

Physical Therapy Enhances Functions and Quality of Life in Older Patients with Breast Cancer-Related Lymphedema: A Prospective Experimental Study

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ABSTRACT

Background: Lymphedema of the arm is one of the most common complications following breast cancer surgery. **Aims:** The primary aim of this study was to evaluate the effects of complex decongestive physical therapy (CDPt) on upper extremity functions, activities of daily living (ADL), and quality of life (QoL), and secondly the effects of the degree of lymphedema on post-treatment differences in older patients with breast cancer-related lymphedema (BCRL). **Subjects and Methods:** Sixty-eight patients who had BCRL were included between 2015 and 2017. Arm function was evaluated with the Constant-Murley scale, while ADL was measured with the Lawton Instrumental Activities of Daily Living Scale, and QoL was measured with the Lymphedema Functioning, Disability and Health Questionnaire as pre- and post-treatment tests. The patients underwent a CDPt program for 6 weeks. **Results:** There were statistically significant improvements for all outcome measurements in older patients with Grade 1 and 2 lymphedemas after the treatment ($P < 0.001$). The Grade 1 patients had a greater difference at mobility, participation in the life and social activities, and their total scores of quality of life had a significance level of $P < 0.001$. **Conclusion:** Older patients with Grade 1 BCRL had better mobility, participation in the life, and social activities. CDPt provides enhancement of arm functions, ADL, and QoL in older patients with breast cancer-related lymphedema.

KEYWORDS: Breast cancer surgery, complex decongestive physical therapy, elderly, lymphedema

INTRODUCTION

Lymphedema of the arm, which may occur following breast cancer surgery, is the most common complication that affects arm function and quality of life (QoL). This should be more important for older individuals whose functions have already been reduced due to the progressive physical changes they experience.^[1] Cancer is the leading cause of death in older adults aged 60–79 years. Healthy older people are able to tolerate common treatment modalities in the same way as younger patients, particularly when adequate supportive care is provided.^[2,3] However, as a consequence of breast cancer treatments, the results may include side effects such as many arm impairments including joint mobility, loss of muscle strength, pain and

lymphedema in the upper limb.^[4] Consequently, these problems lead to limitations in ADL and participation, as well as a poor QoL. Significant treatment-related upper extremity morbidity, associated activities of daily living (ADL) disabilities and decreased QoL may be observed after surgery.^[5,6]

CDPt is the gold standard in the treatment of lymphedema.^[7] Studies investigating the effects of

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CDPt at older patients are limited.^[8-10] The aim of this study was to evaluate the effects of CDPt on upper extremity functions, ADL and QoL patients with breast cancer-related lymphedema.

MATERIALS AND METHODS

Participants and study protocol

The participants were recruited among patients treated at Bezmialem Vakif University from December 2015 to December 2017. This study was managed as a non-randomized, prospective, and experimental study. A difference of 2 cm or more in the circumferential measurements between both extremities was diagnosed as BCRL by a cardiovascular surgeon. The inclusion criteria were as follows: patients aged 60–85 years with unilateral Grade 1 and 2 BCRL (a difference in circumference of up to 2 cm indicated Grade 1 lymphedema; a difference of 2–5 cm showed Grade 2 lymphedema) following their mastectomy and with a duration of at least 3 months. Active infections, Grade 3 BCRL, severe cardiac diseases and chronic musculoskeletal diseases affecting upper extremities constituted the exclusion criteria. All participants were informed about the study, and they signed an informed consent form. The Institutional Ethics Committee approved this study (09/12/2015-580), which was performed in accordance with the ethical principles for human research as outlined by the Second Declaration of Helsinki.

Assessment and outcome measurement

Patient characteristics; age, body mass index (BMI), effected side, dominant side, lymphedema duration, comorbid diseases, characteristics of breast cancer; type of surgery (modified radical mastectomy, breast conserving surgery) were recorded.

Circumferential measurements

The affected and unaffected upper extremities of the patients were measured with a standard one inch, retractable and fiberglass tape. The measurements were taken at 13 points on the arm; the first point was the top of the third finger, and then, this was followed by further points at 4-cm intervals along the arm. The extremity volume was calculated by Khunke's disc method. The efficacy of treatment intervention was quantified as the percentage reduction of excess volume (PREV), calculated as follows: $PREV = 100 \times (V_{pre} - V_{post}) / V_{pre}$. V_{pre} ; pre-treatment arm volume; V_{post} ; post-treatment arm volume.

The Constant-Murley Score

The Constant-Murley Score has four subscales including pain (15 points maximum), activities of daily living (20 points maximum), range of motion (ROM, 40 points maximum),

and strength (25 points maximum). The total score ranges from 0 to 100, with a higher score indicating a higher quality of functioning.^[11]

The Lawton Instrumental activities of daily living scale (ADL)

The Lawton Instrumental ADL Scale is mostly useful for identifying how a person is functioning at the present time and identifying improvement or deterioration over time.^[12] Women are scored on all 8 areas of function, while historically, for men, areas of food preparation, housekeeping, laundering are excluded. Participants are scored according to their highest level of functioning in a category. A summary score ranges from 0 (low function, dependent) to 8 (high function, independent) for women, and 0 through 5 for men.

Lymphedema functioning, disability and health questionnaire (Lymph-ICF)

QoL of life was measured using the condition-specific Lymphedema Functioning, Disability and Health Questionnaire (Lymph-ICF).^[13] The questionnaire was developed to assess QoL specific to lymphedema and monitor the progress of treatment on the function and symptoms that are related to lymphedema, as well as assessing activity limitations and participation restrictions. The Lymph-ICF questionnaire consists of 29 questions. Lymph-ICF has 5 domains: physical function, mental function, household activities, mobility activities and life and social activities. The total score of Lymph-ICF is equal to the sum of the scores of the questions divided by the total number of answered questions.

Treatment protocol

All participants underwent CDPt for 6 weeks, and the one-session treatment protocol was as follows; meticulous skin care every day, which can optimize the normal tissue. MLD begins with stimulation of the lymph vessels and nodes in unaffected and opposite lymph nodes (neck, contralateral axilla, ipsilateral groin). MLD was carried out by a certified physiotherapist two times a week for 6 weeks. An MLD session lasted 30 min. Multilayer low-stretch bandaging was applied immediately following MLD. Bandages were worn 12 h/day throughout the therapy, removed at night and reapplied every morning, 7 days a week. Family members were taught this method on the first day by using videos of bandaging techniques and asked to perform the procedures on the days they did not attend the therapy sessions. The bandaged patient was then guided through exercises involving active range of motion for muscle and joint functioning. Shoulder abduction–adduction, flexion–extension, internal–external rotation, elbow flexion–extension, supination–pronation, posture corrections were repeated 10 times

in each session and twice daily. All exercises were performed with deep breathing exercises.

Statistical analysis

The data were evaluated using the Statistical Package for the Social Sciences (SPSS) v. 22.0 for Windows and by analyzing descriptive statistics [frequency, mean, and standard deviation (SD)]. Power analysis was performed to determine the sample size at the beginning of the study, considering Constant-Murley Score, which focuses on upper extremity function, with a minimum significant clinical change score of 17 using the Raosoft sample size calculator, it was calculated that

at least 45 patients must be assigned the study. Before the statistical analysis, all the variables cohered to normal distribution ($P > 0.05$) according to the normal probabilistic plot and Kolmogorov–Smirnov test. Clinical and demographic characteristics of the patients mean and standard deviation values were calculated. Student's *t*-test was used to compare the pre- and post-treatment values in the results measurements. A paired-samples *t*-test was used to determine the effects of the therapy program. Independent-samples *t*-test was used to compare the Constant-Murley scores, ADL scores and Lymph-ICF scores between patients with different grades. A significance level of $P < 0.05$ was accepted.

RESULTS

Baseline characteristics

Initially, a total of 68 eligible patients were included in this study. Nineteen patients dropped out from the study (5 patients from lymphangitis, 4 patients from severe heart failure, 3 patients from uncontrolled hypertension, 2 patients from painless fibromyalgia, and 5 patients from transfer problems), and a total of 49 patients completed the study. The demographic and clinical characteristics of the patients are presented in Table 1. All patients were over 60 years old and 73.5% were Grade 2 lymphedema patients. Hypertension (30.6%), diabetes mellitus (32.7%), cardiac disease (12.2), thyroid disease (28.6%), vascular disorder (10.2%), kidney disease (6.1%), and allergies (28.6%) were included among the comorbidities.

Changes in QoL

Table 2 presents the mean pre-treatment and post-treatment values and the changes in outcome measures at the end of the CDPt program. There were statistically significant improvements for all outcome measures after the treatment. For the Lawton Brody ADL measurements, there were statistically significant

Table 1: Clinic and demographic characteristics of patients

Demographic/clinic characteristics	mean (SD)/n (%)	min-max
Age (year) mean (SD)	68.79 (5.39)	60-81
BMI (kg/m ²) mean (SD)	35.94 (5.13)	25.97-48.08
Lymphedema duration (month) mean (SD)	23.79 (14.68)	11-80
Time from surgery (months) mean (SD)	67.4 (28.6)	
Lymphedema grade		
Grade 1 n (%)	13(26.5)	
Grade 2 n (%)	36(73.5)	
Dominant side R/L, n (%)	44/5 (89.8/10.2)	
Effected side R/L, n (%)	23/26 (46.9/53.1)	
Operation type		
MRM+ALND n (%)	26 (53.1)	
BCS+SLNB n (%)	23 (46.9)	

SD=standard deviation, BMI=body mass index, F=female, M=male, R=right, L=left, min=minimum, max=maximum, MRM=modified radical mastectomy, BCS=breast conserving surgery, ALND=axillary lymph node dissection, SLNB=sentinel lymph node biopsy

Table 2: Mean pre- and post-treatment values and P values for outcome measurements

Outcome measurements	pre-treatment mean (SD)	post-treatment mean (SD)	<i>t</i>	<i>p</i>
Volume (ml)	3787.61 (976.63)	2618.35 (823.99)	18.42	0.001
Constant-Murley Score	58.92 (10.05)	74.29 (8.70)	-27.59	0.003
ADL Total	5.26 (1.05)	6.20 (0.93)	-8.48	0.002
Lymph ICF				
Physical Function	45.07 (23.84)	37.14 (18.33)	4.84	0.001
Mental Function	44.79 (30.16)	37.05 (24.13)	3.11	0.003
Household activities	35.98 (27.69)	30.01 (21.52)	4.59	0.001
Mobility activities	26.76 (19.63)	21.11 (15.38)	3.75	0.001
Life and social activities	36.92 (21.97)	29.95 (18.13)	5.44	0.002
Total Score	36.56 (17.07)	28.57 (12.73)	5.51	0.001

ADL=activities of daily living, SD=standard deviation.

Table 3: The percentage reduction of excess volume

Lymphedema grade	PREV mean (SD)	<i>p</i>
Grade 1 (<i>n</i> =13)	31.39 (9.74)	0.634
Grade 2 (<i>n</i> =36)	29.30 (9.01)	

PREV=percent reduction of excess volume.

Table 4: The impact of lymphedema grade on improvement in function, ADL and quality of life scores

	Grade 1 mean (SD)	Grade 2 mean (SD)	<i>p</i>
Constant-Murley score	16.41 (18.09)	11.73 (19.85)	0.13
ADL score	1.0 (0.81)	0.91 (0.76)	0.74
Lymph-ICF			
Physical Function	10.67 (12.41)	7.04 (10.53)	0.34
Mental Function	10.62 (25.92)	6.80 (12.80)	0.51
Household activities	3.91 (8.01)	6.63 (8.95)	0.37
Mobility activities	11.72 (18.34)	3.68 (4.21)	0.02
Life and social activities	10.89 (10.50)	5.69 (4.29)	0.01
Total Score	11.89 (16.46)	6.68 (5.67)	0.01

ADL=activities of daily living.

negative changes among the participants ($P < 0.001$). At the same time, significant improvements were observed in physical function, household activities, mobility activities, life and social activities and mental function parameters of the Lymph ICF questionnaire after the treatment. Moreover, significant changes were observed in the volume measurements of the lymphedema patients after the treatment ($P < 0.001$). No adverse events occurred during the treatment period in this study. The percentage of excess volume reduction is shown in Table 3. There was no statistically significant difference between the percentage of volume reduction in grade 1 and grade 2 patients ($P > 0.05$). The impacts of lymphedema grade on improvement in the Constant-Murley scores (flexion, abduction, internal and external rotation range of motions), ADL scores and Lymph-ICF scores were also evaluated. The Grade 1 patients had greater difference in mobility, participation in life and social activities and total score of quality of life respectively by significance levels of $P = 0.02$, $P = 0.01$, and $P = 0.01$ [Table 4].

DISCUSSION

In this study, the CDPt effects were found higher in terms of mobility and participation in life and social activities among the patients with Grade 1 BCRL. This study was undertaken to examine whether or not QoL was improved in BCRL following 6 weeks after CDPt and whether or not limb volume changes were associated with any detected changes in QoL.

We noted that the extremity volumes decreased from 3787.61 ± 976.63 ml at the baseline to 2618.35 ± 823.99 ml in 6 weeks. PREV was 31.39% among the Grade 1 BCRL patients. The percentage reduction in the lymphedema volume varied from 20% to 80% in previous studies.^[10,14] Johansson *et al.* examined the effects of low stretch compression bandaging alone or in combination with MLD in 38 female patients with arm lymphedema after treatment for breast cancer.^[15] They reported that low stretch compression bandaging is an effective treatment for reduction of volume from slight to moderate level of lymphedema for the treatment of breast cancer. In their study, the mean lymphedema duration of the patients was 6 months, but our patients' mean lymphedema duration was higher (23.79 months). Hutzschenreuter *et al.* showed that MLD combined with low stretch compression bandaging decreased arm lymphedema volume by 20% as similar to our results.^[16] Butt *et al.* enrolled 15 patients who were given compression therapy alone and 15 patients who were provided with compression therapy along with exercise, and the excess total limb volume decreased in both groups.^[17] The results of different therapy modalities were compared in the literature review for patients with BCRL, but all treatments had different positive effects.

Arm functions, ADL, and QoL were adversely affected in older patients.^[18] In the literature, most studies emphasized that a majority (70%) of breast cancer survivors are overweight or obese, putting most survivors at greater risk for cancer recurrence, cardiovascular disease, diabetes, and overall poorer QoL.^[19] Older individuals are less active in their daily lives, and for this reason, their BMIs may rise.^[20] In our study, the mean BMI of the patients was very high (35.94 ± 5.13), and there were many comorbid diseases.

In the case of lymphedema patients, the loss of functions is a reason for disability. Previous studies in the literature showed that a person with upper extremity lymphedema has much lower ROM, pain, and stiffness than a person without upper extremity lymphedema.^[21] In the vast majority of studies in the literature, there were different rates of shoulder ROM restrictions on the dominant side, but it was very difficult to compare the results due to differences in surgical techniques, differences in RT administration areas and doses, definitions of restriction and differences in evaluation time. In our study, we evaluated the degree of ROM and muscle strength with the Constant-Murley score. The low scores of the patients improved significantly after 6 weeks of CDPt. This led to the patients' heightened usage of their arms in ADL with decreasing arm lymphedema volume. The ADL scores of the patients also increased significantly at the same time.

Previous studies on the effectiveness of treatment for BCRL found that CDPt was effective,^[21,22] but an isolated study with an older sample was not found. Our patients also had chronic BCRL, but having chronic lymphedemas and being older did not adversely affect the treatment responses. Zasadzka *et al.* investigated the effects of compression bandage versus CDT for 26 weeks of therapy with 51 women and included 103 patients aged ≥ 60 years with unilateral lower limb lymphedema.^[21] They mentioned compression bandaging as a vital component of CDT. MLD requires a trained physiotherapist, and it should be considered that older patients cannot come to the hospital every day. We taught this method to the patients' families so that compression bandages were being applied every day in our treatment method.

The QoL of the patients after breast cancer treatment was affected negatively. In the results of a study which aimed to determine the QoL of patients with breast cancer, it was stated that the most common problems for the patients were pain and fatigue, as well as nausea, loss of appetite, alopecia, dyspnea, vomiting, insomnia, heartburn, digestive problems, visual loss and headache. All these problems lead to difficulties in the functional life of individuals with cancer.^[22] Rietman *et al.* compared the QoL of healthy controls to that of patients who underwent breast cancer surgery and reported that the quality of life, physical function, energy and general health scores of the patients who underwent surgery decreased significantly.^[23] In our study, in parallel to their study, the mean scores of the physical components of Lymph-ICF, which were found to be low before treatment for both groups, were significantly improved after the treatment. Exercise, which is one of the components of CDPt, contributed to the mobility of the patients. Additionally, with the reduction of the arm volume, the women were able to move more easily. However, the differences in mobility and participation in life and social activities mostly increased after treatment. This is very important for older individuals.

In the literature, many studies revealed positive effects of CDPt on QoL in upper limb BCRL. Not only lymphedema, but also arm/shoulder pain and limited mobility were significantly associated with poor QoL in chronic BCRL. These problems should be treated to improve QoL. Limited arm functions may adversely affect the daily life activities in older patients. The Lymph-ICF questionnaire is the most complete and accurate questionnaire in the assessment of QoL in patients with BCRL, because this questionnaire assesses the largest number of QoL domains and is specific for arm symptoms.^[24]

The first limitation of this study was no control group that included individuals who were treated due to ethical principles. There was no follow-up to observe the long-term effects of this method. Future studies are required to evaluate the outcomes of a unified plan of treatment in a specific population for greater generalizability of the outcomes. The strengths of the study were that the treatments in the seasons were carried out by the same physiotherapist, and in the recent literature, the number of studies conducted with only older samples is very limited, and there are no studies examining the quality of life and ADL of such patients. In most studies, the effectiveness of this treatment method was presented in a wide range of age, while our study was carried out with an older group. This study is a preliminary study for future studies. The benefit CDPt in older patients was presented by the outcome measurements that were used. Future research aims to develop multidimensional randomized intervention programs on large samples to improve the quality of life of older patients with BCRL.

CONCLUSION

CDPt enhances arm functions, ADL, and QoL in older patients with Grade 1 and Grade 2 BCRL. Grade 1 BCRL patients also had greater difference in their QoL scores, especially in terms of mobility, participation in life and social activities and the total score of QoL.

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Conflicts of interest

There are no conflicts of interest.

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