Joint Committee on Cancer; ECOG, Eastern Cooperative Oncology Group; 5-FU, fluorouracil; FEC, 5-FU, epirubicin and cyclophosphamide regimen; pCR, pathological complete response; HER2, human epidermal growth factor receptor 2; TNM, tumor-node-metastasis.

Patients. A total of 14 hormone receptor-negative patients with local breast cancer (triple-negative type, 9 patients; HER2 type, 5 patients) who were treated between April 2012 and February 2014 were enrolled in the study. All patients were administered 3 or 4 cycles of a 5-FU 500 mg/m^2, epirubicin 100 mg/m^2 and cyclophosphamide 500 mg/m^2 regimen intravenously every 3 weeks, followed by 9 or 12 weeks of 80 mg/m^2 paclitaxel on days 1, 8, and 15, and/or weekly

Table II. All adverse events of FEC (n=14).

Adverse event following FEC	Grade 1		Grade 2		Grade 3		Grade 4	
	n	%	n	%	n	%	n	%
Anemia	5	35.7	7	50.0	1	7.1	0	0.0
Neutropenia	0	0.0	1	7.1	0	0.0	13	92.9
Nausea	10	71.4	3	21.4	0	0.0	0	0.0
Vomiting	1	7.1	0	0.0	0	0.0	0	0.0
Fatigue	11	78.6	0	0.0	0	0.0	0	0.0
Myalgia	2	14.3	0	0.0	0	0.0	0	0.0
Headache	2	14.3	0	0.0	0	0.0	0	0.0
Lumbago	1	7.1	0	0.0	0	0.0	0	0.0
Insomnia	1	7.1	0	0.0	0	0.0	0	0.0
Appetite loss	10	71.4	0	0.0	0	0.0	0	0.0
Dyspepsia	4	28.6	0	0.0	0	0.0	0	0.0
Stomatitis	2	14.3	0	0.0	0	0.0	0	0.0
Dysgeusia	3	21.4	0	0.0	0	0.0	0	0.0
Diarrhea	1	7.1	1	7.1	0	0.0	0	0.0
Constipation	7	50.0	0	0.0	0	0.0	0	0.0
Fever	1	7.1	0	0.0	0	0.0	0	0.0
Dermatitis	1	7.1	0	0.0	0	0.0	0	0.0

FEC, fluorouracil, epirubicin and cyclophosphamide regimen.

trastuzumab (4 mg/kg on week 1 and 2 mg/kg/week thereafter, if HER2-positive) in 4-week cycles. The different number of treatment regimens was due to the therapeutic efficacy using diagnostic imaging during the treatment period. The mean age of the patients at the time of paclitaxel administration was 57 years (range, 29-68 years) (Table I). In all patients, the histological type of the primary cancer was invasive ductal carcinoma. Among the 14 women who received the regimen, 5 presented with stage I cancer (35.7%), 3 with stage IIA (21.4%), 3 with stage IIB (21.4%), 1 with stage IIIB (7.1%) and 2 with stage IIIC (14.3%), according to the American Joint Committee on Cancer staging system (https://cancerstaging.org/references-tools/quickreferences/Documents/BreastSmall.pdf). With regard to the tumor-node-metastasis classification (9), 5 patients were T1N0M0 (35.7%), 3 were T2N0M0 (21.4%), 3 were T2N1M0 (21.4%), 2 were T3N3M0 (14.3%) and 1 was T4N1M0 (7.1%). Concomitant medication that did not interfere with the evaluation of FEC and paclitaxel, including antiemetics, antidiarrhea therapy, corticosteroids and antihistamines, were administered at the discretion of the clinician. Based on the American Society of Clinical Oncology guidelines and standard practice (10), granulocyte colony-stimulating factor and prophylactic use of growth factors were allowed. All other antitumor therapies were prohibited.

Pathological assessment. Pre-treatment ER and PR status was assessed by immunohistochemistry (IHC), and HER2 status was assessed by either fluorescent *in situ* hybridization (FISH) or a validated IHC method. For ER and PR, patients were classified as negative when the percentage of immunoreactive tumor cells was <1%; the rest (staining of ≥1% of tumor cells) were classified as positive. The HER2 status was assessed at study entry by IHC and/or FISH. IHC analysis for HER2 was performed on 4-μm sections of formalin (Yoshida Pharmaceutical Co., Ltd., Tokyo, Japan)-fixed, paraffin (Sakura Finetek Japan Co., Ltd., Tokyo, Japan)-embedded tissues. IHC was performed with an anti-HER2 antibody (Ventana PATHWAY HER2 antibody; rabbit monoclonal; clone, 4B5; catalog no., 790-2991; ready to use; Ventana Medical Systems, Inc., Tucson, AZ, USA) on a Ventana Benchmark XT automated staining system (Ventana Medical Systems, Inc.). The Food and Drug Administration-approved Ventana PATHWAY is scored between 0 and 3+. Staining in <10% of tumor cells is scored as showing no overexpression (0 or 1+). Strong, complete, circumferential membrane staining in >30% of tumor cells is considered as overexpression and is designated as strong positive (3+). Strong circumferential membrane staining in <30% of tumor cells, or circumferential but less than strong staining in any proportion of tumor cells, is designated as equivocal (2+). Patients with a HER2 receptor overexpression score of 3+ were immediately eligible for inclusion. HER2 expression with a score of 2+ required confirmation of evidence of HER2 gene amplification by FISH. HER2 testing was performed on samples of the primary tumor or on a biopsy of a metastatic site. The number of genes proportional to the number of centromeres was represented as the FISH ratio, with HER2 amplification considered as a HER2 FISH signal ratio of ≥2.

A lack of invasive carcinoma in the axilla and breast was defined as a pCR, no matter whether carcinoma *in situ* was present or not. A pCR of the primary tumor was considered as the absence of invasive carcinoma in the breast. The phenotypical classification of the tumors was as follows:

Table III. Adverse events following administration of paclitaxel alone (n=9) and paclitaxel + trastuzumab (n=5).

A, Paclitaxel treatment alone

	Grade 1		Grade 2		Grade 3		Grade 4	
Adverse event	n	%	n	%	n	%	n	%
Anemia	3	33.3	3	33.3	1	11.1	0	0.0
Neutropenia	4	44.4	4	44.4	1	11.1	0	0.0
Elevated AST	2	22.2	1	11.1	0	0.0	0	0.0
Elevated ALT	3	33.3	1	11.1	0	0.0	0	0.0
Elevated T-bilirubin	0	0.0	1	11.1	0	0.0	0	0.0
Nausea	2	22.2	0	0.0	0	0.0	0	0.0
Fatigue	4	44.4	2	22.2	0	0.0	0	0.0
Myalgia	1	11.1	0	0.0	0	0.0	0	0.0
Headache	1	11.1	0	0.0	0	0.0	0	0.0
Lumbago	1	11.1	0	0.0	0	0.0	0	0.0
Joint pain	3	33.3	0	0.0	0	0.0	0	0.0
Leg pain	1	11.1	0	0.0	0	0.0	0	0.0
Insomnia	2	22.2	0	0.0	0	0.0	0	0.0
Peripheral neuropathy	4	44.4	0	0.0	0	0.0	0	0.0
Appetite loss	0	0.0	0	0.0	0	0.0	0	0.0
Dyspepsia	1	11.1	0	0.0	0	0.0	0	0.0
Stomatitis	2	22.2	0	0.0	0	0.0	0	0.0
Dysgeusia	4	44.4	0	0.0	0	0.0	0	0.0
Diarrhea	2	22.2	1	11.1	0	0.0	0	0.0
Constipation	4	44.4	0	0.0	0	0.0	0	0.0
Wheezing	0	0.0	0	0.0	1	11.1	0	0.0
Cough	5	55.6	1	11.1	0	0.0	0	0.0
Hand-foot skin reaction	1	11.1	0	0.0	0	0.0	0	0.0
Pruritus	0	0.0	0	0.0	0	0.0	0	0.0
Vasculitis	0	0.0	0	0.0	0	0.0	0	0.0
Limb edema	2	22.2	0	0.0	0	0.0	0	0.0

B, Paclitaxel + trastuzumab treatment

	Grade 1		Grade 2		Grade 3		Grade 4	
Adverse event	n	%	n	%	n	%	n	%
Anemia	2	40.0	3	60.0	0	0.0	0	0.0
Neutropenia	1	20.0	3	60.0	1	20.0	0	0.0
Elevated AST	3	60.0	0	0.0	0	0.0	0	0.0
Elevated ALT	0	0.0	3	60.0	0	0.0	0	0.0
Elevated T-bilirubin	0	0.0	0	0.0	0	0.0	0	0.0
Nausea	1	20.0	1	20.0	0	0.0	0	0.0
Fatigue	2	40.0	2	40.0	0	0.0	0	0.0
Myalgia	1	20.0	0	0.0	0	0.0	0	0.0
Headache	0	0.0	0	0.0	0	0.0	0	0.0
Lumbago	0	0.0	0	0.0	0	0.0	0	0.0
Joint pain	1	20.0	0	0.0	0	0.0	0	0.0
Leg pain	1	20.0	0	0.0	0	0.0	0	0.0
Insomnia	0	0.0	0	0.0	0	0.0	0	0.0
Peripheral neuropathy	4	80.0	0	0.0	0	0.0	0	0.0
Appetite loss	0	0.0	0	0.0	1	20.0	0	0.0
Dyspepsia	1	20.0	0	0.0	0	0.0	0	0.0

Table III. Continued.

	Grade 1		Grade 2		Grade 3		Grade 4	
Adverse event	n	%	n	%	n	%	n	%
Stomatitis	0	0.0	0	0.0	0	0.0	0	0.0
Dysgeusia	2	40.0	0	0.0	0	0.0	0	0.0
Diarrhea	3	60.0	0	0.0	0	0.0	0	0.0
Constipation	1	20.0	0	0.0	0	0.0	0	0.0
Wheezing	0	0.0	0	0.0	0	0.0	0	0.0
Cough	3	60.0	0	0.0	0	0.0	0	0.0
Hand-foot skin reaction	1	20.0	0	0.0	0	0.0	0	0.0
Pruritus	1	20.0	0	0.0	0	0.0	0	0.0
Vasculitis	1	20.0	0	0.0	0	0.0	0	0.0
Limb edema	0	0.0	0	0.0	0	0.0	0	0.0

ALT, alanine transaminase; AST, aspartate aminotransferase.

Hormone-dependent HER2-negative (ER- and/or PR-positive and HER2-negative), hormone-dependent HER2-positive (ER- and/or PR- and HER2-positive), HER2-positive (ER- and PR-negative and HER2-positive) or triple-negative (ER-, PR- and HER2-negative), according to pre-treatment IHC results. The pathological responses of the tumor and dissected lymph nodes were classified based on the evaluation criteria of the Japanese Breast Cancer Society (11), using the following 5-histological-grade scale: Grade 0, no response or hardly any changes in cancer cells following treatment; grade 1, marginal response; grade 1a, mild response recognised as mild cancer cell changes regardless of the site, or marked cancer cell changes in <1/3 of the total number of cancer cells; grade 1b, moderate response as shown by marked changes in ≥1/3 but <2/3 of the total number of cancer cells; grade 2, marked response or marked changes in ≥2/3 of the total number of cancer cells; and grade 3, lack of residual cancer cells, necrosis or disappearance of all cancer cells, or replacement of all cancer cells by granuloma-like and/or fibrous tissue. pCR was regarded as the total disappearance of infiltrates, including lymph node infiltrates, regardless of the presence of residual ductal carcinoma *in situ*. Near-pCR was defined as marked changes that approached a complete response but with a few remaining cancer cells (12). All other cases were classified as non-pCR.

Statistical analysis. All statistical analyses were performed using SPSS version 19.0 statistical software (SPSS Japan, Inc., Tokyo, Japan). The χ^2 test was used to examine differences between categorical data. $P<0.05$ was considered to indicate a statistically significant difference.

Results

The pathological response was evaluated using resected tissue following neoadjuvant chemotherapy. Of the tumors investigated, 21.4% of all cases (3/14) and 33.3% of triple-negative cases (3/9) exhibited a grade 1a histological response, and 7.1% of all cases (1/14) and 11.1% (1/9) of triple-negative cases exhibited a grade 1b response. Furthermore, 21.4% of all cases (3/14), 11.1% (1/9) of triple-negative cases and 40.0% (2/5) of HER2 cases exhibited a grade 2b response, and 50.0% of all cases, 44.4% of triple-negative cases and 60.0% of HER2 cases (7/14, 4/9 and 3/5, respectively) exhibited a grade 3 response. According to the grade of the local breast cancer, patients were classified into pathological responders [grades 2 and 3: 71.4% of all cases (10/14); 55.6% of triple-negative type cases (5/9); 100% of HER2 cases (5/5)] and non-responders [grade 1: 28.6% of all cases; 44.4% of triple-negative type cases (4/9]. A pCR was achieved in 50.0% of all cases (7/14); 44.4% of triple-negative type cases (4/9) and 60.0% of HER2 type cases (3/5). It was shown by χ^2 tests that the tumor size ($P=0.07$ in triple-negative type cases; $P=0.36$ in HER2 type cases) or stage ($P=0.19$ in triple-negative type cases; $P=0.36$ in HER2 type cases) did not affect the pathological response.

All 14 patients were evaluated for toxicity using the Common Terminology Criteria for Adverse Events version 4.0 (http://ctep.cancer.gov/protocolDevelopment/electronic_applications/ctc.htm#ctc_40). Hematological toxicity was reversible and manageable. Patients who received the FEC regimen reported grade 3 anemia (7.1%; 1/14) and grade 4 neutropenia (92.9%; 13/14) (Table II). The latter was treated with granulocyte colony-stimulating factors. No non-hematological toxicities were noted in grade 3 patients. Also, no treatment-related mortality was observed. In the paclitaxel and/or trastuzumab regimen, patients reported grade 3 anemia (7.1%; 1/14) and grade 3 neutropenia (14.3%; 2/14) (Table III). Grade 3/4 non-hematological toxicities included wheezing (7.1%; 1/14) and appetite loss (7.1%; 1/14). No treatment-related mortality was observed. Due to the mild nature of these toxicities, dose omission in FEC and paclitaxel and/or trastuzumab combination therapy was rare, and the study achieved favorable compliance.

Discussion

In the present study, patients with local breast cancer were classified into pathological responders [grades 2 and 3: 71.4% of all patients (10/14); 55.6% of triple-negative type (5/9);

100% of HER2 type (5/5)] depending on the grade of the tumor. A pCR was achieved in 50.0% of all cases (7/14); 44.4% of triple-negative-type cases (4/9) and 60.0% of HER2-type cases (3/5), which indicated that neoadjuvant FEC followed by weekly paclitaxel and/or trastuzumab administration induces a high pathological response and pCR rate in patients with hormone receptor-negative.

The breast conservation rate for patients with operable disease can be increased, even if the risk of local recurrence is slightly higher (13). An initially inoperable breast cancer can be converted into an operable or conservatively operable breast cancer, which is of crucial importance. Locoregional and systemic control are clinical problems in the treatment of locally advanced breast cancer. The risk of recurrence and mortality is high, particularly in patients who respond poorly to chemotherapy (13). pCR has been considered as a predictor of long-term outcome in a neoadjuvant trial (14), and this has been also been confirmed by two further studies (15,16). The meta-analysis conducted by the Collaborative Trials in Neoadjuvant Breast Cancer (15) included 12 randomized neoadjuvant trials (n=13,125); the findings showed that individual patients who achieved a pCR had a more favorable long-term prognosis. In this particular patient group, the improvement of overall and disease-free survival rates is a major goal.

Pre-operatively, weekly paclitaxel administration has been associated with significantly higher rates of pCR and breast conserving surgery in comparison to administering paclitaxel every 3 weeks (5). The NSABP B28 trial consisted of in 3,060 patients and compared treatments with doxorubicin and cyclophosphamide combined with or without 4 cycles of paclitaxel; no significant difference was found in the relative risk of recurrence and overall survival with regard to hormone receptor status (17). In the CALGB 9342 trial, which assessed three paclitaxel doses for metastatic breast cancer, no significant difference was observed in the time to treatment failure or response rate between triple-negative and hormone receptor-positive breast cancer; however, the overall survival time was found to be significantly lower in triple-negative breast cancer compared with hormone receptor-positive breast cancer (18).

Despite the increased proportion of patients achieving a pCR in response to neoadjuvant therapy, 40-80% of the patients, depending on the biological subtype of their tumor, do not achieve a pCR (16). It has been consistently demonstrated that pCR is a considerably effective predictor for the long-term benefit from neoadojuvant therapy, particularly for patients with triple-negative and HER2-positive breast cancer (16). As in the adjuvant setting, the absolute benefit from chemotherapy is smaller for hormone receptor-positive tumors, resulting in a lower pCR rate. Prediction of pCR can only be reliable if patients are treated adequately according to their true HER2 status. Patients with HER2 generally derive the largest benefit from anti-HER2 therapy, with a pCR rate of 46.8% (19). Within the HER2-positive study population, HR status has been shown to be a predictor for pCR following neoadjuvant therapy. Subgroup analysis of the data from the NeoALTTO (20) and NeoSphere (21) trials showed that the pCR rate-related benefit was higher in HR-negative patients compared with HR-positive patients, regardless of the anti-HER2 therapy administered (lapatinib, trastuzumab, or a combination of the two). The same effect was observed in the NSABP B-41 trial (22) in which even higher pCR rates were achieved using the combination of weekly paclitaxel administration and targeted therapy (lapatinib, trastuzumab, or a combination of the two) following standard doxorubicin plus cyclophosphamide treatment (21).

In conclusion, in the present study, the toxicity profile associated with FEC and weekly paclitaxel and/or trastuzumab administration was generally acceptable (Tables II and III). Recent clinical studies, including the present study, have demonstrated that neoadjuvant FEC followed by weekly paclitaxel and/or trastuzumab administration can induce a high pathological response and pCR rate in patients with hormone receptor-negative breast cancer. Due to its high clinical benefit rate and acceptable safety profile, this regimen is considered an acceptable neoadjuvant treatment option for hormone receptor-negative breast cancer.

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