

Comparing the Effect of Complex Decongestive Physical Therapy with Combination of Intermittent Pneumatic Compression Pump and Complex Decongestive Physical Therapy on Secondary Upper Extremity Lymphedema Volume and Quality of Life in Patients with Breast Cancer

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ARTICLE INFORMATION

Article Chronology:

Received: 06.06.2016

Revised: 12.08.2016

Accepted: 18.09.2016

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ABSTRACT

Introduction: Breast cancer is one of the most common cancers among women. One complication after mastectomy following breast cancer is ipsilateral upper extremity lymphedema. This study aims to compare the effect of complex decongestive physical (CDP) therapy with a combination of intermittent pneumatic compression pump and CDP therapy on secondary upper extremity lymphedema volume and quality of life in patients after mastectomy following breast cancer.

Material and Methods: A total of 20 women with secondary upper extremity lymphedema after mastectomy following breast cancer were selected according to criteria. After the initial assessment, the patients were randomly divided into two groups. One group was treated with CDP therapy techniques, and another group was treated with intermittent compression pump in addition to CDP therapy techniques. These techniques were included manual lymphatic drainage, bandaging, therapeutic exercise, skin care, and intermittent compression pump. Patients were treated for 2 weeks and 5 days/week. Lymphedema volume and quality of life were evaluated before and after treatment. The quality of life was assessed by cancer-specific questionnaire (QLQ-C30) and breast cancer-specific quality of life questionnaire (QLQ-Br23), and lymphedema volume was measured by volumeter.

Results: The mean of lymphedema volume was significantly decreased after treatment as compared with before treatment in both groups ($P < 0.050$). The scores of all items of quality of life except of cognitive and sexual items of both questionnaires were significantly increased after treatment as compared with before treatment in both groups ($P < 0.050$). There was no significant difference in lymphedema volume and quality of life scores between two groups ($P > 0.050$).

Conclusion: The results of this study showed that the combination of CDP therapy and intermittent compression pump are useful for improving the affected limb lymphedema volume and quality of life.

Keywords: Upper extremity lymphedema; Complex decongestive physical therapy; Intermittent compression pump; Quality of life

Citation: Bagheri H, Arab-Kheradmand A, Montazeri A, Razavi F, Mousavi S, Nafissih S. Comparing the Effect of Complex Decongestive Physical Therapy with Combination of Intermittent Pneumatic Compression Pump and Complex Decongestive Physical Therapy on Secondary Upper Extremity Lymphedema Volume and Quality of Life in Patients with Breast Cancer. J Mod Rehab 2016; 10(3): 104-9.

Introduction

The breast cancer is one of the most common cancers among women. Lymphedema is one of the most serious and predominant complication of breast cancer which leads to psychological and functional disabilities in patients with breast cancer (1-4).

Lymphedema is a chronic disease of the lymphatic system, which is caused by a blockage or disruption in the flow of lymph fluid. Impaired lymph flow leads to accumulation of protein-rich fluid and thus leading to swelling of the involved extremities (5).

In recent years, the survival rate of patients with breast cancer is constantly increasing due to development in surgical treatment, chemotherapy and as well as detection of the disease in the less advanced stage.

All factors such as the removal of axillary lymph nodes, axillary radiation therapy, obesity and infection of involved extremity may increase the risk of lymphedema, and this has led to the loss of the patient's social abilities (6).

Therefore, it is necessary to reduce the incidence of lymphedema and even in patients with lymphedema apply proper treatment to reduce the negative effects of lymphedema on quality of life (7).

Complex decongestive physical (CDP) therapy is known as an international standard approach for lymphedema treatment. These techniques include manual lymphatic drainage, compression bandaging, exercise, and skin care. Pneumatic pump applies a gradual pressure on the lymph vessels and facilitates the lymph flow. The previous studies investigate mainly therapeutic effects of CDP therapy techniques on the changes of extremity size and lymphedema volume (8-10).

The application of intermittent pneumatic compression (IPC) as part of CDP therapy remains controversial (11).

Although current clinical studies showed that decongestive lymphatic therapy and IPC pump reduced lymphedema and improved subjective symptoms, however, quality of life should be considered following treatment protocols in the clinic (12). Therefore, the main aim of this study is to compare the effect of CDP therapy with a combination of IPC pump and CDP therapy on secondary upper extremity lymphedema volume and quality of life in patients after mastectomy following breast cancer.

Materials and methods

The study was performed at the Physical Therapy Department of Institute Cancer of Imam Khomeini Hospital between December 2015 and March 2016. Ethical approval was obtained by the Ethical Committee of the Tehran University of Medical Sciences, and all patients signed an informed consent attachment.

A total of 20 patients with breast cancer who underwent mastectomy with lymphedema on affected side introduced by a specialist surgeon according to inclusion and exclusion criteria.

Inclusion criteria: Unilateral upper extremity lymphedema after mastectomy surgery, the severity of lymphedema with Grade II, previous treatment for lymphedema, the absence of following items such as congestive heart failure, renal failure, having surgery on arm, flaccid paralysis without any nerve damage in the arms and upper limb or neck roots, malignant lymphedema, infection in the arm, taking anticoagulant drugs. Exclusion criteria were included: The return of cancer, infection in the arm, intolerable bandage, skin redness and intense itching as a result of bandages, the lack of cooperation from the patient.

This study was a randomized control trial study. For randomization, it was written group CDP and group CDP + IPC on separate sheets. Patients selected one of these sheets by chance and were classified in one of these groups. After the initial assessment, the patients of both groups were treated for 2 weeks and 5 days/week.

The treatment protocol for the first group was manual lymphatic drainage, multi-layer bandaging, exercise, and skin care.

The treatment protocol for the second group included manual lymphatic drainage therapy, multi-layer bandaging, exercise, skin care, and IPC pump.

Arm volume assessment

Limb volume was measured by water displacement using a volumeter (13) (Figure 1).



Figure 1. A volumeter to measure limb volume by water displacement

Volumetric measurement with water displacement is known as a gold standard method to estimate the size of the extremity (14).

The arm was placed in a water-filled cylinder, and the overflowing water was measured (Figure 2).



Figure 2. The arm was placed in a water-filled cylinder (volumeter) and the overflowing water was measured

For the arm measurements, subjects were instructed to lower the arm slowly into the volumeter and stop when the top of the volumeter came in contact with the axilla. At this point, a rod was placed at the level of the second and third finger web space. This rod became the stopping point that determined the depth of immersion for repeated measurements. The water flow from volumeter was measured using a graded cylinder. The same was repeated for the healthy side. The difference between the overflowing water of both arms was calculated. The volume of the involved extremity was obtained (14).

Quality of life assessment

Quality of life in patients was evaluated using two questionnaires, cancer-specific questionnaire (QLQ-C30), and breast cancer-specific quality of life (QLQ-BR23) before and after treatment. Reliability and validity of these questionnaires were conducted in Iran by Montazeri et al. (15, 16).

QLQ-C30 questionnaire (cancer-specific questionnaire) consisted of 30 questions, including functional, physical, social, emotional, and cognitive aspects (15). The scores are between 0 and 100. It is an indicator of the quality of life and higher scores reveals better condition. QLQ-BR23 Questionnaire is breast

cancer-specific quality of life that consists of 23 questions about the side effects of breast cancer treatment such as body image, sexual problems, and patients' future perspective. Answers have been ranked from 1 to 4 and the number 1 indicates a lack of problem in patients and the number 4 indicates the severity of symptoms in patients (15).

Statistical analysis was performed using paired t-test to evaluate pre- and post-treatment variables within the groups. The independent t-test was used to compare the variables between groups. The level of statistical significance was set at $P < 0.050$.

Results

The demographic variables such as age, body mass index, duration of lymphedema, and number of lymph nodes dissections were similar between two groups ($P > 0.050$) (Table 1).

The average of lymphedema volume before treatment in Groups I and II was 883 and 942 ml, respectively. In the last session, lymphedema volume in Groups I and II was decreased to 626 and 496 ml, respectively.

The mean of lymphedema volume was significantly decreased after treatment as compared with before treatment in both groups ($P < 0.050$). The scores of all items of quality of life except of cognitive and sexual items of both questionnaires were significantly increased after treatment as compared with before treatment in both groups ($P < 0.050$). There was no significant difference in lymphedema volume and quality of life scores between two groups ($P > 0.050$) (Table 2).

The mean percentage of reduction of lymphedema volume was 29.23% in Group I and 45.58% in Group II. There was a significant difference in mean percentage of reduction of lymphedema volume between two groups ($P < 0.050$) (Table 2).

Discussion

Following the use of CDP therapy techniques both alone and in combination with IPC pump, significant changes were obtained in volume of lymphedema after treatment in both groups.

Karadibak et al. used CDP therapy techniques and showed that the average lymphedema volume was reduced from 927 ml before treatment to 510 ml after treatment (17).

Table 1. Demographic characteristics of patients in both groups (mean \pm SD)

Characteristics	Group I (CDP) (n = 10)	Group II (CDP + IPC) (n = 10)	P value
Age (years)	46.20 \pm 10.97	49.20 \pm 12.42	0.570
Height (cm)	57.70 \pm 3.81	155.90 \pm 3.72	0.290
Weight (kg)	71.60 \pm 11.27	75.85 \pm 7.31	0.650
BMI (kg/m ²)	28.54 \pm 4.41	31.27 \pm 3.77	0.490
Duration of lymphedema (months)	24.00 \pm 32.11	11.40 \pm 9.19	0.250
Number of lymph node dissections	11.30 \pm 7.49	11.30 \pm 7.57	1.00

SD: Standard deviation, IPC: Intermittent pneumatic compression, BMI: Body mass index, CDP: Complex decongestive physical

Table 2. Changes in lymphedema volume and different items of quality of life scores before and after treatment

Outcome Measures	Group I (CDP) (n = 10)	Paired t-test P value	Group II (CDP+IPC) (n = 10)	Paired t-test P value	Independent t t-test P value
Lymphedema volume (ml)					
Before	883.00 ± 208.32	< 0.001*	924.00 ± 248.87	< 0.001*	0.130
After	626.00 ± 192.71		496.00 ± 183.01		
Global health status					
Before	58.33 ± 17.12	0.002*	53.33 ± 22.97	0.001*	1.000
After	76.66 ± 11.65		76.66 ± 15.61		
Physical functioning					
Before	71.33 ± 14.41	< 0.001*	69.33 ± 24.85	0.004*	0.650
After	83.33 ± 16.10		86.33 ± 18.73		
Role functioning					
Before	68.33 ± 27.72	0.090	70.00 ± 25.81	0.100	0.500
After	60.00 ± 31.37		83.33 ± 20.78		
Emotional functioning					
Before	52.50 ± 33.58	< 0.001*	60.00 ± 31.37	0.009*	0.190
After	66.66 ± 29.13		80.83 ± 14.19		
Cognitive functioning					
Before	70.00 ± 44.99	0.100	73.33 ± 23.83	0.080	0.700
After	88.33 ± 20.86		85.00 ± 18.24		
Social functioning					
Before	58.33 ± 22.56	0.002*	69.16 ± 24.23	0.007*	0.490
After	80.00 ± 20.48		86.66 ± 21.94		
Body image					
Before	55.00 ± 26.98	0.010*	45.00 ± 29.96	0.006*	0.640
After	68.33 ± 23.50		63.33 ± 24.27		
Sexual functioning					
Before	27.08 ± 37.73	0.190	18.33 ± 22.83	0.790	0.940
After	20.83 ± 29.20		20.00 ± 17.21		
Sexual enjoyment					
Before	33.33 ± 39.84	0.680	23.33 ± 22.49	0.220	0.710
After	76.66 ± 11.65		30.00 ± 17.21		
Future perspective					
Before	46.66 ± 32.20	0.720	46.66 ± 39.12	0.160	0.830
After	50.00 ± 36.00		53.33 ± 32.20		
Reduction of percentage of lymphedema	29.23% ± 12.49	-	45.58% ± 12.54	-	0.010*

CDP: Complex decongestive physical, SD: Standard deviation; *Significant value = 0.001

Uzkeser et al. (18), in 2013, conducted a study to evaluate the effect of manual lymphatic drainage and IPC pump on extremity circumference and volume of lymphedema. They statistically showed a significant decrease after treatment as compared with before treatment in both groups, but there were no significant differences in extremity circumference and volume between the two groups that corresponded with the results of this study.

The common characteristics of manual lymphdrainage technique are gentle predominantly circular stretching of the skin which has an effect on epifascial lymph vessels. Stretching of the wall of lymphangion increases lymphangion motion and lymph motion (19). In lymphedema tissue fluid steadily accumulates in the subcutaneous space containing loose connective tissue. The formation of the structure of subcutaneous collagen bundles and fat by excess fluid leads to formation of lakes and interconnected channels with irregular shape. Since there is no force that could mobilize and propel

stagnant fluid to regions where lymphatics absorb and contract, this task should be taken over by external massage. The most effective in this respect seems to be the sequential IPC (20).

In this study, the average total score of quality of life of QLQ-C30 questionnaire showed a significant increase after treatment in both groups. This questionnaire includes different items such as physical, functional, cognitive, social, and emotional. The scores of all dimensions of the questionnaire with the exception of cognitive and function scores statistically showed a significant increase after treatment compared with before treatment in both groups that reflects improvement of the quality of life in patients after treatment. There was no significant difference in total score of quality of life between two groups after treatment.

The quality of life was assessed with QLQ-BR23 questionnaire too. This questionnaire includes of body image, sexual problems (sexual function and enjoyment), and patient's future perspective. The average of body image score statistically showed a

significant increase after treatment as compared with before treatment in both groups. The average of sexual enjoyment and patient's future perspective were increased in both groups after treatment, but there were no significant differences in comparison with before treatment. There was no significant difference in the scores of different items of QLQ-BR23 questionnaire between two groups.

Karadibak et al. (17) showed that the quality of life increased after treatment with CDP therapy techniques. In this study, the patient's quality of life assessed by functional assessment of cancer therapy-breast (FACT-B+4) questionnaire. FACT-B+4 is the FACT-B+4 quality of life and were used to assess the patients who developed lymphedema after breast surgery and adjuvant radiotherapy. This questionnaire includes physical, emotional, social, and functional aspects. The greatest improvement occurred in the physical and social aspects.

Gurdal et al. (21) assessed the quality of life with QLQ-C30 questionnaire. In this study, both groups showed significant improvement in social and emotional items, but there were no significant differences in these items between two groups. The global health, functional, and cognitive scores showed significant improvement only in the group that just received CDP therapy techniques.

Lymphedema is one of the major complications of breast cancer surgery that affects the physical and psychosocial aspects of patient's life (22).

Breast cancer surgery can significantly alter body image; the swelling of the upper limb may be even more troublesome than living without the breast. Lymphedema causes arm disfigurement that could be difficult to hide, while the lack of a breast is visible only in intimate situations. Besides this, cosmetic surgery and prosthetics now make it easier to keep the lack of breast private. The visibility of lymphedema and characteristic arm garments causes women to feel different or even stigmatized. In addition, lymphedema is difficult to keep hidden and private; it frequently causes social anxiety and constantly reminds the patient of their cancer experience. Therefore, isolation may become the defense mechanism employed to avoid negative feedback. CDP therapy technique alone or in combination with IPC pumps result in volume reduction of involved extremity.

The average volume of lymphedema in involved extremity showed a greater reduction in IPC + CDP group patients, so mean score of social dimension of quality of life showed greater increase in comparison with CDP group patients; however, there was no significant difference between two groups.

Conclusion

The results of this study showed that the combination of CDP therapy and intermittent compression pump

were useful for improving the affected limb lymphedema volume and quality of life. Increase in mean global health score of quality of life and also improvement in patients' body image showed that physical therapy has an important role in the treatment of patients with breast cancer. Pneumatic pump in combination with CDP therapy techniques can have a significant role in the effectiveness of these techniques.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgement

Thanks to deputy of research of Tehran University of Medical Sciences for financial support and physical therapy staffs of the Cancer Institute of Imam Khomeini Hospital.

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