Proceedings of Anticancer Research, 2024, Volume 8, Issue 6
http://ojs.bbwpublisher.com/index.php/PAR
ISSN Online: 2208-3553
ISSN Print: 2208-3545

Clinical Analysis of Trastuzumab-Targeted and Chemotherapy Treatment for Breast Cancer Patients

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Abstract: *Objective:* To explore the clinical effectiveness and safety of trastuzumab combined with chemotherapy in breast cancer patients. *Methods:* Eighty patients with postoperative local recurrence of breast cancer were divided into a control group (chemotherapy only) and an observation group (chemotherapy plus trastuzumab-targeted therapy). The clinical efficacy, adverse reactions, and complications were compared between groups. *Results:* The overall effective rate of clinical treatment in the observation group was higher than that in the control group ($P < 0.05$). The incidence of adverse reactions showed no difference between the groups ($P > 0.05$), while the complication rate was significantly lower in the observation group ($P < 0.05$). *Conclusion:* Trastuzumab-targeted therapy combined with chemotherapy can significantly improve clinical treatment outcomes for breast cancer patients, reduce the risk of complications, and maintain good safety, making it suitable for clinical promotion.

Keywords: Breast cancer; Trastuzumab; Targeted therapy; Chemotherapy; Clinical treatment efficacy

Online publication: November 27, 2024

1. Introduction

As one of the most common malignant tumors among women worldwide, breast cancer's incidence continues to rise annually, posing a severe threat to women's health. Statistics indicate that breast cancer has become a leading cause of cancer-related mortality in women, with high incidence and mortality rates raising serious health concerns. The etiology of breast cancer is complex and varied, closely related to factors such as genetics, environment, and lifestyle. Among these, poor lifestyle choices, including obesity, excessive alcohol consumption, and overnutrition, are recognized as significant risk factors [1]. Breast cancer presents with various clinical manifestations, with early symptoms often subtle and easily overlooked by patients, leading to delayed diagnosis and treatment. As the disease progresses, patients may experience a range of symptoms, such as breast

lumps, breast skin abnormalities (e.g., dimpling or peau d'orange changes), and nipple discharge (which may be bloody, serous, or watery). These symptoms not only severely impact physical health but also place substantial psychological and emotional pressure on patients, significantly affecting their quality of life [2].

Traditional breast cancer treatments primarily include surgery, chemotherapy, and radiotherapy. Although these traditional methods can extend patients' survival time to some extent, some patients still experience disease recurrence or metastasis, resulting in poor prognosis and unsatisfactory treatment outcomes. Improving treatment outcomes for breast cancer and seeking safer, more effective therapies have become goals for medical researchers. Targeted therapy involves the use of drugs that specifically act on molecular targets (such as genes or proteins) uniquely expressed in tumor cells. This precision enables the selective killing of tumor cells while minimizing damage to normal cells, thereby enhancing treatment efficacy and reducing toxicity. Trastuzumab (Herceptin), a humanized monoclonal antibody targeting the human epidermal growth factor receptor 2 (HER2), binds specifically to HER2 receptors on HER2-positive breast cancer cells, blocking downstream signaling pathways, thereby inhibiting tumor cell proliferation and inducing apoptosis. Numerous clinical studies indicate that trastuzumab combined with chemotherapy can significantly improve progression-free survival and overall survival in patients with HER2-positive breast cancer and has become a standard treatment for HER2-positive breast cancer [3]. This study aims to analyze the clinical therapeutic effects of trastuzumab-targeted therapy combined with chemotherapy for breast cancer, providing a scientific basis for clinicians to formulate individualized treatment plans and contribute to improved survival rates and quality of life for breast cancer patients.

2. Materials and methods

2.1. General information

A total of 80 cases of patients with postoperative local recurrence of breast cancer, treated in our hospital from July 2022 to January 2024, were selected. Inclusion criteria included: (1) pathologically confirmed breast cancer; (2) HER2-positive status (immunohistochemistry [IHC] 3+ or fluorescence *in situ* hybridization [FISH] positive); (3) previous radical mastectomy with postoperative local recurrence; (4) Karnofsky performance score ≥ 70; (5) expected survival of ≥ 3 months, with informed consent signed. Exclusion criteria included: (1) presence of other malignancies; (2) severe cardiac, liver, or renal insufficiency; (3) allergy to trastuzumab or other chemotherapeutic drugs; (4) participation in other clinical trials. All patients were randomly divided into a control group and an observation group, with 40 cases in each. There was no statistically significant difference in age, tumor stage, or pathological type between the two groups ($P > 0.05$), making them comparable.

2.2. Methods

(1) Control group: The control group received a standard chemotherapy regimen, consisting of carboplatin injection at a dose of AUC = 6, mixed with 250 mL of 5% glucose solution, administered as an intravenous drip on day 1 of each 21-day cycle. Docetaxel at 75 mg/m² was mixed with 250 mL of saline and administered as a one-hour intravenous infusion, repeated every three weeks.

(2) Observation group: The observation group received trastuzumab-targeted therapy in addition to the control group regimen. The initial dose of trastuzumab was 8 mg/kg, administered as an intravenous infusion over 90 minutes in the first cycle. If the patient tolerated the infusion, subsequent cycles could

be completed within 30 minutes. Trastuzumab was repeated every three weeks until disease progression or the occurrence of intolerable toxic side effects.

Both groups received standard adjuvant treatments, including postoperative radiotherapy and endocrine therapy as appropriate.

2.3. Observation indicators

2.3.1. Clinical treatment efficacy

The World Health Organization (WHO) criteria for evaluating the efficacy of solid tumors was used, which includes the following four primary indicators:

(1) Complete Response (CR): all measurable lesions disappear following treatment, with no new lesions appearing for a specified period (usually at least four weeks), indicating a significant treatment effect.

(2) Partial Response (PR): the size of measurable lesions decreases by at least 30% after treatment, with no new lesions appearing during a specific observation period. This indicates a positive effect, though not complete control.

(3) Stable Disease (SD): the tumor lesions remain relatively unchanged in size post-treatment, indicating stability in the disease during the treatment period.

(4) Progressive Disease (PD): tumor lesions increase in size, or new lesions appear, indicating that the treatment has not effectively controlled the disease and a treatment change may be necessary.

Overall response rate = Complete Response rate + Partial Response rate + Stable Disease rate [4].

2.3.2. Adverse reactions

Adverse reactions occurring during treatment were recorded, including fever, rash, nausea, vomiting, and liver function impairment.

2.3.3. Complications

Complications occurring during treatment were recorded, including cardiotoxicity, bone marrow suppression, and anemia.

2.4. Statistical analysis

SPSS version 25.0 was used for statistical analysis. Categorical data were presented as [*n* (%)], and clinical indicators between the two groups were compared using the χ^2 test. Bonferroni correction was applied to prevent false positives in multiple comparisons. All tests were two-sided, with $P < 0.05$ indicating statistical significance.

3. Results

3.1. Comparison of clinical treatment efficacy between the two groups

The overall clinical treatment efficacy rate in the observation group was significantly higher than that in the control group ($P = 0.004$). See **Table 1** and **Figure 1**.

Table 1. Comparison of clinical treatment efficacy between the two groups [*n* (%)]

Group	CR	PR	SD	PD	Overall efficacy rate
Control (*n* = 40)	10 (25.00%)	10 (25.00%)	5 (12.50%)	15 (37.50%)	25 (72.50%)
Observation (*n* = 40)	18 (45.00%)	16 (40.00%)	2 (5.00%)	4 (10.00%)	36 (90.00%)
χ^2 value	-	-	-	-	8.352
P value	-	-	-	-	0.004

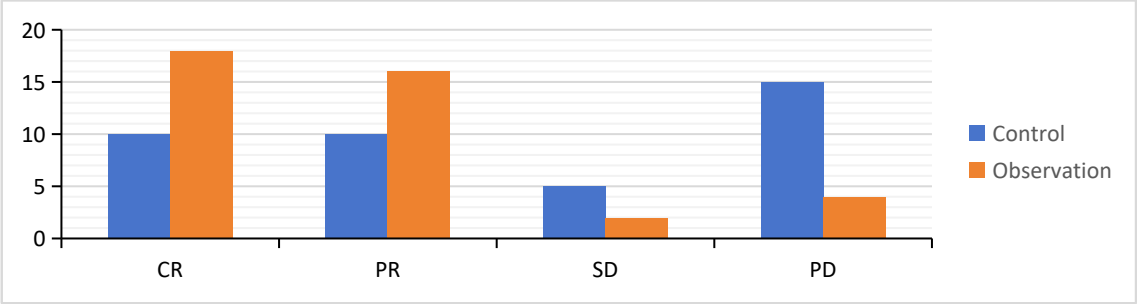

Figure 1. Bar chart of clinical treatment efficacy in the two groups

3.2. Comparison of adverse reaction rates between the two groups

The incidence of adverse reactions during treatment did not differ significantly between the observation group and the control group ($P = 0.239$). See **Table 2** and **Figure 2**.

Table 2. Comparison of adverse reaction rates between the two groups [*n* (%)]

Group	Fever	Nausea and vomiting	Rash	Liver function impairment	Overall adverse reaction rate
Control (*n* = 40)	3 (7.50%)	2 (5.00%)	2 (5.00%)	2 (5.00%)	9 (22.50%)
Observation (*n* = 40)	1 (2.50%)	2 (5.00%)	2 (5.00%)	0 (0.00%)	5 (12.50%)
χ^2 value	-	-	-	-	1.385
P value	-	-	-	-	0.239

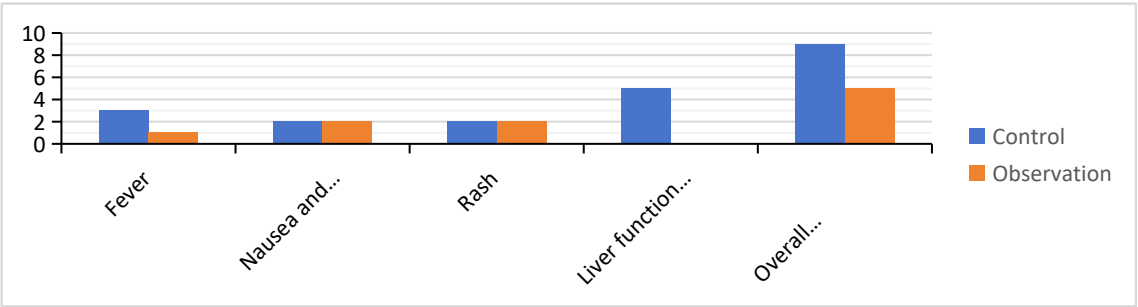

Figure 2. Bar chart of adverse reactions in the two groups

3.3. Comparison of complication rates between the two groups

The complication rate during treatment in the observation group was significantly lower than in the control group ($P = 0.021$). See **Table 3** and **Figure 3**.

Table 3. Comparison of complication rates between the two groups [*n* (%)]

Group	Cardiotoxicity	Bone marrow suppression	Anemia	Complication
Control (*n* = 40)	8 (20.00%)	5 (12.50%)	7 (17.50%)	20 (50.00%)
Observation (*n* = 40)	3 (7.50%)	3 (7.50%)	4 (10.00%)	10 (25.00%)
χ^2 value	-	-	-	5.333
P value	-	-	-	0.021

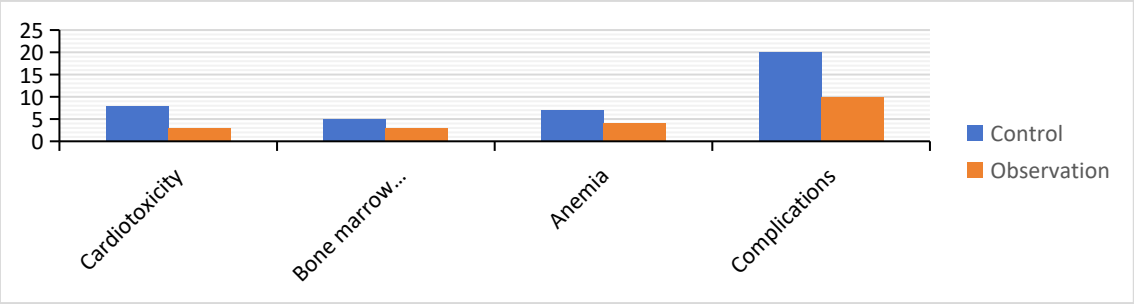

Figure 3. Bar chart of complications in the two groups

4. Discussion

Breast cancer is a malignant tumor that severely impacts women's health, with its incidence increasing with age and peaking between 40 and 50 years old [5]. Breast cancer not only causes significant physical harm to patients but also negatively affects their mental health and quality of life [6]. Chemotherapy remains an important treatment option, with commonly used drugs including carboplatin and docetaxel, which effectively inhibit tumor cell proliferation and spread [7,8]. Carboplatin, a cell cycle-nonspecific anti-cancer drug, works by disrupting the DNA structure of tumor cells, thereby inhibiting their proliferation and division. Docetaxel, a microtubule inhibitor, prevents tumor cells from undergoing mitosis, thus obstructing their growth and spread. Combining these chemotherapy drugs can produce a synergistic effect, enhancing treatment efficacy, though it may also involve certain side effects. With advancements in tumor immunology, targeted therapy has emerged as a new trend in breast cancer treatment, with trastuzumab being a targeted drug specifically for HER2-positive breast cancer. By activating the patient's immune system to kill tumor cells, trastuzumab significantly improves clinical outcomes [9]. As a monoclonal antibody, trastuzumab specifically binds to the HER2 receptor, blocking growth signaling pathways in tumor cells and activating the immune system to destroy these cells. Compared with traditional chemotherapy drugs, trastuzumab offers better targeting and lower toxicity, thereby improving patients' survival and quality of life. However, both chemotherapy and targeted therapies have their limitations and side effects. The nonspecific effects of chemotherapy drugs can harm normal cells, leading to side effects such as nausea, vomiting, and hair loss. Although targeted therapies have relatively fewer side effects, they may still cause reactions like rash or diarrhea, and some patients may develop drug resistance, impacting treatment efficacy. Therefore, safer and more effective treatment methods are urgently needed in future breast cancer treatment.

The results of this study show that the overall clinical treatment efficacy rate in the observation group was significantly higher than in the control group, suggesting that trastuzumab combined with chemotherapy can substantially improve clinical outcomes in breast cancer patients. This finding offers new ideas and directions

for breast cancer treatment, potentially due to the following factors:

(1) Trastuzumab specifically binds to HER2-positive breast cancer cells, blocking the HER2 signaling pathway, thereby inhibiting tumor cell proliferation and inducing apoptosis. HER2 (human epidermal growth factor receptor 2) is overexpressed in certain breast cancer cells and is closely related to tumor growth and metastasis. Thus, targeting this pathway can effectively inhibit tumor development.

(2) There is a synergistic effect between trastuzumab and chemotherapy drugs, which significantly enhances the efficacy of chemotherapy. During chemotherapy, trastuzumab can increase cancer cells' sensitivity to chemotherapy drugs, thereby improving the overall treatment outcome. Additionally, trastuzumab can enhance the immune function of the body, increasing its ability to attack tumor cells. This immune activation not only helps the body recognize and eliminate cancer cells more effectively but also helps prevent cancer recurrence and metastasis to a certain extent.

This study also shows that the incidence of adverse reactions in the observation group receiving trastuzumab treatment was not significantly different from the control group, indicating good safety. Meanwhile, the complication rate in the observation group was significantly lower than in the control group, suggesting that trastuzumab effectively reduces the risk of complications. This could be related to its effectiveness in controlling tumor progression, as effective tumor control may reduce complications associated with spread or metastasis, thereby improving overall prognosis and enhancing the immune system's ability to resist complications such as infections.

Future research directions could explore the combined application of targeted therapy with other emerging treatments, such as combining with immunotherapy to activate the patient's immune system through immune checkpoint inhibitors, working in synergy with trastuzumab to enhance tumor cell destruction. Additionally, gene therapy and other advanced techniques could be considered to precisely target specific gene defects in tumor cells. For individualized treatment strategies, research could further investigate the genetic characteristics and biological features of tumors in different patients to develop more precise treatment plans. By predicting patients' sensitivity and resistance to drugs, the most suitable treatment combinations can be selected to improve efficacy and reduce adverse reactions. This would bring more hope to breast cancer patients and promote breast cancer treatment toward a more precise and effective approach.

5. Conclusion

In conclusion, trastuzumab combined with chemotherapy in breast cancer patients has demonstrated significant clinical efficacy and good safety. This not only provides an effective treatment option for breast cancer but also opens up new avenues for further clinical research. Future research may delve into the responses of different patient populations to trastuzumab and explore how this treatment strategy can be better applied in clinical practice to achieve personalized treatment, improve efficacy, and reduce the incidence of adverse reactions and complications.

Funding

Yunnan Provincial Department of Education Scientific Research Fund Project "Research on the Construction of Antibody-Drug Conjugate MMAF-Trastuzumab and Its Biological Function in Inhibiting Breast Cancer" (Project No. 2024J0227)

Disclosure statement

The author declares no conflict of interest.

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