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ORIGINAL ARTICLE

Combined decongestive therapy and reduction of pain and heaviness in patients with breast cancer-related lymphedema

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Abstract

Purpose We aimed to determine the effectiveness of combined decongestive therapy (CDT) and the minimum sessions required to significantly reduce pain and heaviness in patients with breast cancer-related lymphedema.

Methods A sample of 169 patients with breast cancer-related lymphedema underwent CDT, 5 days/week for a total of 3 to 4 weeks. Self-reported pain and heaviness was quantified on a separate visual analog scale (VAS) prior to CDT and after 3, 5, 7, 10, and 15 sessions. Scores derived from VASs were categorized into three categories: mild (score < 4), moderate (score = 4–6), and severe (score > 6). Downward transition for at least one category in severity of each parameter was considered as an improvement. Repeated measure analysis of variance was conducted to test the effect of time on the severities of pain and heaviness while age, afflicted side with lymphedema, history of chemotherapy, and radiotherapy were considered as covariates.

Results The mean age of patients was 52.66 ± 12.20 years. In all 132 patients, out of 169 patients (71.3%) reported pain and 155 patients (83.7%) reported heaviness at baseline. However, after intervention, the cumulative percentage of patients with at least a one category reduction in pain and heaviness was 86.4% and 83%, respectively. At least seven sessions of CDT were shown to be sufficient in alleviating the severity of the symptoms in greater than 83% of patients.

Conclusions The combined decongestive therapy significantly reduced the intensities of pain and heaviness in patients with breast cancer-related lymphedema.

Keywords Breast cancer · Lymphedema · Pain · Combined decongestive therapy

Introduction

The prevalence of breast cancer-related lymphedema (BCRL) ranges from 8 to 44% [1–3], resulting in a high cost to patients due to the frequent number of visits for seeking treatment [4–6]. Previous reports have shown that specific symptoms associated with lymphedema, such as pain, may cause greater distress and a lower quality of life in comparison to the size or volume of the affected limb [6–8].

Patients with BCRL experience a wide range of psychological distress, physical immobility including impaired limb movement, and pain [9, 10]. In addition, BCRL can cause skin alterations, fibrosis, and heaviness in the arm [8, 11, 12]. Chronic pain in the arm may interfere with patients' abilities to follow daily routines, thus leading to disability. Recent studies showed that while there was no relationship between size or volume of lymphedema and distress [4, 13], there was a significant association between lymphedema, pain, and the level of distress experienced by patients [6]. Evidently,

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alleviating pain can improve a patient's sensation, function, and perceived quality of life.

The combined decongestive therapy (CDT) is the practice of combining treatment techniques together, including manual lymphatic drainage, bandaging, compression garments, exercise, and self-care. This method is considered as the gold standard treatment for lymphedema as it is an intensive therapy program consisting of two phases, phase I as the decongestion phase and phase II as the maintenance phase [14]. Phase I is conducted with professional therapist and that phase II involves self-manual lymphatic drainage and -reduction practices including skin care. It is also worth mentioning that CDT is not a cure for BCRL, but its main purpose is to alleviate swelling, pain, heaviness, and improve quality of life [14, 15]. Although it has been primarily developed for limb volume reduction in lymphedema patients, there are limited data in favor of its effect on pain alleviation [15, 16].

Similar to many other countries, CDT is not covered by insurance companies in Iran. Therefore, due to financial constraints, patients often fail to start or complete their required treatment procedures and had to cut short their treatment. Since pain intensity is reduced significantly during the early treatment sessions, we hypothesize that it would not be necessary for patients to continue further with volume reduction at outpatient clinics when they achieved satisfactory outcomes. As a result, those patients can undergo few number of treatment sessions to reduce pain and/or heaviness intensity and continue with self-treatment procedures for volume reduction at home at an economic cost. Thus, present study aimed to assess the effect of CDT on intensity of pain and heaviness among patients with BCRL and investigate the minimal number of CDT treatment sessions that would be required to significantly reduce the severities of the symptoms in patients with lymphedema in their ipsilateral arm after breast cancer treatment.

Methods

Design and participants

A longitudinal study was conducted at Breast Cancer Research Center (BCRC) in Tehran, Iran. From August 2015 to January 2017, patients with post mastectomy upper limb lymphedema that were referred to the lymphedema clinic for upper arm volume reductions were recruited. We included female breast cancer patients and those who clinically were diagnosed with post mastectomy secondary lymphedema of ipsilateral arm. Also, patients who had a sensation of pain and/or heaviness in the affected side were included.

The following exclusion criteria were used: breast cancer recurrence, other associated malignancies, any previous treatments for lymphedema, affliction with bilateral lymphedema, absolute contraindication for CDT (acute systemic infection, lymphangitis, erysipelas, deep vein thrombosis, congestive heart failure), presence of neuropathy in upper section of body, untreated wounds or skin diseases, as well as any known musculoskeletal disease in the upper limbs. None of the patients who fulfilled inclusion criteria was excluded from the study due to lack of financial resources. The cost of treatment for few patients who were not able to pay was completely waived.

The study flow chart is presented in Fig. 1.

Procedure

All patients were visited by a CDT certified physician. Demographic and clinical data were obtained from patients' medical records. The first phase of CDT, known as the therapeutic phase, was performed on a daily basis (5 days/week) for 3 to 4 weeks, giving a total of 15 to 20 sessions. However, if during the sessions, patients' pain or heaviness severity was entirely relived, the sessions were ceased. Each session consisted of 40 min of Dr. Vodder's method of manual lymph drainage [17] performed by a trained therapist followed by appropriate skin care procedures and moisturization. Multilayer short stretch bandaging was applied using Lohmann and Rauscher's compression bandaging [Lohmann & Rauscher GmbH & Co. KG, Rengsdorf, Germany and Vienna, Austria]. All patients were instructed to practice remedial exercises of their upper extremities at least two times per day with their bandages on at home. Remedial exercises were given with diaphragmatic breathing exercises in between. The patients sat comfortably, relaxed, place their hands over their abdominal muscles, and took deep breaths through the nose followed by prolonged expiration through the mouth without any strenuous effort. The following order was adopted for remedial exercises: protraction, depression, shoulder extension, elbow flexion and extension, wrist flexion and extension, and ball squeeze.

Patients' education regarding at-home exercise was provided once at first visit and continued if patient experienced any difficulties.

Measures

1. A 100-mm visual analog scale (VAS) [18] was used to determine the severity of pain and heaviness. Patients quantified their pain and heaviness sensations on two separate VAS rating on a scale ranging from 0 to 10, with 0 being none and 10 being most severe. The VAS was completed in the first day prior to commencing the CDT program with similar subsequent forms being completed after the 3rd, 5th, 7th, 10th, and 15th sessions in a 3-week period. The severity of pain and heaviness was categorized into three severity groups based

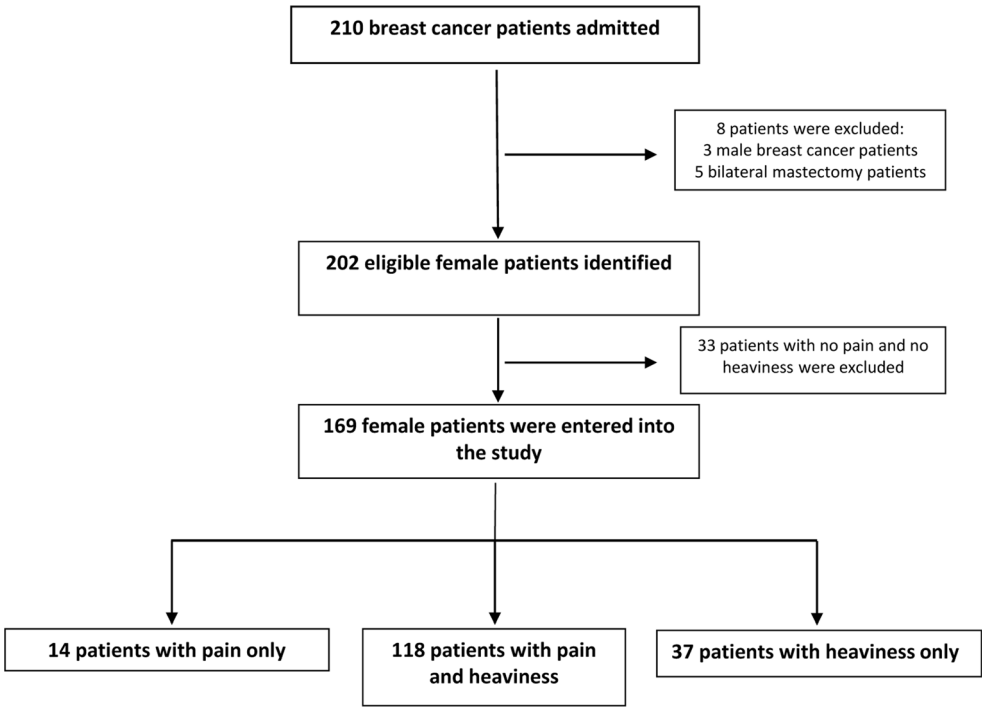

Fig. 1 Flowchart for data collection process from 2015 to 2017

on baseline scores (mild: < 4, moderate: 4–6, and severe: > 6) [18]. Downward transition for at least one category in the severity of each parameter (that are severe to moderate, moderate to mild, and mild to none) was considered as a clinically important improvement [19].

2. Limb volumes for both arms were measured before initiation of CDT and at the end of treatment for each patient. Volume was measured using water displacement method by placing the arm in a column of water to a depth of 15 cm above the elbow and the volume difference between two arms were recorded.

Statistical analysis

Descriptive analyses, including frequencies, means, and standard deviations, were used to explore the data. Repeated measure analysis of variance was conducted to test the effect of time on the severities of pain and heaviness while age, afflicted side with lymphedema, history of chemotherapy, and radiotherapy were considered as covariates. Comparisons between two measurements were performed with Wilcoxon signed ranks. Bonferroni adjusted p value was set to 0.0025. Statistical analyses were conducted using SPSS Version 18.0 (PASW Statistics for Windows, Chicago).

Results

All 169 patients with pain and/or heaviness were studied. Of these, 14 had pain only, 37 had heaviness only, and 118 had both pain and heaviness. Demographic and clinical characteristics of patients are summarized in Table 1. Overall, 133 patients received 15 or more sessions. The remaining patients received less than 15 sessions since in these patients, volume difference between the two arms became very small and the severity of their pain or heaviness reached to zero before completion of sessions.

Assessment of pain

Varying degrees of pain were reported by 132 (65.3%) patients. Repeated measure analysis revealed a significant effect of time of treatment on pain intensity (p value < 0.001, Table 2). Age, side afflicted with lymphedema, chemotherapy, and radiotherapy all did not interact with the effect of the number of treatments received and the intensity of pain felt. Prior to CDT, 97/132 (73.5%) indicated moderate or severe pain in their affected arm. This value decreased to 58.3%, 40.92%, 25%, 10.6%, and 3% after 3, 5, 7, 10, and 15 treatments, respectively.

According to Table 2, the median pain score was reduced from 5 to 4 after three treatments and decreased even further to a value of 1 after seven treatments and zero after ten treatments. Figure 2 depicts the cumulative percentage of patients who reported a reduction in pain intensity of at least one grade during their CDT sessions. The frequency of patients reporting at least a one grade reduction in pain increased continually from the first to the 15th session. As shown in Fig. 2, after five sessions, pain reduction was noticeable in 64.4% of patients, and after seven sessions, this percent was increased to

Table 1 Demographic and clinical characteristics of patients

	Total $n = 169$	Patients with pain $n = 132$	Patients with heaviness $n = 155$
Age, years	52.66 ± 12.20	52.24 ± 12.06	52.79 ± 12.29
Side of mastectomy, %			
Right	79(46.7)	63(47.7)	72(46.5)
Left	90(53.3)	69(52.3)	83(53.5)
Chemotherapy			
Yes	147(87.6)	115(87.1)	137(88.4)
No	5 (3)	5 (3.8)	4(2.6)
Radiotherapy			
Yes	141(83.4)	116(78.9)	129(83.2)
No	4(2.4)	4 (3)	3 (1.9)
Interval between surgery and admission, months	27.1(12.4, 57.5)	23.4(12.5, 46.7)	27.8(12.4, 61.3)
Excess volume in affected arm before CDT, ml	910(463, 1271)	863(376.6, 1169)	942(502, 1318)
Excess volume in affected arm after CDT, ml	251(94, 471)	219(62.8, 408)	314(112, 502)
Pain			
No	37(21.9)	–	37(23.9)
Mild	35(20.7)	35(26.5)	28(18)
Moderate	47(27.8)	47(35.6)	44(28.4)
Severe	50(29.6)	50(37.9)	46(29.7)
Heaviness			
No	14(8.3)	14(10.6)	–
Mild	23(13.6)	16(12.1)	23(14.8)
Moderate	61(36.1)	44(33.3)	61(39.4)
Severe	71(42)	58(43.9)	71(45.8)

CDT combined decongestive therapy

Categorical variables are presented as a number (%), and continuous variables are presented as mean ± standard deviation, or median (1st, 3rd percentile)

86.4%. Upon completion of 15 sessions, pain reduction was reported by 97.6% of patients.

Assessment of heaviness

From the 169 patients, 155 (92%) reported heaviness in various degrees. Out of 155, a total of 121 (78%) reported moderate or severe heaviness. Through repeated measure analysis, there was a significant reduction in heaviness during treatment course (p value < 0.001), as illustrated in Table 3. Age, side afflicted with lymphedema, past treatments of chemotherapy, or radiotherapy did not influence the effect of treatment numbers on pain reduction. The percentages of patients with moderate or severe heaviness prior to CDT (78%) decreased to 69.7%, 54.8%, 33.6%, 17.4%, and 3.2% after 3, 5, 7, 10, and 15 treatments, respectively.

Figure 3 presents the cumulative percentage of patients who reported at least a reduction of a grade of 1 in their intensity of heaviness felt. Majority of patients reported a noticeable reduction in heaviness as the number of CDT sessions progressed from one to 15 treatments. After 5 sessions, 53.5% of patients had a reduction of one grade in heaviness, while after 7 and 15 treatments, 83% and 97.9% of subjects reported such reductions, respectively.

Table 2 Result of one-way repeated measure analysis of variance to test the effect of treatment numbers on pain and heaviness intensity

	Pain score $n = 132$ Mean ± SD	Heaviness score $n = 155$ Mean ± SD
Before treatment	5.76 ± 2.73	6.44 ± 2.60
3 sessions	4.16 ± 2.61	5.03 ± 2.75
5 sessions	3.10 ± 2.50	3.88 ± 2.59
7 sessions	2.06 ± 2.19	2.63 ± 2.28
10 sessions	1.16 ± 1.74	1.65 ± 1.85
15 sessions	0.48 ± 1.14	0.72 ± 1.32
P value	< 0.001	< 0.001

Discussion

The findings indicated that a considerable number of breast cancer patients with lymphedema suffer from pain and

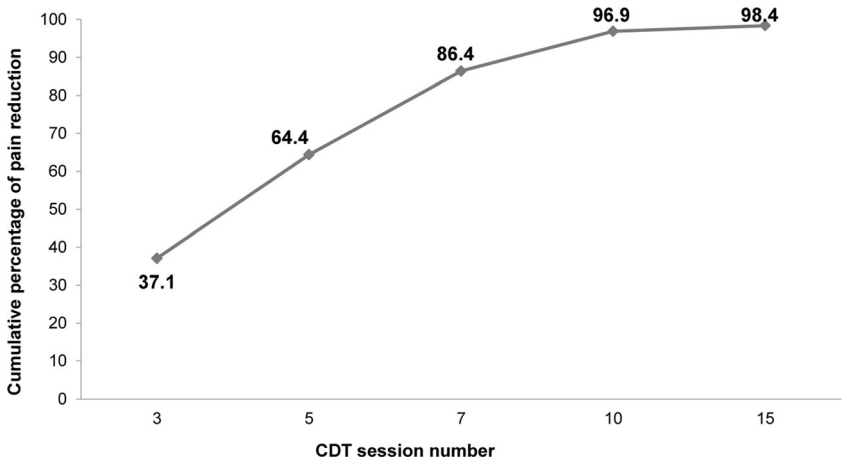

Fig. 2 Cumulative percentage of patients reporting at least a one grade improvement in pain intensity during CDT sessions

heaviness. Treatment of BCRL using CDT not only significantly reduced limb volume, but also the intensity of pain and heaviness experienced from early on during treatment. Based on our data, a large percentage of patients experienced at least a single-grade reduction of pain and heaviness after seven sessions of treatment of CDT.

To the best of our knowledge, the current research is the first longitudinal study that investigates the effect of CDT on intensity of pain and heaviness during the early periods of therapy. The intensity of pain and heaviness progressively improved after CDT sessions in 98% of BCRL patients. Similar findings were reported by other investigators [9, 15, 16, 20] where for instance, a study by Hamner et al. [15] reported that after treatments, pain intensity was reduced from 6.9 to 1.1 on the VAS. However, our study not only confirms their findings in illustrating the effect of CDT in controlling pain, but also addresses the minimal number of treatments required to sufficiently reduce the severity of the pain.

Since CDT tends to be time-consuming and requires the patient's cooperation throughout treatment phases, it is important for both the therapist and the patient to be assured that the pain will reduce soon after starting treatment. Although CDT can result in a marked decrease in volume and percentage of lymphedema, it takes at least 3 weeks for any noticeable results to occur. Meanwhile, pain intensity reduction during the early sessions can diminish patients' distress and improve their compliance. The results depict that after five treatment sessions, pain intensity and heaviness was decreased by at least one category (severe to moderate or moderate to mild) in 64.4% and 53.5% of patients, respectively. These figures were elevated after the 7th session to 86.4% of subjects for pain and 83% for heaviness. This suggests that if the therapy continues for at least seven treatments, the majority of patients would feel a significant decline in the two symptoms, which can improve associated depressive symptoms and encourage patients to successfully complete their CDT course.

Certain patients in our clinic were unable to pay the fee for CDT and have to cut short their treatment despite the fact that in BCRC lymphedema clinic, patients are charged at a very low cost compared to the other centers. Patients with BCRL suffering from pain and who could not afford to pay for the full treatment course were still able to benefit from the minimal number of sessions and observe improvement in pain and

Table 3 Changes in severities of pain and heaviness from one to ten sessions of CDT

	Pain score			Heaviness score		
	n	Median (1st, 3rd quartile)	*p**	*n*	Median (1st, 3rd quartile)	*p**
Before CDT	132	5(3, 8)	–	155	6(5,9)	–
3 sessions	132	4(2, 6)	< 0.0001	155	5(3,7)	< 0.0001
5 sessions	132	3(1, 5)	< 0.0001	155	4(2,6)	< 0.0001
7 sessions	128	1(0, 4)	< 0.0001	152	3(0,4)	< 0.0001
10 sessions	120	0 (0, 2)	< 0.0001	147	0(0,3)	< 0.0001
15 sessions	105	0 (0, 0)	< 0.0001	132	0(0, 1)	< 0.0001

CDT combined decongestive therapy, *SD* standard deviation

*Each *p* value is for a comparison between two measurements. Comparisons were performed using Wilcoxon signed rank test with Bonferroni was adjusted value set to 0.0025

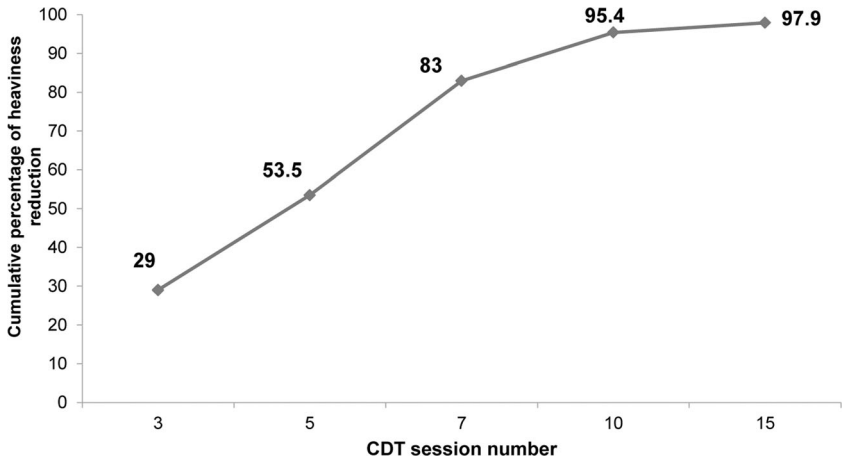

Fig. 3 Cumulative percentage of patients reporting at least a one grade improvement in heaviness intensity during CDT sessions

heaviness sensed after just seven treatments at the outpatient clinic. After significant reduction of pain, patients were enabled to continue self-treatment procedures and follow in-home programs [16] more effectively while gaining maximum volume reduction of the arm. This strategy not only can reduce the cost of treatment, but also may possibly persuade insurance companies to at least cover a small portion of the CDT sessions for patients with pain.

Strengths and limitations

The main strength of the current study was its longitudinal design and its discrete measurements of pain and heaviness throughout the CDT course. Moreover, assessing the impact of the number of treatments on patients' experience of pain and heaviness was an additional strength to the study. In the BCRC lymphedma clinic, CDT was performed by two well-trained therapists under the supervision of a lymphologist. However, similar to many studies, our study also suffers from certain limitations. One caveat is that we did not consider how long patients had lymphedema and the duration of the pain felt. In addition, the possible effect of lymphedema stage (I, II, and III) on the pain severity was not assessed. These would have shed light upon the possible interaction of chronic pain and any changes in its intensity while undergoing CDT. Moreover, we did not include the use of painkillers by patients. However, most patients with pain had already tested multiple painkillers but with little success, and so were referred to our clinic not only for volume reduction, but for pain alleviation as well.

Conclusions

The findings indicated that CDT could reduce the intensity of pain and heaviness in breast cancer patients who suffer from lymphedema. According to our results, it seems that with seven sessions of treatments, a vast majority of patients might benefit from a clinically important improvement. This would allow patients to still reap the health benefits of CDT at a lower cost and allow for better adherence to self-treatment strategies.

Compliance with ethical standards The study was approved by the BCRC's review board and the ethics committee of the Academic Center for Education, Culture and Research (ACECR). All participants completed the informed consent form.

Conflict of interest The authors declare that they have no conflicts of interest.

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References

1. Lopez Penha TR, Slangen JJ, Heuts EM, Voogd AC, Von Meyenfeldt MF (2011) Prevalence of lymphoedema more than five years after breast cancer treatment. Eur J Surg Oncol 37:1059–1063. https://doi.org/10.1016/j.ejso.2011.09.001
2. Paiva DM, Rodrigues VO, Cesca MG, Palma PV, Leite IC (2013) Prevalence of lymphedema in women undergoing treatment for breast cancer in a referral center in southeastern Brazil. BMC Womens Health 13:6. https://doi.org/10.1186/1472-6874-13-6
3. Miller CL, Specht MC, Skolny MN, Horick N, Jammallo LS, O'Toole J, Shenouda MN, Sadek BT, Smith BL, Taghian AG (2014) Risk of lymphedema after mastectomy: potential benefit of applying ACOSOG Z0011 protocol to mastectomy patients. Breast Cancer Res Treat 144:71–77. https://doi.org/10.1007/s10549-014-2856-34
4. Shih YC, Xu Y, Cormier JN, Giordano S, Ridner SH, Buchholz TA, Perkins GH, Elting LS (2009) Incidence, treatment costs, and complications of lymphedema after breast cancer among women of working age: a 2-year follow-up study. J Clin Oncol 27:2007–2014. https://doi.org/10.1200/JCO.2008.18.3517
5. McWayne J, Heiney SP (2005) Psychologic and social sequelae of secondary lymphedema: a review. Cancer 104:457–466. https://doi.org/10.1002/cncr.21195
6. Teo I, Novy DM, Chang DW, Cox MG, Fingeret MC (2015) Examining pain, body image, and depressive symptoms in patients

with lymphedema secondary to breast cancer. Psycho-Oncology 24:1377–1383. https://doi.org/10.1002/pon.37457
7. Pyszel A, Malyszczak K, Pyszel K, Andrzejak R, Szuba A (2006) Disability, psychological distress and quality of life in breast cancer survivors with arm lymphedema. Lymphology 39:185–192
8. Newman ML, Brennan M, Passik S (1996) Lymphedema complicated by pain and psychological distress: a case with complex treatment needs. J Pain Symptom Manag 12:376–379
9. Sitzia J, Sobrido L (1997) Measurement of health-related quality of life of patients receiving conservative treatment for limb lymphoedema using the Nottingham health profile. Qual Life Res 6:373–384
10. Ahmed RL, Prizment A, Lazovich D, Schmitz KH, Folsom AR (2008) Lymphedema and quality of life in breast cancer survivors: the Iowa Women's health study. J Clin Oncol 26:5689–5696. https://doi.org/10.1200/JCO.2008.16.4731
11. Moffatt CJ, Franks PJ, Doherty DC, Williams A, Badger C, Jeffs E, Bosanquet N, Mortimer P (2003) Lymphoedema: an underestimated health problem. Qjm 96(10):731–738
12. Passik SD, McDonald MV (1998) Psychosocial aspects of upper extremity lymphedema in women treated for breast carcinoma. Cancer 83(S12B):2817–2820
13. Chachaj A, Małyszczak K, Pyszel K, Lukas J, Tarkowski R, Pudełko M, Andrzejak R, Szuba A (2010) Physical and psychological impairments of women with upper limb lymphedema following breast cancer treatment. Psycho-Oncology 19:299–305. https://doi.org/10.1002/pon.1573
14. Committee E (2016) The diagnosis and treatment of peripheral lymphedema: 2016 consensus document of the International Society of Lymphology. Lymphology 49:170–184
15. Hamner JB, Fleming MD (2007) Lymphedema therapy reduces the volume of edema and pain in patients with breast cancer. Ann Surg Oncol 14:1904–1908. https://doi.org/10.1245/s10434-006-9332-1
16. Buragadda S, Alhusaini AA, Melam GR, Arora N (2015) Effect of complete decongestive therapy and a home program for patients with post mastectomy lymphedema. J Phys Ther Sci 27:2743–2748. https://doi.org/10.1589/jpts.27.2743
17. Kasseroller RG (1998) The Vodder School: the Vodder method. Cancer 83(12 Suppl American):2840–2842
18. Reed MD, Van Nostran W (2014) Assessing pain intensity with the visual analog scale: a plea for uniformity. J Clin Pharmacol 54:241–244. https://doi.org/10.1002/jcph.250
19. Lee JS, Hobden E, Stiell IG, Wells GA (2003) Clinically important change in the visual analog scale after adequate pain control. Acad Emerg Med 10:1128–1130
20. Szolnoky G, Varga E, Varga M, Tuczai M, Dósa-Rácz E, Kemény L (2011) Lymphedema treatment decreases pain intensity in lipedema. Lymphology 44:178