A Randomized Trial of the Effect of Self-care Booklet Plus Routine Care Compared with Routine Care Alone in Breast Cancer-related Lymphedema Patients

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ABSTRACT

Objectives: To investigate the effectiveness of the self-care booklet plus routine care on reducing arm volume in patients with breast cancer related lymphedema (BCRL).

Setting: Outpatient department, Department of Rehabilitation Medicine, Siriraj Hospital.

Study design: Prospective, randomized single-blinded controlled trial.

Subjects: Fifty-one patients with stage 1 or 2 BCRL were enrolled during December 2017 and December 2018.

Methods: Patients were randomized into 2 groups, the intervention group received self-care booklet plus routine care and the control group receives routine care alone for 12 weeks. Patients in the intervention group were asked to follow the instructions in the booklets and record their self-monitor routine in the booklet weekly. Arm volume, quality of life, arm range of motions, patients' knowledge, and overall satisfactions were recorded at baseline, 4 weeks and 12 weeks.

Results: After using the self-care booklet for 4 weeks, patients in the intervention group demonstrated significantly higher score in the physical sub-scale of the Lymph-ICF questionnaire when compared between groups (p=0.046) but there were no significant differences regarding the arm volume reduction and knowledge score. After 12 weeks, there were significant increases in shoulder forward flexion and shoulder abduction ROM (p= 0.033, 0.025 respectively) in the intervention group but no difference between groups was found in terms of arm ROM, volume reduction, knowledge score, overall satisfaction and adverse events.

Conclusion: The self-care booklet plus routine care demonstrated some benefit for women with stage 1 or 2 BCRL in terms of improving the physical subscale QOL score after using for 4 weeks. But after 12 weeks, there were no difference from the routine care alone.

Keywords: breast cancer related lymphedema, self-care booklet, patient education

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Introduction

Breast cancer is the most common type of cancer in women. In 2012, approximately 1.7 million women worldwide were diagnosed with breast cancer and 521,900 women succumbed to the disease.[1] Despite of improved standard of breast cancer care practices, some patients will continue to suffer substantial adverse effects.[2,3] One of the most common complications is lymphedema, a set of pathological conditions, in which protein-rich fluid accumulates in soft tissues due to disruption of the lymphatic flow.[4] Affected women can experience pain, swelling, arm tightness, and heaviness of the arm. If left untreated, lymphedema may predispose the affected limb to the development of other secondary complications such as repeated episodes of cellulitis or lymphangitis, axillary vein thrombosis, severe functional impairment, and cosmetic embarrassment.[5] All of these leads to compromised quality of life (QOL) of breast cancer survivors.[6] In high income countries, breast cancer treatment is recognized as the most significant cause of secondary lymphedema.[7] The incidence of breast cancer related lymphedema (BCRL) varies from 8-56% 2-year post-surgery.[5]

The standard of care in lymphedema treatment is complete decongestive therapy (CDT), which consists of manual lymphatic drainage (MLD), compression therapy, lymph-reducing exercises, and skin care. The purposes of this multi-modality approach are to reduce the size of the extremity, reverse any distortion in the shape, soften the subcutaneous tissue, improve the overall health of the skin, maintain these achievements and prevent complications such as infection and injury to the skin.[8] This regimen can be done either in an outpatient setting or at home, which requires a life-long commitment by the patients.[9]

In an outpatient clinical setting treatment, CDT is found to be very costly, time-consuming and personnel-intensive because this process needs to be done by well-qualified therapists.[10] Therefore, ideally, it is necessary for the patients to attempt to manage this life-long condition at home. However, home-based treatment is challenging because many patients find home-based treatment complicated and difficult to carry out, especially for self-MLD.[11] Moreover, a research has suggested that many women with lymphedema neither realized nor understood the risk, causes, and treatment of their own condition.[12] As a result, poor patient understanding and adherence can result in a failure to maintain treatment progress.

Self-care booklets have been widely used to help provide knowledge of many diseases, including lymphedema. But there was still a lack of evidence on their effectiveness. Therefore, a self-care booklet for BCRL patients was created as a patient guide

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to provide essential information, step-by-step self-management on complete decongestive therapy, and some worksheets for the patients to closely self-monitor their conditions.

The goal of this study was to determine the effect of self-care booklet on patients with BCRL. We hypothesized that patients who received the self-care booklet would have reduced swelling caused by lymphedema when compared with patients who received routine care alone and the booklet would develop a better understanding, as well as improve symptoms, function and quality of life in BCRL patients.

Materials and Methods

The study was a single-centered randomized controlled trial. Ethics approval was granted by Siriraj Institutional Review Board, certificate of approval no. Si 576/2017. The Thai Clinical Trial Registry number is RCTR20181011004.

After meeting the selection criteria and giving informed consent, participants were randomized on a 1:1 ratio to an intervention group (routine care plus self-care booklet) or the control group (routine care only). Outcome measurements were performed at baseline (week 0), week 4 and at week 12. All data collecting sessions were held in the Physical Medicine and Rehabilitation outpatient department, Siriraj Hospital between December 2017 and December 2018.

Randomization was conducted by a person not associated with the trial from a computer-generated random number system (http://www.randomization.com). The participants received notification of their group allocation in a sealed envelope after baseline testing.

Participants

Inclusion criteria

- Diagnosis of stage one or two upper extremity lymphedema secondary to breast cancer treatment as defined by the International Society of lymphology[8]
- At least 18 years old
- Adequate literacy skills and were able to give an informed consent

Briefly, stage one lymphedema is defined as early stage lymphedema that will subside with elevation and may have signs of pitting, stage two is "Spontaneously Irreversible Lymphedema", the later stage in which the edematous limb is much firmer due to an increase in fibrosis and soft tissue scarring. There is some temporary reduction of edema with prolonged elevation, but mostly does not disappear without lymphedema management.

Exclusion criteria

- Incomplete treatment for breast cancer (surgery, radiotherapy and chemotherapy),
- Other lymphedema treatment (such as surgery)
- Recurrent cancer or an infection

Interventions

1. The evidence-based self-care booklet was developed at our institution by reviewing lymphedema literatures,[8,13] practice guidelines,[8,14] and some lymphedema booklets[15-17] from lymphedema institutions, comments from BCRL patients and approved the contents which consisted of essential information for BCRL patients (such as causes, stages, treatment options and complications), step-by-step self-management on complete decongestive therapy, and self-monitor worksheets, by physical medicine and rehabilitation physicians, resulted in a 24-page patient friendly booklet, presented in an easy to understand way using graphic pictures and designed for easy portability.

2. The participants randomized to the control group (routine care) were supervised by a physical medicine and rehabilitation physician about the self-CDT and advised to maintain their usual self-care which included wearing of pressure garments, self-massage, exercises, and skin care.

The participants randomized to the intervention group received the self-care booklet. Each week for the duration of 12 weeks, the participants were asked to record their body weight, arm circumference (at 10 cm above elbow, 10 cm below elbow, wrist and hand) and changes in their arms, given booklet instruction by a researcher and also received the same routine care which is medical advice by a physical medicine and rehabilitation physician.

3. All participants in both groups were asked to abstain from receiving any supplemental treatment during the study.

4. Though, at the end of the study, all of them were asked again if they had received any additional treatment related to lymphedema.

Outcome measurements

The primary outcome of this study was lymphedema volume. The secondary outcomes were arm range of motion, quality of life, disease knowledge, and patients' overall satisfaction.

Measurements, based on validated instruments and protocols, were taken by 2 researchers, blinded to the group allocation and spent 3 hours of training before the beginning of the study to measure the proposed outcomes, and prevent biases that may occur in this study.

Baseline demographic data

Demographic information including age, gender, BMI, arm dominance, and medical history data was collected at baseline. Medical history data included type of surgery, chemotherapy, radiation, time since surgery, and time since lymphedema were also collected.

Lymphedema volume

Volumetric measurements were taken by the water displacement method, which is based on Archimedes' Principle. The measurements were performed in the afternoons. Patients removed their pressure garments just before the measuring the arm volume. Then, they were advised to keep their arm straightand immerse it slowly by sliding the fingers down inside the wall of the volumeter until their armpit reached the upper edge of the volumeter, which was then filled with water. The patients then removed their arm and the difference of water levels before and after removing the arm were measured as each arm volume. Both left and right arms were measured to calculate the difference.[18]

Range of motion (ROM)

Shoulder forward flexion, abduction and elbow flexion ranges of motion were measured using a standard goniometer by the same person blinded to group allocation.

Quality of life (QOL)

A Thai-version questionnaire, specifically-developed to measure QOL for people with arm lymphedema, Lymph-ICF[19] was used. It consisted of 29 questions in 5 categories: physical function, mental function, household activities, mobility activities, life and social activities.

Total QOL was self-recorded with scores from 0-10 in each question, calculated to the total score of 0-100, zero being the best and ten the worst rating within the last 2 weeks of testing. A higher score indicated a lower QOL rating for that sub-scale.

The Thai version of Lymph-ICF questionnaire was tested for its face validity before this study started. Twenty questionnaires were randomly selected to test for its internal consistency; the Cronbach alpha for all questions was 0.798. The reliability of the questionnaire was therefore accepted.

Knowledge

Participants' knowledge was tested using a similar test at each visit.

Overall satisfaction

Participants' overall satisfaction of the treatment was measured using the satisfaction scale which was the self-recorded with scores from 0-10. A higher score indicated more satisfaction.

Statistical analysis

The sample size calculation was performed in order to compare continuous variables of 2 independent samples.[20] It indicated that 32 participants per group would be required to detect statistically significant changes in the primary outcome variables. Due to some administration problems, the recruitment had to stop after 51 patients were participated.

Data were analyzed using PASW Statistics (SPSS) 18.0 (SPSS Inc., Chicago, IL, USA).

Results

Seventy-six BCRL patients were assessed for eligibility, 25 were excluded, resulted in 51 BCRL patients participated in the study. Seven participants were lost to follow up because of their personal reasons. All analyses were conducted on an intention-to-treat basis by an independent researcher. Missing data were interpolated, by carrying forward the last observation value.

The flow of participants through the trial is outlined in Figure 1.

Baseline demographic data

The study included 51 women. Baseline characteristics between groups for demographic and medical history were compared by independent two-tailed t-tests (normality) and Mann-Whitney U-test (non-normality) for continuous variables and by Chi-square test for categorical variables.

At the inclusion period of the study, the data regarding to the staging of breast cancer prior to surgery was not enough to be analyzed. The excess arm volume of the intervention group seems to be higher than the control group but the difference was notstatistical significant (p=0.059). In summary, there was no significant difference between groups in terms of demographics or medical characteristics at baseline. (Table 1)

Outcomes

Lymphedema volume

We performed repeated measures ANOVA to compare the percentage changes of excess arm volume between groups.

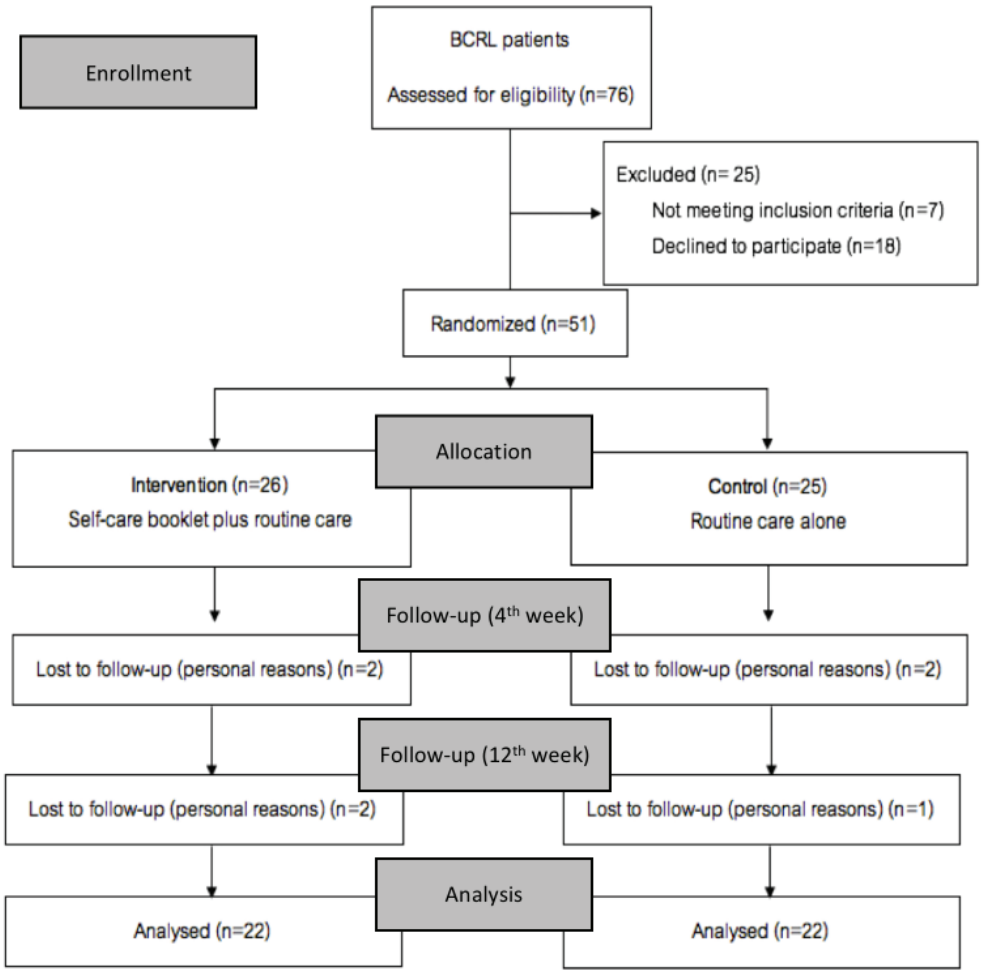

Figure 1. Trial flow

Table 1. Demographic data of participants

Characteristics	Intervention (n=26)	Control (n=25)	*p*-value
Age (years)[1]	61.6 (9.7)	60.8 (7.8)	0.755
BMI (kg/m^2)[1]	25.3 (4.2)	26.3 (9.7)	0.458
Time since surgery (months)[2]	150 (11-396)	96 (6-288)	0.127
Time since lymphedema (months)[2]	24 (2-336)	36 (2-240)	0.977
Stage of breast cancer[3]			
1	3 (12)	2 (8)	
2	3 (12)	12 (48)	
3	8 (30)	2 (8)	
No data	12 (46)	9 (36)	
Type of surgery[3]			1.000
Mastectomy	23 (88)	22 (88)	
Breast conservation surgery	3 (12)	3 (12)	
Surgery on dominant side[3]	10 (38)	10 (40)	
Affected arm[3]			
Right	10 (38)	10 (40)	
Left	16 (62)	15 (60)	
Radiation[3]	25 (96)	19 (76)	0.050
Chemotherapy[3]	21 (81)	23 (92)	0.419
Excess arm volume[1] (mL)	963.5 (435.2)	666.0 (439.6)	0.059
Range of motion[1]			
Shoulder flexion	141.3 (22.5)	146.0 (22.8)	0.467
Shoulder abduction	154.0 (27.1)	158.4 (23.1)	0.540
Elbow flexion	139.2 (8.1)	138.0 (8.7)	0.637
Lymph-ICF score[1]	25.5 (14.4)	29.0 (14.5)	0.949
Knowledge[1]	6.0 (1.8)	5.9 (1.7)	0.872

[1]Mean (standard deviation), [2]median (min.–max.), [3]n (%)

Table 2. Arm volume change

Group (n)	Week 4		Week 12		0-12 weeks	
	% Δ volume (week 4–week 0)[1]	Within group (*p*-value)[2]	% Δ volume (week 12–week 4)[1]	Within group (*p*-value)[2]	% Δ volume (week 12–week 0)[1]	Within group (*p*-value)[2]
Intervention (26)	-2.8 (-75-67)	0.041	0 (-100-211)	1.000	0 (-100-67)	0.278
Control (25)	0 (-75-78)	1.000	0 (-84-350)	1.000	0 (-92-77)	1.000
Between group (*p*-value)	0.408		0.647		0.643	

[1]Percentage change of arm volume [median (min.–max.)], [2]significance of weeks by group interaction

Table 3. Range of motion (between group comparison)

ROM	Intervention	Control	*p*-value	Intervention	Control	*p*-value	Intervention	Control	*p*-value
Shoulder flexion	141.3 (22.5)	146.0 (22.8)	0.467	147.7 (19.7)	146.8 (16.4)	0.861	155.9 (18.1)	148.2 (31.5)	0.283
Shoulder abduction	154.0 (27.1)	155.4 (23.1)	0.540	161.0 (23.1)	159.2 (20.7)	0.776	165.0 (17.4)	159.8 (21.1)	0.340
Elbow flexion	139.2 (8.1)	138.1 (8.7)	0.637	142.9 (10.7)	135.4 (11.7)	0.021	144.0 (11.5)	143.0 (14.4)	0.777

Mean (SD); No within group data here

At the end of the study, there was a significant reduction in the excess arm volume of the intervention group (p=0.041). But there was no significant difference between groups. (Table 2)

Range of motion

At the end of the study, a repeated measures ANOVA showed significant increases in shoulder forward flexion ROM (p=0.033) and shoulder abduction ROM (p=0.025) in the intervention group. But there was no significant difference between groups. Table 3 demonstrates the details of ROM of both groups at baseline, at the end of week 4, and at the end of week 12 (Table 3).

Quality of life

There was a significant difference in the physical sub-scale (p=0.046) of the Lymph-ICF questionnaire when compared between groups at week 4 (Table 4). There was also a significant increase in the movement sub-scale in the control group at week 4 when compared to baseline measure (p=0.041). No other significant difference was found.

Knowledge

There were no differences between groups for the knowledge scores. However, there were significant changes of knowledge scores between baseline vs week 4 and baseline vs week 12

Table 4. Total Lymph-ICF score and sub-scales between group comparisons

Lymph	Intervention	Control	*p*-value	Intervention	Control	*p*-value	Intervention	Control	*p*-value
Overall score	27.4 (14.7)	27.1 (15.8)	0.949	26.8 (15.8)	32.6 (21.6)	0.282	27.9 (15.5)	30.8 (24.3)	0.611
Physical	32.0 (15.6)	33.6 (20.7)	0.756	26.7 (15.1)	38.7 (25.8)	0.046	29.2 (19.9)	40.2 (26.4)	0.098
Mental	20.5 (17.7)	16.8 (15.9)	0.439	19.5 (22.7)	20.9 (26.9)	0.837	20.0 (21.4)	24.0 (30.0)	0.582
Housework	23.5 (22.2)	24.6 (25.2)	0.864	23.5 (22.1)	38.1 (31.1)	0.058	25.9 (21.5)	31.9 (26.9)	0.374
Movement	33.3 (28.6)	30.9 (20.1)	0.725	35.4 (31.0)	41.6 (25.6)	0.436	33.0 (26.6)	34.7 (28.6)	0.831
Social	27.8 (27.5)	19.4 (18.5)	0.208	28.2 (24.0)	24.5 (21.7)	0.567	29.6 (22.1)	23.9 (22.7)	0.387

Table 5. Knowledge score

Group	Week 0	Week 4	Week 12	Within group[2]		
	Knowledge score[1]	Knowledge score[1]	Knowledge score[1]	Week 0 vs 4 *p*-value	Week 4 vs 12 *p*-value	Week 0 vs 12 *p*-value
Intervention	6.0 (1.8)	7.1 (1.5)	7.1 (1.6)	0.012	1.000	0.022
Control	5.9 (1.7)	6.8 (1.8)	7.0 (1.8)	0.104	1.000	0.024
p-value	0.872	0.404	0.470			

[1]Mean (SD), [2]significance of weeks by group interaction

in the intervention group and baseline vs week 12 in the control group (Table 5).

Adverse events and overall satisfaction

There were no differences between groups in the overall satisfactions (p=0.840), adverse events (in the intervention group, 1 participant felt more heaviness and 1 participant had infection in the arm; in the control group, 5 participants felt more swelling, 2 participants felt more heaviness and 1 participant had infection in the arm) (p=0.071), and numbers of patients who received other treatments (in the intervention group, 3 participants received pneumatic compression therapy at a hospital and 1 participant had a traditional massage; in the control group, 3 participants received pneumatic compression therapy at a hospital) (p=0.691).

Discussion

We found that the first 4 weeks of using the booklet resulted in a significant reduction in affected arm volume in the intervention group, as well as improved QOL in the physical sub-scale while the control group experienced more limitation of arm movement, as implied by the significantly increased ICF score in the movement sub-scale. One study had concluded that even small changes in limb volume changes had an impact in breast cancer survivors; even a 5% volume difference was considered clinically significant with higher frequency of signs and symptoms of tenderness, tightness, swelling, heaviness and aching, when limb volume increased. These could ultimately result in significant decrements in QOL.[21] As other QOL sub-scales did not improve in the study, it is likely that the reduction in edema volume noted on the subjects using the self-care booklet would have produced symptom improvements which would likely have resulting in QOL improvements.

At the end of the study, there were also significant increases in shoulder forward flexion ROM and shoulder abduction ROM in the intervention group. There was a significant increase in elbow flexion ROM when compared between week 12 and week 4 in the control group. This significant difference might be resulted from a significant reduction of elbow flexion range of motion in the control group in week 4. This could make the change at week 12 significant.

In the aspect of knowledge of lymphedema, there seemed to be no difference among the participants in both groups in any time points. However, when compared within group, participants in the intervention group showed earlier improvements of their knowledge scores resulting in a significant higher knowledge score at the 4th week whereas no significant difference in control groupThis suggests that the self-care booklet may help developing earlier understanding of their own condition among BCRL patients. However, to generalize these results, some points need to be considered.

First, at baseline assessment, there was a significant difference in breast cancer stages of participants prior to surgery between the intervention group and the control group. A study found that the risk of lymphedema was statistically significantly higher in patients with advanced breast cancer (Stage III) than in patients with early-stage breast cancer (Stage I, II).[21] Unfortunately, 12 participants in the intervention group had no data of their stages, as most of the them had undergone surgeries at other hospitals and there were some limitations to data access. Therefore, in order to minimize the effect of baseline difference, comparison of percentage changes of excess arm volume calculated by repeated measures ANOVA was used.

Second, the intervention group had a significantly higher percentage of excess arm volume. On the contrary, the improvement turned out to be significant in this group. Moreover, there were no other significant differences between groups in other demographics or medical characteristics at baseline that could be related to the changes of the outcome measured. This could imply that the significant results were possibly reliable.

Next, besides a small sample size, we did not categorize the stages of lymphedema (stage 1 or 2) in each patient. In addition, we also recorded the compliance of the participants to their self-care routine through the worksheets in the booklets, which might not accurately have represented the actual time of the exercise, self-MLD, skin care, and pressure garment use. Moreover, the duration of the study (12 weeks) was possibly too short to yield the differences in some aspects.

In addition, some participants in the both groups received co-interventions for an example, pneumatic compression therapy. The co-intervention might interfere the outcome the study. Moreover, at the last follow-up, the compliance of participants in the intervention group to the booklet was approximately 80%. These may be contributing factors to the outcome. Further study is needed for better understanding the reason why the compliance is not good as expected.

In conclusion, we demonstrate the improved quantitative outcomes in edema volume, QOL in physical sub-scale at 4-week follow-up, better shoulder ROM after the end of the study, and better understanding of lymphedema, without increasing the risk of adverse effect, suggest that the use of the booklets may be beneficial in reducing or at least not increasing volume of arm lymphedema, as well as causes no difference in adverse effects compared to the routine treatment in women with stage 1 and 2 BCRL. A more in-depth study with higher participant numbers should be warranted.

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Disclosure

The authors declare no conflict of interest.

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