Am J Cancer Res 2025;15(3):991-1001
www.ajcr.us /ISSN:2156-6976/ajcr0160623

*Original Article*

# Effects of warming needle moxibustion on postoperative rehabilitation, pain degree, immune function, and upper limb lymphedema in patients with breast cancer undergoing radical mastectomy

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Received September 19, 2024; Accepted January 24, 2025; Epub March 15, 2025; Published March 30, 2025

**Abstract:** This study aims to evaluate the effects of warm acupuncture combined with conventional functional rehabilitation training (FRT) on the recovery of breast cancer (BC) patients following radical mastectomy, focusing on immune function, pain management, and quality of life (QoL). This retrospective study involved 118 BC patients who underwent radical surgery at the Second People's Hospital Affiliated to Fujian University of Chinese Medicine between January 2022 and May 2024. The included patient were assigned into an experimental group (EG, n=62, warm acupuncture in conjunction with conventional FRT) and a control group (CG; n=56; conventional FRT only). Postoperative outcomes, including surgery duration, intraoperative blood loss (IOBL), drainage volume (DV), length of hospital stay, upper limb mobility, immune function indicators, and pain scores, were compared between the two groups. Multivariate logistic regression was employed to identify factors affecting treatment outcomes. The EG demonstrated significantly lower visual analog scale (VAS) scores at post-operative 2, 4, and 8 weeks compared to the CG (all $P < 0.05$). The incidence of upper limb lymphedema in the EG was 9.26%, notably lower than the 24.07% observed in the CG ($P < 0.05$). Immune function indicators, including $CD3^+$, $CD4^+$, $CD8^+$, and the $CD4^+/CD8^+$ ratio, were significantly higher in the EG postoperatively ($P < 0.05$). Furthermore, the EG reported significantly improved scores in role physical, general health, vitality, social functioning, role emotional, mental health, and physiological functioning, alongside significantly lower scores in bodily pain compared to the CG (all $P < 0.05$). Multivariate logistic regression analysis revealed $CD3^+$ and $CD4^+/CD8^+$ ratio as independent factors affecting patient treatment efficacy (both $P < 0.05$). In conclusion, the combination of warm acupuncture and conventional FRT significantly enhances immune function, pain management, and overall QoL in BC patients after surgery, with $CD3^+$ and $CD4^+/CD8^+$ ratios being crucial factors influencing recovery.

**Keywords:** Functional rehabilitation training, warming needle moxibustion, radical mastectomy, upper limb lymphedema, immune function

## Introduction

Breast cancer (BC) is the most common malignant tumor in women worldwide, with its incidence increasing notably in many countries. According to the statistics of the World Health Organization, BC has become one of the major health threats to women, especially in developed countries [1-3]. Its pathogenesis is complex and influenced by genetic factors, hormone levels, lifestyle, and environmental factors. The development of BC usually originates from the mammary duct or lobules [4]. In its early stage, BC often presents no obvious symptoms, making early diagnosis critical. As the tumor progresses, patients may experience symptoms such as breast lumps, nipple discharge, ang skin changes, which promote seeking for treatment [5]. Early detection and treatment of BC can significantly improve both the survival rate and quality of life (QoL) of patients. Survival rates are closely related to the stage at which the cancer is detected. When diagnosed early, patients can have a long survival time,

https://doi.org/10.62347/YXHG6188

and with standardized comprehensive treatment and regular follow-up, some may survive for many years [6, 7]. However, if distant metastases have occurred, survival will be affected to varying degrees. Nevertheless, active and standardized treatment can still prolong the survival time and improve the QoL [8].

Warm acupuncture is a traditional Chinese medicine technique that combines acupuncture with moxibustion. This method involves heating the acupuncture points with dried mugwort to promote local blood circulation, reduce inflammation, and enhance immune function. It not only alleviates postoperative pain but also supports overall physical recovery [9-11]. In the treatment of BC, a comprehensive postoperative rehabilitation strategy is particularly important, addressing multiple facets [12, 13]. Surgical intervention remains the primary approach for BC treatment, typically involving tumor resection and lymphadenectomy. Zhang et al. [14] evaluated postoperative upper limb lymphedema (ULL) in 2,597 female BC patients and found that the of postoperative ULL occurrence correlated with T stage of BC, lymph node metastasis, etc. Lymph node metastasis and Ki-67 expression were identified as independent factors affecting the pathological complete response rate to neoadjuvant chemotherapy. Chemotherapy and radiotherapy are commonly employed to control the cancer cell spread and reduce recurrence risk. While effective, these treatments often come with side effects, such as fatigue, decreased immunity, and diminished QoL. Therefore, patients require an active rehabilitation plan post-surgery, including physical therapy and psychological support to address both physical and emotional challenges. Additionally, nutritional support plays a crucial role, as a balanced diet can enhance immune function and promote wound healing. Psychological counseling and social support can alleviate anxiety and depression, thereby improving QoL [15]. Integrating warm acupuncture conventional treatments may provide additional benefits for BC patients, particularly in enhancing immune response, alleviating pain, improving physical function, and enhancing overall QoL. By combining multiple therapeutic modalities, patients can receive better support during the postoperative recovery period. However, the precise clinical effects and underlying mechanisms of this combined treatment approach require further scientific investigation and clinical validation [16].

This study aims to explore the potential impact of warming needle moxibustion on the rehabilitation, pain degree, immune function, and upper limb lymphadenoma in patients after radical mastectomy. Through systematic clinical observation and scientific analysis, the study seeks to provide new ideas and methods for the comprehensive treatment of BC after radical mastectomy, offering a theoretical basis and clinical practice guidance for improving rehabilitation and QoL in patients.

## Materials and methods

### *Subjects*

A total of 118 BC patients who underwent radical surgery at The Second People's Hospital Affiliated to Fujian University of Chinese Medicine between January 2022 and May 2024 were retrospectively included in this study. Based on the type of intervention, the patients were divided into two groups: the experimental group (EG) that received conventional functional rehabilitation training (FRT) combined with warm acupuncture treatment (n=62), and the control group (CG) that received only conventional FRT (n=56). This study was approved by the Ethics Committee of The Second People's Hospital Affiliated to Fujian University of Chinese Medicine.

Inclusion criteria: (1) Complete surgical records and preoperative examination data; (2) BC confirmed by pathological examination; (3) Age over 20 years; (4) Patients without intellectual disabilities and can communicate normally.

Exclusion criteria: (1) Contraindications for surgery; (2) Pregnant women; (3) Distant metastasis of the lesion; (4) Significant organ dysfunctions such as heart, liver, or kidney; (5) Severe skin damage at the acupuncture site.

### *Warm acupuncture treatment method*

First, the treatment room was ensured to be warm, clean, and comfortable, with sterile, disposable acupuncture needles prepared. The patient was instructed to adopt a comfortable position, and the selected acupuncture points, including Jianyu, Waiguan, Quchi, and Zusanli,

were disinfected with 75% alcohol. The acupuncture needles were inserted vertically or at an angle into the selected points, with a typical insertion depth of 1 cun, adjusted based on the acupuncture point and the patient's constitution. A lit moxa stick was placed on the handle of the inserted needle, maintaining a distance of 3-5 cm from the skin to provide warmth without causing burns. Moxibustion was applied for 20 minutes per session. During the moxibustion, the height and angle of the moxa stick were periodically adjusted to ensure even warmth. After the treatment, the moxa stick and then the acupuncture needle were carefully removed. A clean cotton ball or gauze was used to gently apply pressure to the insertion site to prevent bleeding. The patient was advised to keep the needle site clean to avoid infection. The treatment was conducted twice a week, with each session lasting 20 minutes, for a total course of 6 weeks.

*Data collection*

Data on various pre- and post-operative indicators of patients were collected through the hospital's electronic medical record system (EMR), including structured data (such as tables) and unstructured data (such as clinical notes). The data were stored and analyzed using standardized Excel formats.

Primary outcome measures included: (1) Visual analogue scale (VAS); (2) ULL condition (mild, moderate, severe); (3) Serum immune function markers: $CD3^+$, $CD4^+$, $CD8^+$, and $CD4^+/CD8^+$ ratio; (4) Clinical efficacy: complete response (CR): all measurable tumor lesions have disappeared; partial response (PR): measurable tumor lesions have decreased in size by at least 50%; stable disease (SD): measurable tumor lesions that do not meet the criteria for CR or PR and show no significant progression; progressive disease (PD): measurable tumor lesions have increased in size by at least 20% or new lesions have appeared. Based on these definitions, the objective response rate (ORR) and disease control rate (DCR) were calculated to assess treatment efficacy.

Secondary outcome measures included: (1) Baseline data: age, lesion diameter, menopausal status, pathological type, etc.; (2) Perioperative monitoring indicators: surgery time, intraoperative blood loss (IOBL), number of lymph nodes removed, postoperative drainage volume (DV), bed rest time, hospital stay, and medical expenses; (3) The MOS 36-Item Short Form Health Survey (SF-36) score.

*Statistical processing*

Statistical analysis was performed using SPSS 22.0. For normally distributed measurement data, results were expressed as mean ± sd ($\bar{x} \pm s$). Categorical data were expressed as frequencies and percentages (%). The Mann-Whitney U test was used for non-normally distributed data, while one-way ANOVA was applied to normally distributed data. The chi-square test was adopted for comparing categorical data. Pearson correlation analysis was conducted to assess the correlation between patient treatment outcomes and factors such as age, lesion diameter, menopausal status, pathological type, pre-treatment immune function cell counts ($CD3^+$, $CD4^+$, $CD8^+$, and $CD4^+/CD8^+$), and VAS scores. Multivariate logistic regression analysis was performed to identify factors affecting patient treatment efficacy. Statistical significance was set at $P < 0.05$.

## Results

*Comparison of baseline characteristics between the two groups*

The EG had a mean age of 47.98 ± 8.12 years, with a mean lesion diameter of 1.91 ± 0.34 cm. This group included 28 postmenopausal and 34 premenopausal women, with 30 cases of invasive ductal carcinoma, 27 cases of invasive lobular carcinoma, and 5 cases of ductal carcinoma in situ. The CG had a mean age of 46.77 ± 5.82 years and a mean lesion diameter of 1.95 ± 0.38 cm. This group comprised 26 postmenopausal and 30 premenopausal women, with 26 cases of invasive ductal carcinoma, 25 cases of invasive lobular carcinoma, and 5 cases of ductal carcinoma in situ. There were no significant differences between the two groups in terms of age, lesion diameter, menopausal status, or pathological type (all $P > 0.05$).

*Comparison of perioperative indicators between the two groups*

As shown in **Figure 1**, the surgical duration in EG was 93.08 ± 14.75 minutes, with IOBL of

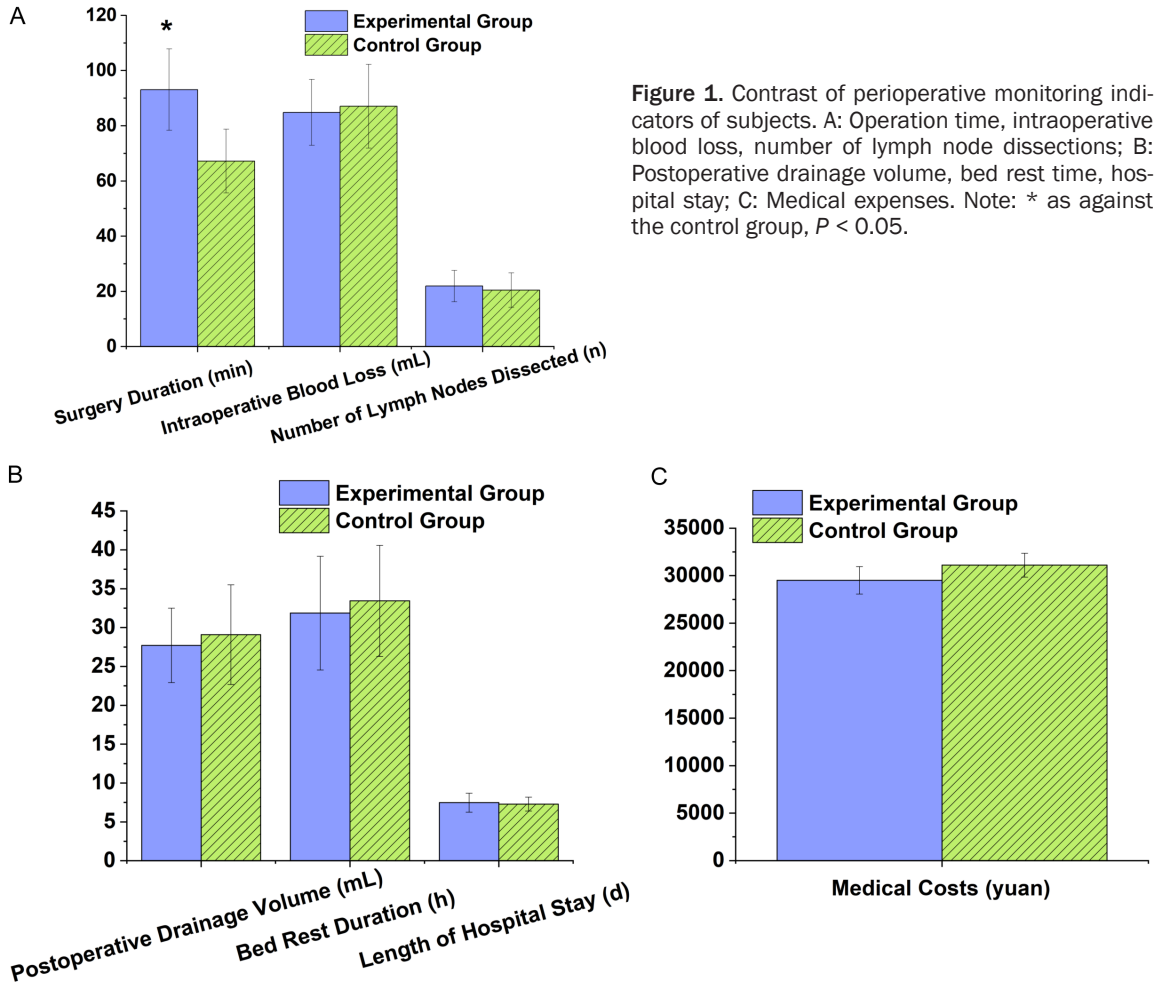


**Figure 1.** Contrast of perioperative monitoring indicators of subjects. A: Operation time, intraoperative blood loss, number of lymph node dissections; B: Postoperative drainage volume, bed rest time, hospital stay; C: Medical expenses. Note: * as against the control group, $P < 0.05$.

84.85 ± 11.95 ml, an average of 21.92 ± 5.72 lymph nodes excised, postoperative DV of 27.71 ± 4.79 ml, a bed rest duration of 31.86 ± 7.32 hours, a hospital stay of 7.47 ± 1.22 days, and medical expenses amounting to 29,510.48 ± 1,445.85 yuan. In comparison, the CG had a surgical duration of 67.22 ± 11.52 min, IOBL of 87.06 ± 15.18 ml, an average of 20.48 ± 6.21 lymph nodes excised, postoperative DV of 29.08 ± 6.41 ml, a bed rest duration of 33.44 ± 7.15 hours, a hospital stay of 7.29 ± 0.89 days, and medical expenses totaling 31,106.67 ± 1,265.04 yuan. In summary, the surgical duration in EG was significantly longer than that in CG ($P < 0.05$), while no significant differences were observed between the two groups regarding IOBL, number of lymph nodes excised, medical expenses, postoperative DV, bed rest duration, and length of hospital stay (all $P > 0.05$).

*Comparison of postoperative pain scores between the two groups*

As shown in **Figure 2**, the EG reported pain scores of 5.51 ± 1.33 at postoperative 2 weeks, 4.37 ± 0.92 at 4 weeks, and 1.71 ± 0.35 at 8 weeks. In contrast, the CG reported pain scores of 7.09 ± 1.16 at postoperative 2 weeks, 5.88 ± 1.11 at 4 weeks, and 3.94 ± 0.62 at 8 weeks. The VAS scores at 2, 4, 8 weeks following operation were significantly lower in the EG compared to the CG (all $P < 0.05$).

*Comparison of the incidence of ULL between the two groups*

**Figure 3** illustrates that, in the EG, there were 5 cases of mild lymphedema, 0 case of moderate lymphedema, and 0 case of severe lymphedema in the upper limb following operation. In the CG, 11 cases of mild lymphedema, 2 cases

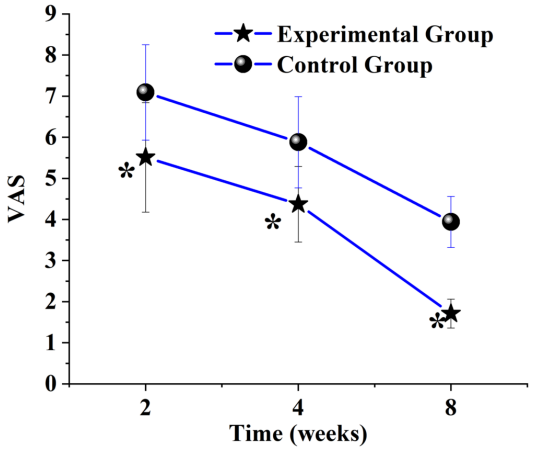


**Figure 2.** Contrast of postoperative pain scores of subjects. Note: * as against the control group, $P < 0.05$; VAS: Visual Analog Scale.

of moderate lymphedema, and 0 case of severe lymphedema were observed. The incidence of significant upper limb lymph edema was markedly lower in the EG (8.06%) compared to the CG (23.21%) ($P < 0.05$).

*Comparison of postoperative upper limb motor function between the two groups*

**Figure 4** illustrates the upper limb mobility results for both groups. In the EG, preoperative flexion was 159.98° ± 5.78°, and postoperative flexion was 120.33° ± 6.27°; preoperative extension was 60.45° ± 3.78°, and postoperative extension was 56.87° ± 5.83°; preoperative abduction was 180.95° ± 9.33°, and postoperative abduction was 117.92° ± 7.64°. In the CG, preoperative flexion was 166.05° ± 11.15°, and postoperative flexion was 90.58° ± 8.32°; preoperative extension was 62.88° ± 6.04°, and postoperative extension was 58.06° ± 5.47°; preoperative abduction was 175.74° ± 8.45°, and postoperative abduction was 86.43° ± 8.02°. No significant differences were observed in the preoperative flexion, extension, and abduction range of motion between the EG and the CG (all $P > 0.05$). Postoperatively, both groups exhibited a noticeable decrease in the range of motion for upper limb flexion and abduction compared to preoperative levels. However, the EG demonstrated a significantly greater range of motion for upper limb flexion and abduction than the CG (all $P < 0.05$).

*Comparison of immune function indexes between the two groups before and after operation*

As shown in **Figure 5**, in the EG, the preoperative $CD3^+$ level was 54.88% ± 6.72%, decreasing to 52.75% ± 4.63% postoperatively; the preoperative $CD4^+$ level was 38.15% ± 4.78%, decreasing to 34.46% ± 6.11% postoperatively; the preoperative $CD8^+$ level was 28.05% ± 5.31%, decreasing to 26.31% ± 5.05% postoperatively; and the $CD4^+/CD8^+$ ratio was 1.36 ± 0.07 preoperatively and 1.31 ± 0.09 postoperatively. In contrast, the CG exhibited a preoperative $CD3^+$ level of 55.57% ± 4.11%, which decreased to 44.06% ± 5.82% postoperatively; the preoperative $CD4^+$ level was 37.22% ± 6.14%, reducing to 25.25% ± 6.02% postoperatively; the preoperative $CD8^+$ level was 26.78% ± 3.75%, decreasing to 23.38% ± 4.12% postoperatively; and the $CD4^+/CD8^+$ ratio was 1.39 ± 0.15 preoperatively and 1.08 ± 0.12 postoperatively. While no significant difference was observed between the two groups in preoperative immune function indicators ($CD3^+$, $CD4^+$, $CD8^+$, $CD4^+/CD8^+$ ratio) (all $P > 0.05$), their postoperative levels were significantly higher in the EG compared to the CG (*all $P < 0.05$*).

*Comparison of postoperative QoL scores between the two groups*

**Figure 6** shows the postoperative QoL scores for both groups. In the EG, role physical score was 60.15 ± 7.33, bodily pain score was 28.14 ± 4.35, overall health was 64.08 ± 5.93, vitality was 60.07 ± 5.11, social functioning was 74.78 ± 8.52, role emotional was 59.11 ± 8.16, mental health was 68.54 ± 7.08, and physiological functioning was 73.75 ± 7.14. In the CG, role physical score was 42.38 ± 5.09, bodily pain score was 46.07 ± 4.28, overall health was 48.11 ± 5.24, vitality was 35.74 ± 3.98, social functioning was 44.73 ± 5.09, role emotional was 40.47 ± 6.34, mental health was 40.97 ± 5.84, and physiological functioning was 51.69 ± 6.03. The EG exhibited significantly higher scores in role physical, overall health, vitality, social functioning, role emotional, mental health, and physiological functioning but significantly lower score in bodily pain compared to the CG (all $P < 0.05$).

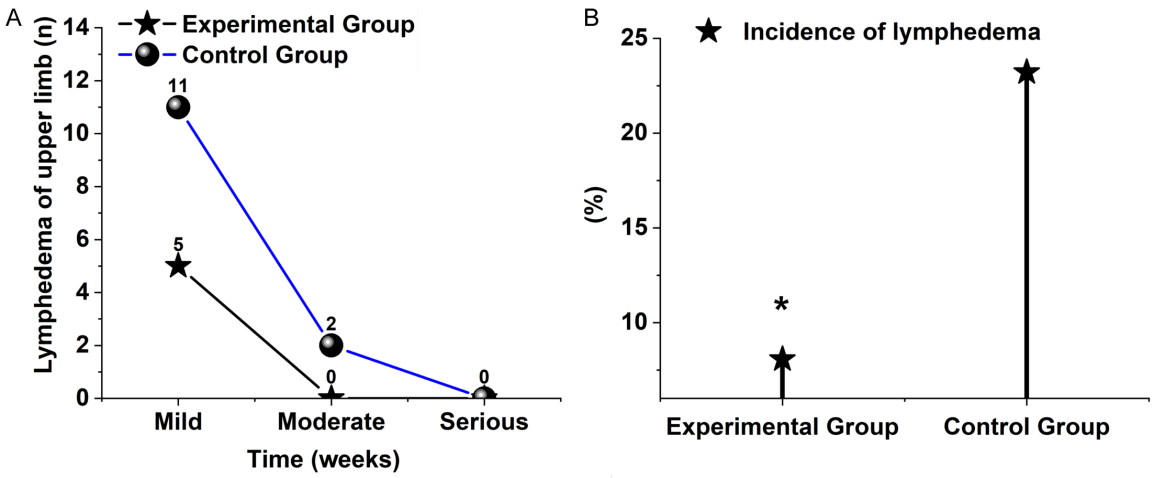


**Figure 3.** Contrast of the incidence of upper limb lymphedema among subjects. A: Number of cases of mild, moderate, and severe lymphedema; B: Incidence of upper limb lymphedema. Note: * as against the control group, $P < 0.05$.

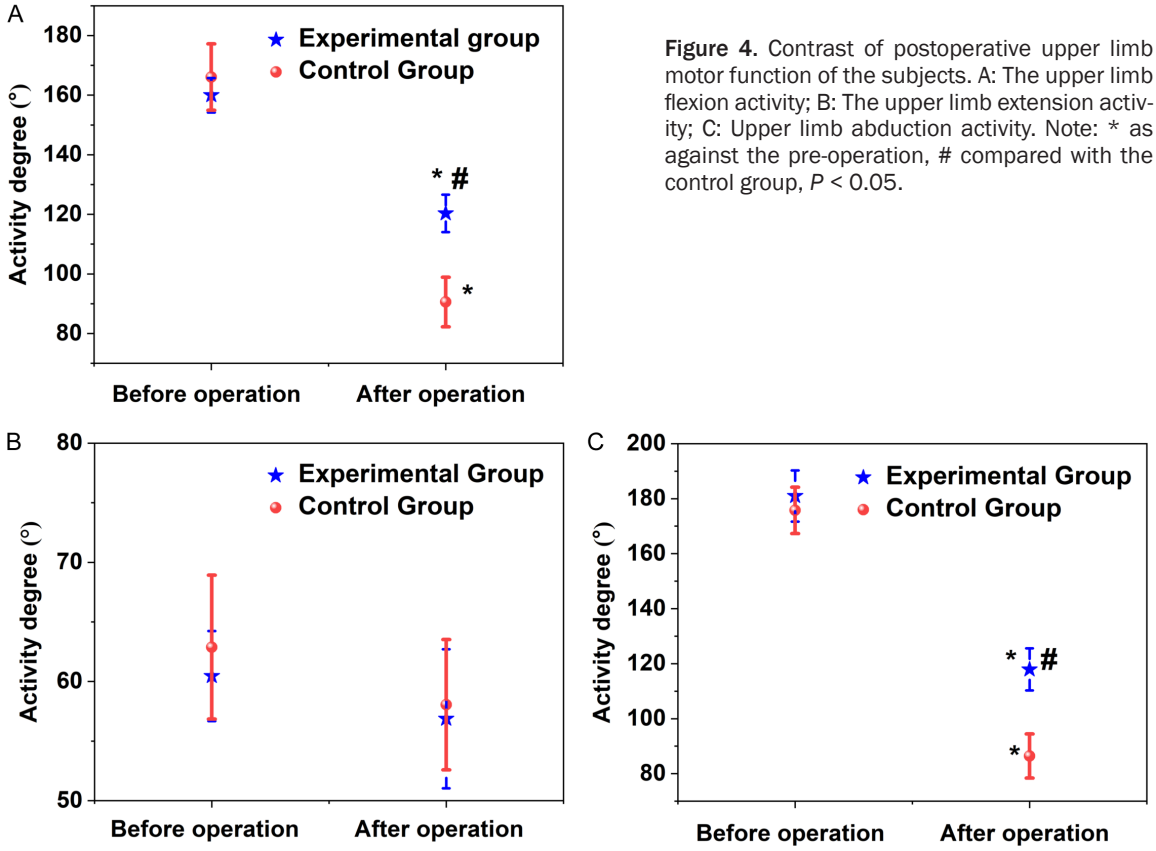


**Figure 4.** Contrast of postoperative upper limb motor function of the subjects. A: The upper limb flexion activity; B: The upper limb extension activity; C: Upper limb abduction activity. Note: * as against the pre-operation, # compared with the control group, $P < 0.05$.

*Comparison of clinical efficacy between the two groups*

As shown in **Figure 7**, in the EG, 4 cases achieved CR, 28 cases achieved PR, 15 cases had SD, and 15 cases had PD, with an ORR of 51.61% and a DCR of 75.81%. In the CG, there were 1 case of CR, 20 cases of PR, 11 cases of SD, 24 cases of PD, with an ORR of 37.5% and a DCR of 57.14%. The ORR and DCR of the EG were significantly higher than those of the CG (*all $P < 0.05$*).

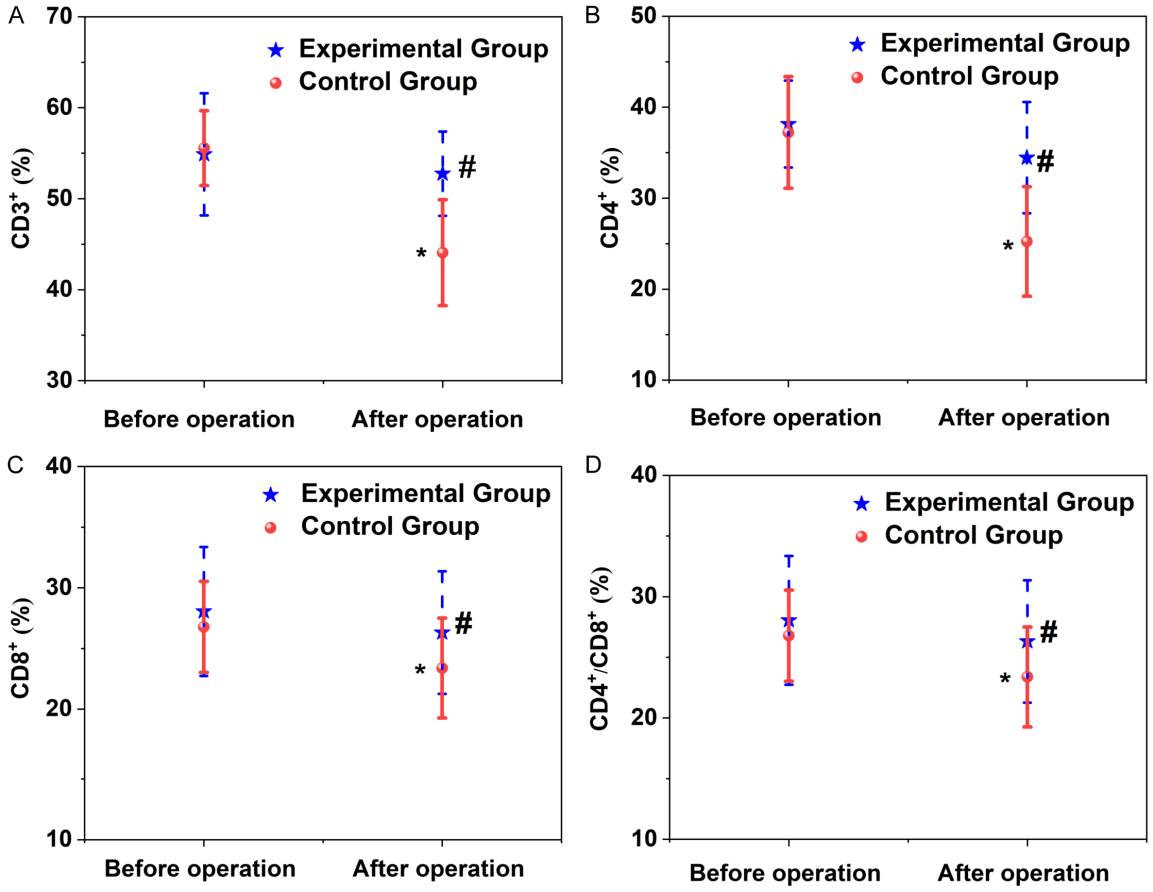


**Figure 5.** Contrast of immune function indexes of subjects. A: $CD3^+$; B: $CD4^+$; C: $CD8^+$; D: $CD4^+/CD8^+$. Note: * as against the pre-operation, # compared with the control group, $P < 0.05$; $CD3^+$: Cluster of Differentiation 3 Positive; $CD4^+$: Cluster of Differentiation 4 Positive; $CD8^+$: Cluster of Differentiation 8 Positive.

*Analysis of factors affecting patient treatment efficacy*

Patients with CR, PR, and SD were categorized as effective, while those with PD were categorized as ineffective. Pearson correlation analysis was performed to assess the correlation between patient treatment outcomes and factors such as age, lesion diameter, menopausal status, pathological type, pre-treatment immune function cell counts ($CD3^+$, $CD4^+$, $CD8^+$, and $CD4^+/CD8^+$), and VAS scores (**Table 1**). The analysis revealed that treatment effectiveness was negatively correlated with the patient age and lesion diameter (*all* $P < 0.05$), and positively correlated with $CD3^+$, $CD4^+$, $CD8^+$, and $CD4^+/CD8^+$ ratio (*all* $P < 0.05$). No significant correlation was found with menopausal status, pathological type, or VAS scores (*all* $P > 0.05$).

Building on these findings, a multivariate Logistic regression analysis was conducted using age, lesion diameter, $CD3^+$, $CD4^+$, $CD8^+$, and $CD4^+/CD8^+$ as independent variables and treatment effectiveness as the dependent variable. The results (**Table 2**) indicated that age, lesion diameter, $CD4^+$, and $CD8^+$ had no significant impact on treatment outcomes (*all* $P > 0.05$), whereas $CD3^+$ and $CD4^+/CD8^+$ had a statistically significant impact (*all* $P < 0.05$).

## Discussion

Postoperative rehabilitation for BC is crucial, as it significantly impacts the overall health and QoL of patients. A comprehensive approach that addresses the physical, psychological, nutritional, and other needs of the patient is essential for optimal recovery [17, 18]. Warm acupuncture, a traditional Chinese medicine technique, aims to balance qi, blood, and yin-yang through targeted stimulation. Its application in postoperative recovery following radical mastectomy may help alleviate symptoms such

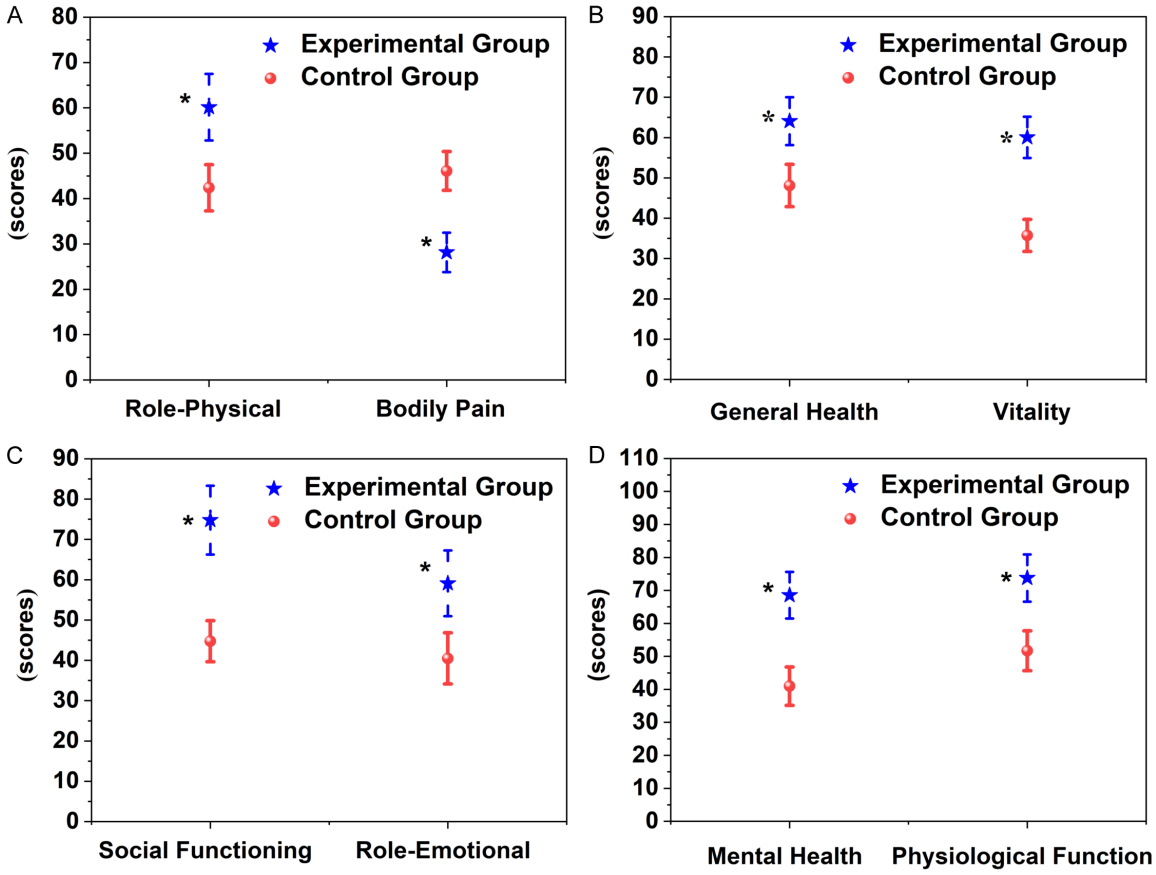


**Figure 6.** Contrast of postoperative quality of life scores of patients. A: Role-physical, bodily pain; B: General health, vitality; C: Social functioning, role-emotional; D: Mental health, and physiological function. Note: * as against the control group, $P < 0.05$.

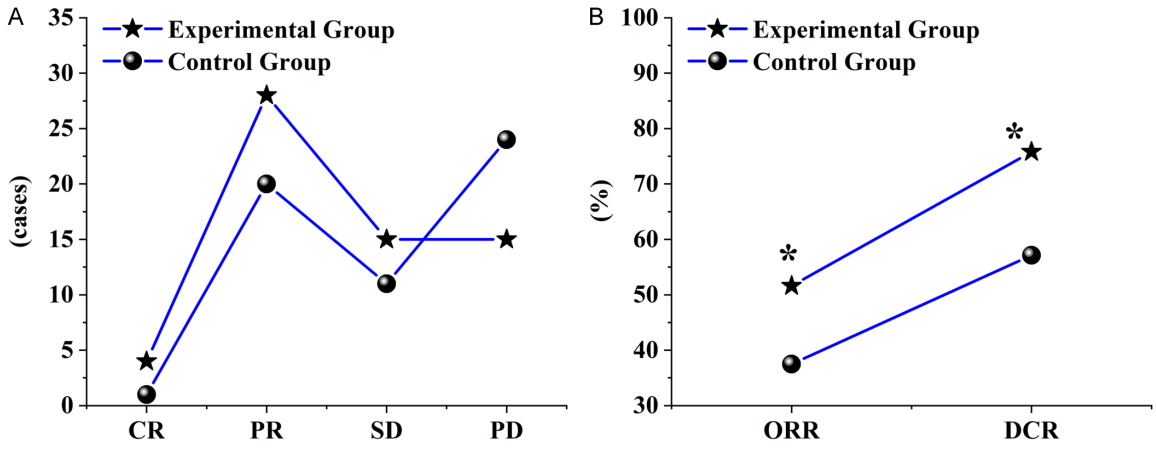


**Figure 7.** Clinical efficacy of patients. A: The number of cases with CR, PR, SD, and PD; B: ORR and DCR. Note: * indicates a significant difference compared to the control group, $P < 0.05$; CR: Complete Response; PR: Partial Response; SD: Stable Disease; PD: Progressive Disease; ORR: Overall Response Rate; DCR: Disease Control Rate.

as postoperative pain, fatigue, and localized discomfort [19-21].

Perioperative monitoring indicators showed no significant differences between the EG and CG

**Table 1.** Pearson correlation analysis of the relationship between treatment efficacy and various clinical data

| Variable | Correlation coefficient (r) | Coefficient of determination ($R^2$) | *P* value |
|---|---|---|---|
| Age | -0.45 | 0.203 | 0.029 |
| Lesion diameter | -0.37 | 0.137 | 0.044 |
| Menopause or not | 0.12 | 0.014 | 0.071 |
| Pathological type | 0.08 | 0.006 | 0.076 |
| $CD3^+$ | 0.52 | 0.270 | 0.033 |
| $CD4^+$ | 0.48 | 0.230 | 0.024 |
| $CD8^+$ | 0.40 | 0.160 | 0.046 |
| $CD4^+/CD8^+$ | 0.43 | 0.184 | 0.038 |
| VAS | -0.09 | 0.008 | 0.056 |

$CD3^+$: Cluster of Differentiation 3 Positive; $CD4^+$: Cluster of Differentiation 4 Positive; $CD8^+$: Cluster of Differentiation 8 Positive; VAS: Visual Analog Scale.

**Table 2.** Multivariate Logistic regression analysis of factors influencing patient treatment efficacy

| Variable | Coefficient of regression (β) | Standard error (SE) | *P* value | 95% confidence interval (CI) |
|---|---|---|---|---|
| Age | -0.015 | 0.020 | 0.058 | 0.946-1.025 |
| Lesion diameter | 0.023 | 0.029 | 0.063 | 0.967-1.082 |
| $CD3^+$ | 0.072 | 0.031 | 0.018 | 1.011-1.143 |
| $CD4^+$ | 0.030 | 0.024 | 0.054 | 0.984-1.078 |
| $CD8^+$ | 0.025 | 0.026 | 0.051 | 0.926-1.027 |
| $CD4^+/CD8^+$ | 0.046 | 0.022 | 0.014 | 1.003-1.093 |

$CD3^+$: Cluster of Differentiation 3 Positive; $CD4^+$: Cluster of Differentiation 4 Positive; $CD8^+$: Cluster of Differentiation 8 Positive.

in terms of IOBL, number of lymph nodes dissected, postoperative DV, bed rest time, hospital stay, or medical costs. However, the surgical duration in the EG was significantly longer than that in the CG. This finding suggests that while the combination of warm acupuncture and conventional FRT did not significantly affect indicators such as blood loss, number of lymph nodes dissected, or treatment costs, it did result in an extended surgical duration. The increase in surgical time may be due to the preparatory steps involved in the application of warm acupuncture. These procedures may require additional time during the surgery to ensure patient comfort and therapeutic efficacy. Moreover, real-time monitoring of the patient's response to warm acupuncture treatment could contribute to the prolonged duration, as adjustments may be needed. While the extended surgical time could be seen as a limitation, further research is necessary to determine whether this additional time has any negative impact on the patient's overall recovery [22].

Hershman et al. [23] suggested that in postmenopausal women with early-stage BC, true acupuncture significantly alleviated aromatase inhibitor-associated joint pain within six weeks, showing clear advantages over sham acupuncture. In this study, the EG demonstrated significantly lower VAS scores at postoperative weeks 2, 4, and 8 compared to the CG. The significant improvement in pain scores in the EG may be attributed to the analgesic mechanisms of warm acupuncture, which stimulates local nerves and blood circulation, promoting the release of endogenous analgesic substances such as endorphins and improving blood flow. This not only alleviates postoperative pain but may also reduce patients' reliance on exogenous analgesics, thereby lowering the risk of associated adverse effects. These findings align with those of Hershman et al., suggesting that the potential advantages of acupuncture in managing BC-related pain. Regarding upper limb functional recovery, the EG showed significant superiority over the CG flexion and abduction, indicating that warm acupuncture may accelerate the restoration of upper limb function by improving local blood circulation, promoting muscle relaxation, and enhancing neural conduction. Previous studies noted that early postoperative physical rehabilitation can reduce tissue adhesions and stiffness, and the combination of warm acupuncture further enhances this effect [24]. Regarding upper limb lymphedema, the incidence in the EG was significantly lower than that in the CG, suggesting that warm acupuncture may reduce the risk of edema by promoting lymphatic fluid movement and drainage. Lymph node dissection or radiation therapy during BC surgery may impair lymphatic drainage. Warm acupuncture may help regulate the lymphatic system by stimulating relevant meridians and acupoints, thereby alleviating edema [25, 26].

The restoration of immune function is a key aspect of postoperative rehabilitation in BC patients. The EG showed significantly higher

levels of $CD3^+$, $CD4^+$, $CD8^+$, and the $CD4^+/CD8^+$ ratio compared to the CG, suggesting that warm acupuncture may help maintain and restore immune function. Previous studies have demonstrated that acupuncture could modulate the neuroendocrine system, enhance immune cell activity, and improve the body's resistance to infections and tumor recurrence. This immune-protective effect not only aids in patient recovery but may also increase long-term survival rates [27]. Moreover, the EG scored significantly higher than the CG on multidimensional QoL measures, including role physical, overall health, and mental health. This indicates that the combination of warm acupuncture and conventional FRT effectively enhanced the patients' overall QoL. Warm acupuncture positively influences QoL by balancing the flow of qi and blood, thereby improving patient comfort and psychological well-being [28]. Multivariate logistic regression analysis revealed that age, tumor diameter, $CD4^+$, and $CD8^+$ levels had no significant effect on treatment outcomes. However, $CD3^+$ levels and the $CD4^+/CD8^+$ ratio significantly impacted treatment outcomes. These results suggest that $CD3^+$ levels and the $CD4^+/CD8^+$ ratio are important factors influencing treatment outcomes, indicating that immune function indicators - particularly the $CD3^+$ count and $CD4^+/CD8^+$ ratio - may be crucial when assessing and optimizing treatment efficacy.

In summary, the combination of warm acupuncture and conventional FRT demonstrates multiple benefits in the postoperative rehabilitation of BC patients, with mechanisms involving pain relief, functional recovery, immune modulation, and QoL improvement. This study provides strong support for clinical practice, and future research could further explore the potential application of warm acupuncture in different patient populations and rehabilitation stages. However, the retrospective design of this study may introduce selection and information biases, limiting the generalizability of the results. Additionally, variations in the specific operational parameters of warm acupuncture may contribute to heterogeneity in the outcomes, highlighting the need for standardized treatment protocols in future studies. Future research should adopt randomized controlled trials, increase sample sizes, and include long-term follow-up to comprehensively elucidate the potential benefits and mechanisms of warm acupuncture.

## Disclosure of conflict of interest

None.

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