



Effects of warm acupuncture on breast cancer–related chronic lymphedema: a randomized controlled trial

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ABSTRACT

Background Effective treatment for breast cancer–related chronic lymphedema (BCRL) remains a clinical challenge. Acupuncture and moxibustion treatments have been shown to be beneficial and safe for treating BCRL. In the present randomized controlled trial, we compared the effectiveness of combined acupuncture and moxibustion (“warm acupuncture”) with that of diosmin in BCRL.

Methods Breast cancer patients who met the inclusion and exclusion criteria ($n = 30$) were randomized to experimental and control groups (15 per group). On alternate days, patients in the experimental group received 30 minutes of acupuncture at 6 acupoints, with 3 of the needles each being topped by a 3-cm moxa stick. The control treatment was diosmin 900 mg 3 times daily. The control and experimental treatments were administered for 30 days. Outcome measures included arm circumferences (index of effectiveness), range of motion [ROM (shoulder joint function)], quality of life, clinical safety, and adverse events.

Results Measured by the index of effectiveness, BCRL improved by 51.46% in the experimental group and by 26.27% in the control group ($p < 0.00001$). Effects were greatest at 10 cm above the elbow and at the wrist, where the warm needling was provided. Impairments in shoulder joint ROM were minimal at baseline in both treatment groups. However, the ROMs of rear protraction, abduction, intorsion, and extorsion in the experimental group improved significantly; they did not change in the control group. Self-reported quality of life was significantly better with warm acupuncture than with diosmin. No adverse effects were reported during the treatment period, and laboratory examinations for clinical safety fell within the normal ranges.

Conclusions Compared with diosmin, warm acupuncture treatment can effectively reduce the degree of BCRL at the specific acupoints treated and can promote quality of life. Warm acupuncture showed good clinical safety, without any adverse effects on blood or the cardiovascular system.

Key Words Warm acupuncture, breast cancer–related lymphedema, range of motion, quality of life, clinical safety

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INTRODUCTION

With the increase in the incidence of breast cancer (BCA) and improvements in BCA survival observed globally¹, approaches to improve physical and psychosocial treatment outcomes are needed. Upper-arm lymphedema is a major complication observed during BCA treatment. A systematic review and meta-analysis reported an incidence of 21.4%

for BCA–related lymphedema (BCRL) and identified axillary dissection and radiotherapy as important treatment-related risk factors. Elevated body mass index and infections are also risk factors for BCRL². Chronic BCRL can lead to the formation of excess subcutaneous adipose tissue secondary to slow or absent lymph flow. The result can be debilitating physical effects, including arm swelling and stiffness, and skin thickening and roughness. Beyond those physical

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impairments, BCRL has adverse psychological effects and can ultimately negatively affect recovery from bca³. Because effective treatments are limited, BCRL remains an important challenge in the treatment of bca.

A number of methods to assess upper-limb lymphedema are used in clinical and research settings⁴. Measuring arm circumference at predetermined distances from anatomic landmarks remains one of the main assessments because of its advantages: affordability, transportability, user-friendliness, non-invasiveness, and time savings⁵. Related assessments include the functional assessment of upper-limb lymphedema, including range of motion (ROM) of the shoulder joint and quality of life. Patients with bca undergoing modified radical mastectomy often experience complications of BCRL and perform worse in the shoulder joint functions of anteflexion, backward extension, elevation, abduction, adduction, internal rotation, and external rotation than do patients free from BCRL. Restriction in above-the-shoulder-joint activities is suggested to negatively affect quality of life, because quality of life scores are lower in patients with BCRL than in those free from the condition⁶.

There is no consensus on a single specific treatment for BCRL, but a combination of therapies is recommended⁷. Those therapies includes manual and mechanical lymph drainage, exercise and myolymphokinetic activities, compression garments and bandages, carefulness with hygiene and daily tasks, and psychological support. In China, BCRL is ascribed to a disease called “edema” that, in the theory of Traditional Chinese Medicine (TCM) is caused by *chi* deficiency and blood stagnation. The Chinese herbs having the traditional functions of improving *chi* and blood circulation by way of oral intake or external fuming and steaming have demonstrated positive results for more than 20 years⁸. Decoctions of traditional Chinese herbs for the treatment of lymphedema have been reported to produce good results⁹.

Among the various TCM therapies, acupuncture plays a key role in the treatment of lymphedema. Acupuncture is suggested to be effective and affordable, to cause few side effects, and to improve quality of life for patients¹⁰. Many methods of acupuncture treatment have been explored in patients experiencing BCRL (including simple acupuncture, moxibustion, electric acupuncture, warm acupuncture, and point injection, among others), and all methods, either as single therapies or in combination with other treatments (including Western medicine and Chinese medicine), were reported to have beneficial effects¹¹. Treatment using acupuncture combined with medication for bca patients with BCRL was reported to have a better effect than medication alone¹². Moxibustion combined with shoulder joint function recovery training has also been evaluated in the treatment of BCRL. The results suggested that combining moxibustion with training led to statistically significant improvements¹³. Taken together, the foregoing findings suggest that treating BCRL with acupuncture and moxibustion combined, such as in warm acupuncture, might have beneficial effects.

Current treatment options for BCRL are often time-consuming, expensive, and temporary^{14,15}. There is a pressing need to find an effective means of treating BCRL and thus improving quality of life and re-establishing self-confidence for affected patients¹⁶. Our randomized, parallel-arm trial compared the effect of warm acupuncture for 1 month with

a control treatment of diosmin on quantitative measures of swelling in various parts of the upper arm, six-direction shoulder joint function, self-reported quality of life, and parameters of clinical safety.

METHODS

Study Protocol and Research Ethics

The research protocol was approved by the Institutional Review Board of Human Research in the Affiliated Hospital of Nanjing University of Traditional Chinese Medicine. During January–December 2013, women from the outpatient department of Jiangsu Provincial Hospital of Traditional Chinese Medicine were identified and screened, and after informed consent was obtained, were enrolled into the study. Women were included if they

- were 30–80 years of age.
- had unilateral lymphedema resulting from surgery for bca (defined as more than a 3 cm difference in circumference between the affected and unaffected arms).
- had met the clinical diagnostic criteria for between 6 months and 5 years.
- had at least 2 months of stable BCRL after primary treatment.
- had upper-limb lymphedema symptoms including stiff or hard skin and impaired range of motion in the shoulder joint.

Women were excluded if they

- were receiving other treatments for lymphedema (exercise, massage, or compression garments, and so on).
- had bca recurrence; other internal organ metastasis; other cancers; or serious heart failure, kidney failure, liver disease, and so on, that could potentially affect the evaluation of edema.

Reasons for a patient to leave the trial included

- withdrawal of consent,
- failure to adhere to the research plan, and
- occurrence of serious adverse events.

Study Design

Assuming an alpha of 0.05, 80% power, and an expected effect size of 20% improvement, the trial had to enrol 30 women¹⁶. The 30 patients who met the inclusion and exclusion criteria were equally allocated to the experimental and control groups using random numbers.

Treatment Technique

Patients assigned to the experimental treatment group received acupuncture treatment (0.45×25 mm needles: Suzhou Medical Instruments, Suzhou City, China) for 30 minutes on alternate days for a period of 30 days (Figure 1). A neutral supplementation and draining method was applied at 6 acupoints: Shousanli (LI.10), Quchi (LI.11), Binao (LI.14), Jianyu (LI.15), Waiguan (SJ.5), and Jianliao (SJ.14). In addition, 3-cm moxa sticks for warm acupuncture (Xuyu Huatuo Company, Xuyu, China) were placed atop the needles at the

SJ.5, LI.15, and SJ.14 acupoints. “Warm acupuncture” (also called thermo-acupuncture) is an indirect way to combine moxibustion treatment with acupuncture¹⁷. A moxa stick is attached at the tail of the needle that has been inserted into an acupoint, and the stick is burned to provide heat via the needle.

Patients assigned to the control treatment group received 900 mg diosmin tablets (Nanjing Zhengda Tianqing Pharmaceutical, Nanjing, China) and were instructed to take them orally 3 times daily for 30 days.

In both groups, objective measures of BCRL were evaluated and recorded at baseline and at weekly intervals throughout the 30-day period.

Outcome Measures

These outcomes were measured:

- **Effective index for upper-limb lymphedema:** Circumferential arm measurements were taken using a modification of the Lopez Penha method¹⁸. To allow for a flexible assessment of the effects of particular acupoints on lymphedema, a leather measuring tape was used to measure arm circumference at the wrist and elbow creases and at 10 cm above those creases. The effective index was then calculated as follows:

$$\text{Effective index (\%)} = \frac{(\text{upper-limb arm circumference before treatment} - \text{upper-limb arm circumference after treatment}) / (\text{upper-limb circumference of the affected arm before treatment} - \text{upper-limb circumference of the unaffected arm before treatment})}{1}$$



FIGURE 1 Acupoints used to treat lymphedema. In the experimental group, acupuncture was administered on alternate days for 30 days at 6 selected acupoints from shoulder joint to wrist in the affected upper arm: Jianyu (LI.15), Jianliao (SJ.14), Binao (LI.14), Quchi (LI.11), Waiguan (SJ.5), and Shousanli (LI.10). The LI.15, SJ.14, and SJ.5 acupoints were selected for warm acupuncture, in which moxa sticks (processed *Artemisia argyi*, 3 cm in length) placed at the free end of the needles are lighted for 30 minutes. The thick paper at the skin guards against burn injury from any hot ash that might fall.

- **ROM of shoulder joint:** Two professional medical practitioners independently measured the angles (in degrees) of anteflexion, rear protraction, adduction, abduction, intorsion, and extorsion that the subjects could reach without discomfort. The average of the two measurements was recorded. Shoulder joint ROM in the affected arm was evaluated as a percentage relative to the ROM in the unaffected arm.
- **Quality of life:** Self-reported quality of life was assessed using a simplified and modified form of the European Organization for Research and Treatment of Cancer’s QLQ-30 questionnaire for the evaluation of quality of life in bca patients¹⁹. Possible responses included “satisfied,” “bothered sometimes,” “annoyance,” and “terrified or horrible” or were recorded on a 0–3 Likert scale for which 0 indicated “satisfied.”
- **Clinical safety and adverse events monitoring:** Routine blood tests, electrocardiography, and hepatic and renal function tests were performed before and after treatment. Any serious adverse events related to acupuncture such as bruising, bleeding, and infection of the acupoints were recorded and controlled with independent monitoring.

Statistical Analysis

The SPSS Statistics software application (version 17.0: SPSS, Chicago, IL, U.S.A.) was used to perform the data analysis, with quantitative data being evaluated by t-test; grade data, by ridit analysis; and categorical data, by chi-square test.

RESULTS

Participant Recruitment and Characteristics

Of 53 women assessed for eligibility, 30 were enrolled into the study (Figure 2). All study participants had undergone modified radical mastectomy, and 5 in each group had

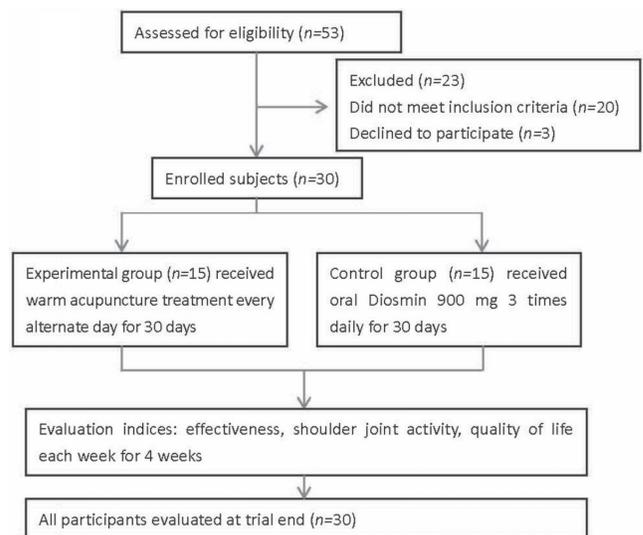


FIGURE 2 Patient flow through the study.

received radiation therapy. The median time from surgery to the start of participation in this clinical study was 8.8 months. At baseline, the groups showed no significant differences in age, duration of edema, circumferential measurement difference (affected arm – unaffected arm), shoulder joint function, or quality of life (Table I).

Effective Index for Upper-Limb Lymphedema

After 1 week of treatment, the overall effective index for upper-limb lymphedema was 19.80% in the experimental group and 8.42% in the control group ($p < 0.001$, Table II). At the end of treatment, the overall effective index reached 51.46% in the experimental group and 26.27% in the control group ($p < 0.00001$). At week 4, the effective index in the experimental group had increased to 65.67% at the wrist and to 44.71% at 10 cm above the elbow, which was significantly higher than in the control group, where those indexes had increased to 34.17% and 17.30% respectively ($p < 0.05$). Changes to the index at the elbow were similar to those for the overall index, although the index values were significantly higher in the experimental group than in the control group only at 2 and 4 weeks. The treatment groups showed no significant differences in the measurements taken 10 cm above the wrist, suggesting that, compared with other arm locations, the arm at 10 cm above the wrist is less sensitive to treatment.

Shoulder Joint ROM

After treatment, the study groups showed no significant differences in any of the ROM measurements (Table III). Compared with baseline, the general ROM of the affected shoulder joint at week 4 had improved significantly in both groups ($p < 0.05$). In the experimental group, function had improved after 1 week of treatment; in the control group, improvement occurred after 4 weeks of treatment.

In evaluating the 6 directions of shoulder-joint ROM, we observed significant improvements in rear protraction, abduction, adduction, intorsion, and extorsion in the experimental group; we observed a significant improvement only in adduction in the control group.

TABLE I Baseline patient characteristics

Characteristic	Patient group		P Value
	Experimental	Control	
Patients (n)	15	15	—
Mean age (years)	56.2±5.82	55.8±5.02	0.84 ^a
Previous treatment received (n)			
Chemotherapy	14	13	0.85 ^b
Radiation therapy	5	5	1 ^b
Mean duration of edema (months)	8.82±4.22	8.81±4.52	0.85 ^a
Mean difference in circumference between the affected and unaffected arms (cm)	15.84±6.68	15.51±7.36	0.78 ^a
Mean shoulder joint function (%)	91.22±8.57	92.74±7.09	0.19 ^a
Quality of life score	2±0	2±0	1 ^a

^a By the Student t-test for paired data.

^b By the Fisher exact test for numeric data.

Quality of Life

Participants in both groups who were experiencing upper-arm lymphedema reported feelings of annoyance at the beginning of treatment (Table IV). After treatment, all participants in the experimental group reported improvements in quality of life (average rating: satisfied); in contrast, participants in the control group reported some continuing impairments in quality of life. Some differences between the treatment groups were significant ($p < 0.05$).

Clinical Safety

Routine blood tests, electrocardiography, and hepatic and renal function tests in both treatment groups were all within normal ranges before and after the study (Table V). No significant changes occurred over time with either treatment. No adverse events were reported during treatment, and no local burns, bleeding, ecchymosis, or inflammation events occurred.

DISCUSSION

The results of our randomized trial show that, compared with diosmin treatment, treatment with warm acupuncture has beneficial effects for BCa patients experiencing BCRL. We found a significant reduction in upper-limb lymphedema of approximately 50% measured by arm circumference (“effective index”) in patients receiving warm acupuncture; patients taking oral diosmin experienced an approximately 25% reduction in effective index. Benefits in self-reported quality of life were also seen in women receiving acupuncture compared with those receiving diosmin. The foregoing findings accord with earlier literature reporting that acupuncture treatment has positive effects on recovery from BCRL²⁰. In the literature, the magnitude of the benefit varies, which might be a result of variation in the acupoints selected and the method of acupuncture used. For example, Cassileth *et al.*²¹ found an approximately 30% decline in the volume of upper-arm lymphedema after acupuncture treatment for 1 month. On the other hand, the Mingqi Xia research group observed a total effect rate of 86.4% after a half month of treatment¹².

Many methods and tools—such as perimeter and circumferential measurement, water replacement, and bioelectrical impedance analysis—have been developed to measure upper-arm lymphedema. Perimeter measurements have a high degree of accuracy, but they depend on large, expensive equipment. Circumferential measurement, which was used in the present study, is a more practical and cost-effective method, whose accuracy is closely related to that of perimeter measurement ($r_c = 0.99$)²². By measuring at 4 locations on the arm, it was possible to evaluate the effectiveness of the various acupoints tested and to compare results at the acupoints receiving and not receiving warm acupuncture.

We selected the Waiguan (SJ.5), Jianyu (LI.15), and Jianliao (SJ.14) acupoints for warm acupuncture application. Not only did we observe a beneficial effect of acupuncture compared with diosmin on the degree of upper-arm lymphedema, but our findings made a step forward by showing location-specific effects. The results at the wrist and above the elbow were much more pronounced than the results at

TABLE II The effective index^a overall and at specific locations on the arm

Upper arm location	Treatment weeks			
	1	2	3	4
At 10 cm above elbow				
Control group	5.53±6.20	10.33±8.73	13.90±8.62	17.30±10.13
Experimental group	16.14±11.77	27.26±19.25	38.87±25.73	44.71±24.21
<i>p</i> Value ^b	0.005	0.006	0.006	0.0007
At elbow				
Control group	9.40±12.50	13.76±13.51	23.50±22.03	29.94±30.91
Experimental group	17.96±13.04	30.85±16.11	41.04±22.94	52.57±29.02
<i>p</i> Value ^b	0.07	0.004	0.06	0.04
At 10 cm above wrist				
Control group	8.74±12.79	16.85±27.42	17.81±26.99	26.61±31.33
Experimental group	18.36±20.40	24.51±25.37	33.52±28.56	43.83±31.21
<i>p</i> Value ^b	0.13	0.43	0.13	0.14
At wrist				
Control group	10.26±8.37	26.48±15.46	25.43±15.71	34.17±22.12
Experimental group	27.23±29.17	39.22±26.48	61.85±25.44	65.67±31.38
<i>p</i> Value ^b	0.05	0.03	0.001	0.005
Overall				
Control group	8.42±10.30	15.18±17.69	19.98±20.89	26.76±25.35
Experimental group	19.80±19.59	30.31±22.35	43.51±28.70	51.46±29.61
<i>p</i> Value ^b	0.00016	0.000091	0.0000016	0.0000038

^a Calculated as: (upper arm circumference before treatment – circumference after treatment) / (affected upper arm circumference before treatment – unaffected upper arm circumference).

^b By the Student *t*-test.

the other locations, which might indicate that acupuncture is better when applied at acupoints near the wrist and above the elbow than at other acupoints. Furthermore, the locations with the most pronounced effects were associated with the acupoints that received warm acupuncture treatment. That observation suggests that warm acupuncture treatment has beneficial effects at local acupoints, a novel finding implying that it is possible to improve the effects of acupuncture treatment in reducing BCRL by changing the acupoints. Further research to optimize acupoint selection is needed.

According to the theory of TCM, BCRL is caused by meridian stagnation, with fluid retention beneath the upper arm skin because of injury at operation. Many methods of acupuncture focusing on BCRL have been explored, including simple acupuncture, moxibustion, electric acupuncture, drawn cans, and point injection, among others. Acupuncture is suggested to have favourable effects when used as a single therapy²³. Heat can promote fluid circulation in the meridians and might therefore be able to further reduce the degree of lymphedema. Using heating and bandage treatment, Zhang *et al.*⁸ demonstrated a total regression rate of up to 57.6% in 1045 patients experiencing chronic lymphedema. That method has become a standard conservative treatment for chronic lymphedema. For the first time, our results show that, compared with diosmin treatment, acupuncture combined with heat—“warm acupuncture”—is beneficial in the treatment of BCRL.

Warm acupuncture has been used as a therapeutic measure to effectively improve chronic diseases arising from a deficient flow of *chi* because of a lack of heat affecting the WenTong meridians, promoting *chi* and activating blood circulation (“making the meridians smooth”)²⁴. Moreover, clinical and experimental studies have shown that warm acupuncture is able to reduce the expression of inflammatory cytokines, to regulate lymph system function, and to improve blood circulation^{24,25}. We therefore hypothesize that the mechanism producing the effects of warm acupuncture in reducing lymphedema might involve anti-inflammatory effects near the acupoints and meridians, with improved blood circulation after treatment. In cases of chronic skin ulcer, Sun *et al.*²⁴ found that, by upregulating expression of vascular endothelial growth factor, warm acupuncture increased blood flow and microvascular circulation, which could partly explain the effect of warm acupuncture in reducing edema.

It has been reported that, compared with patients not having upper-arm lymphedema, patients with this complication have reduced ROM in 6 directions of shoulder function²⁶. Our study population included bca patients experiencing lymphedema. Interestingly, functional impairment was minimal in our patients, with baseline measures of ROM for the affected shoulder joint reaching 90% of those for the healthy joint in both treatment groups. The potential for further improving ROM was thus limited.

TABLE III Shoulder joint range of motion (ROM)^a with warm acupuncture treatment (experimental group) and with oral diosmin (control group)

Shoulder movement	ROM (%) at treatment week					P Value ^b
	0	1	2	3	4	
Anteflexion						
Control group	93.77±5.34	94.08±5.37	94.58±7.21	94.65±5.23	95.11±4.86	0.43
Experimental group	90.14±8.89	91.74±8.39	93.08±4.99	94.88±6.96	95.26±6.45	0.08
Protraction						
Control group	85.89±6.40	86.37±6.61	88.37±6.71	89.13±6.83	89.58±7.30	0.12
Experimental group	86.45±8.36	88.71±8.26	91.26±7.81	91.26±7.81	95.46±8.06	0.01
Abduction						
Control group	94.07±5.15	94.27±5.06	95.06±4.33	95.59±4.04	96.17±4.19	0.29
Experimental group	91.38±6.49	91.97±6.52	94.65±4.80	95.77±4.00	96.62±3.29	0.02
Adduction						
Control group	85.21±6.62	85.62±6.69	87.04±6.10	88.34±5.86	90.27±5.47	0.03
Experimental group	86.34±11.60	87.86±10.92	89.59±10.55	91.27±10.80	93.98±7.16	0.05
Intorsion						
Control group	97.64±2.29	97.85±2.36	98.19±2.28	98.50±1.82	98.60±1.86	0.18
Experimental group	96.50±2.05	96.61±2.04	98.22±1.37	98.55±0.94	98.60±0.90	0.001
Extorsion						
Control group	99.01±1.12	99.22±1.00	99.22±1.00	99.34±0.99	99.34±0.99	0.47
Experimental group	97.46±1.68	97.78±1.51	97.88±1.40	98.25±1.65	98.70±1.27	0.04
Overall						
Control group	92.74±7.08	92.30±6.97	93.87±6.32	94.50±5.91	95.06±5.52	0.015
Experimental group	91.22±8.56	93.06±8.00	93.95±7.15	95.35±6.83	96.34±5.53	0.000005

^a Shoulder anteflexion, protraction, adduction, abduction, intorsion, and extorsion (greatest movement with no discomfort on the part of the participant) were measured independently by 2 professional medical practitioners. The averages of the those independent results are reported.

^b Compares the results at week 4 with the results at week 0 in each group; calculated using the Student t-test.

TABLE IV Quality-of-life scores^a for the study participants

Group	Treatment week				
	0	1	2	3	4
Control	2±0.00	1.93±0.26	1.80±0.41	1.33±0.52	1.07±0.26
Experimental	2.01±0.03	1.80±0.41	0.93±0.25	0.53±0.49	0±0
p Value ^b	0.33	0.29	0.00000018	0.000159	0.00000

^a 0 = satisfied; 1 = bothered sometimes; 2 = annoyance; 3 = terrified or horrible.

^b By the Student t-test.

TABLE V Results of laboratory examinations for clinical safety

Group	Routine blood work				Liver function		Kidney function	
	RBCs (10 ¹² /L)	WBCs (10 ⁹ /L)	Hemoglobin (g/dL)	Platelets (10 ⁹ /L)	AST (U/L)	ALT (U/L)	BUN (mmol/L)	Creatinine (µmol/L)
Control								
Before treatment	5.46±1.18	4.31±0.56	132.93±12.32	182.4±72.09	25.07±4.43	25.87±6.73	3.85±1.30	57.66±11.21
After treatment	5.12±1.00	4.45±0.43	133.87±11.24	188±37.07	24.93±5.39	24.13±7.33	4.16±1.23	55.41±7.16
p Value	0.40	0.43	0.83	0.79	0.94	0.51	0.50	0.52
Experimental								
Before treatment	5.99±1.59	4.30±0.48	135.13±17.29	181.33±41.91	20.93±4.89	22.07±9.07	4.82±1.22	54.91±6.34
After treatment	6.27±1.19	4.49±0.35	130.47±6.46	199.53±36.53	22.6±5.65	20.93±7.39	4.27±0.80	57.94±8.67
p Value	0.58	0.21	0.34	0.22	0.40	0.71	0.16	0.28

RBCs = red blood cells; WBCs = white blood cells; AST = aspartate aminotransferase; ALT = alanine aminotransferase; BUN = blood urea nitrogen.

The greatest risk factors for reduced ROM after bca surgery include mastectomy, radiotherapy to the axilla, axillary lymph node dissection, and radiotherapy to the chest wall²⁷. As we observed, upper-arm lymphedema is not a major risk factor for reduced ROM. Nevertheless, we observed statistically significant improvements in the measure of overall ROM in both groups, but without a significant difference between the control and experimental treatments. That observation suggests that overall improvement in the general ROM of the shoulder joint was no greater with acupuncture than with diosmin. Notably, the significant improvement in overall ROM occurred after 1 week of acupuncture and after 4 weeks of diosmin, suggesting that, compared with diosmin, acupuncture might faster produce improvement.

In looking at specific directions of ROM, treatment with warm acupuncture significantly improved ROM in the rear protraction (maximal angle of pushback by the upper arm without discomfort), abduction (maximal angle of lift away from the body), intorsion (maximal angle of rotation to the inside), and extorsion (maximal angle of rotation to the outside) directions. Rear protraction, abduction, and extorsion are suggested to be the most important and useful movements for daily life, because compared with the other 3 ROM directions, they are more closely related to quality of life²⁸. In contrast, another clinical report showed that shoulder abduction, flexion, and external rotation are more closely related than are the other directions of ROM to quality of life, which suggests that the effects of warm acupuncture treatment on quality of life could partly be a result of its improvements to the main activities of shoulder ROM²⁹. Additional studies have shown that acupuncture treatments improve shoulder joint function by way of relieving pain, muscle adhesions, and inflammation^{30,31}.

Quality of life is multifactorial. It involves physical complications, emotional depression, and satisfaction with esthetic results. Quality of life can affect a patient's prognosis. At baseline, patients in both treatment groups reported impaired quality of life (rating: 2), suggesting that patients considered the experience of BCRL to be an annoyance that decreased their quality of their life. Compared with participants in the control group, all participants receiving warm acupuncture reported improved quality of life. That observation suggests that the patients felt more comfortable and satisfied with warm acupuncture treatment than with taking pills orally.

Several studies have shown that quality of life after bca surgery is related to BCRL and shoulder joint function³²⁻³⁴. We have demonstrated that warm acupuncture treatment effectively reduces the degree of upper-arm lymphedema, especially at 10 cm above the elbow and at the wrist. In addition, it improves the main shoulder joint functions of rear protraction, abduction, and extorsion—a change that likely contributed to the observed increase in quality of life.

All participants in our study had previously received decongestive therapy and had experienced stable BCRL for at least 2 months; they were therefore unwilling to receive such of treatments again. In a departure from most study designs, we compared the effects of warm acupuncture treatment with diosmin treatment, another complementary treatment for lymphedema. Diosmin is a member of the flavonoid family and has been shown to improve

lymphatic drainage by increasing the frequency and intensity of lymphatic contractions and the total number of functional lymphatic capillaries³⁵. Diosmin is often given to reduce the degree of lymphedema and was shown in several clinical trials to have beneficial effects^{36,37}. Our results showed that warm acupuncture treatment was more effective than diosmin in reducing lymphedema and improving quality of life. We hypothesize that, compared with oral ingestion of diosmin, local stimulation at acupoints and warm acupuncture can more rapidly promote lymphatic microcirculation and reduce the local inflammatory reaction.

Our findings suggest that warm acupuncture is well tolerated and safe when provided for 1 month. Others have reported the absence of infections, severe exacerbations, or other serious adverse events when acupuncture is provided for 6 months¹⁶. Lim *et al.*³⁸ measured the pH, heavy metal content, and ultraviolet absorbance spectra of acupuncture needles, and also conducted biologic tests for cytotoxicity and hemolysis; all results suggest that warm needles are biologically safe. In our study, we treated BCRL using warm acupuncture for 1 month, and no adverse events occurred during that study period. For clinical safety, we monitored routine blood measures, hepatic and renal function, and cardiac function. All results remained within normal limits.

CONCLUSIONS

Our research showed that warm acupuncture is more effective than oral diosmin in reducing the degree of BCRL and supporting quality of life for patients after bca treatment. Furthermore, our research found that response was greater at the acupoints where warm acupuncture was applied than at the acupoints receiving simple acupuncture. No clinical adverse events occurred during treatment with warm acupuncture. We conclude that, for reducing BCRL, warm acupuncture is more effective than diosmin, a supplement with proven clinical effectiveness, and that warm acupuncture is safe and well tolerated. Further research to optimize the acupoint locations for warm acupuncture and the duration of treatment required to achieve the maximal effect is recommended.

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CONFLICT OF INTEREST DISCLOSURES

We have read and understood *Current Oncology's* policy on disclosing conflicts of interest, and we declare that we have none.

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