JKAU: Med. Sci., **Vol. 18** No. 4, pp: 37-51 (2011 A.D. / 1432 A.H.)
DOI: 10.4197/Med. 18-4.4

The Effectiveness of a Modified Complete Decongestive Therapy Program in the Treatment of Lymphedema Cases

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Abstract. This study aims to detect the efficacy of a modified complete decongestive therapy program on the improvement of the circumferential measures of the lymphedematous limbs. A prospective observational and interventional study; twenty-six patients with unilateral lymphedema of the extremities both primary and secondary were enrolled. All patients were treated with 6 sessions of complete decongestive therapy on a two-phase program. The first phase consists of meticulous skin care, manual lymphatic drainage, exercises and compression bandages. Phase 2 of self-care program. Circumferential measures of the affected limb were taken as an outcome measure; recorded before and 12 weeks after the application of the decongestive therapy. In both, primary and secondary lymphedema, the modified complete decongestive therapy resulted in a significant reduction ($p < 0.05$) in the circumference of the affected limb. The circumferential measures of the involved limbs after treatment were (79.69 ± 11.92) and (107.68 ± 24.98), consecutively: comparative to the pretreatment measures of (85.14 ± 7.48) for the upper limbs and (113.71 ± 26.91) for the lower limbs. In conclusion, application of a complete decongestive therapy, per available recourses, in a short course or a modified regimen can help in treating primary and secondary lymphedema of the extremities.

Keywords: Lymphedema, Complete decongestive therapy, Manual lymphatic drainage.

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Accepted for publication: 29 May 2011. Received: 19 March 2011.

Introduction

Lymphedema as defined as the abnormal accumulation of protein-rich fluid in soft tissues, results from a dysfunction of the lymphatic system[1]. This dysfunction can be either a congenital abnormality in the development of the lymphatic system, or a secondary obstruction, destruction, or malfunction of the lymphatic pathway. It is a common and troublesome problem.

Effective treatment of breast cancer has resulted in a significant increase in the number of cases of progressive lymphedema, with its complications of recurrent infections, non-healing wounds, discomfort or pain, difficulty with daily tasks, emotional and social distress[2-4].

Lymphedema is considered to be chronic when present for longer than three months[5]. Whether primary or secondary, lymphedema is most often a chronic non curable condition.

Therapy of peripheral lymphedema is divided into non-operative (conservative) and operative methods. Applicable to both methods is an understanding that meticulous skin hygiene and care (cleansing, low pH lotions, emollients) are of the utmost importance to the success of virtually all treatment approaches[6].

The aim of the treatment is to reduce the swelling, increase joint mobility, decrease discomfort and improve the cosmetic appearance of the affected limb.

Management with decongestive therapy became a widespread treatment approach and was recommended by a workgroup of the American Cancer Society of Lymphedema Workshop in 1998[7].

Complete decongestive therapy (CDT) is the main treatment for lymphedema. Experts who treat lymphedema consider CDT the "gold standard" of treatment[8,9]. It has been shown to be safe and effective[10-17].

It generally involves a two-stage treatment program that can be applied to both, children and adults. The first phase consists of skin care, a specific light manual massage (manual lymph drainage (MLD)), a range of motion exercise and a compression, typically applied with multi-layered bandage-wrapping. Phase 2 (initiated promptly after Phase 1) aims to conserve and optimize the result obtained in Phase 1. It consists

of compression by a low-stretch elastic stocking or sleeve skin care, continued "remedial" exercise, and repeated light massage as needed. In each patient undergoing therapy, an assessment of limb volume should be made before, during and after treatment. Treatment outcomes should be reported in a standardized manner in order to compare and contrast the effectiveness of various treatment protocols[6].

Segmental circumference measurement has been the most frequently used technique because of its easy application. Thus, it allows the therapist to measure specific areas and concentrate on it during treatment.

Tewari *et al.*[18] stated that using a narrow tape, circumferential arm measurement is an appropriate method for assessing arm volume in the Sentinel Lymph Node versus Axillary Clearance (SNAC) trial. In this trial, there was a highly significant correlation between circumferential and volumetric arm measurements ($p < 0.000$).

The cost barrier to CDT and the adherence of the patients to their active role in the lymphedema reduction are of major impact on the outcome of lymphedema management.

The objective of this study was to detect the efficacy of CDT when performed with some modifications on the improvement of the circumferential measures of the lymphedematous limbs, whether it was primary or secondary lymphedema.

Subjects and Methods

Sample

Twenty-six (26) patients with a diagnosis of primary or secondary unilateral lymphedema of either the upper or the lower limb with observable swelling of the involved limb were the subjects.

Table 1 summarizes the basic characteristics of the 26 patients.

None of the subjects received active treatment for lymphedema within the six months period before entering the study.

Exclusion criteria: - active cancer cases, influencing drugs including diuretic, signs of infection in the affected limb (redness, rash, red streaks, hotness, pain), evidence of contraindications to treatment: uncontrolled hypertension, congestive heart failure, renal insufficiency, and venous thrombosis**.**

The article protocol was approved by the Ethical Committee of King Abdulaziz University Hospital.

Treatment Intervention

All patients underwent complete physical examination and were evaluated for their eligibility in participating in this study. The scheme of the study was discussed in detail with the patient prior to start.

All the patients received six CDT sessions; three sessions weekly (for two weeks) in two points of the study: week 1 and week 7. Then, the patient was instructed to do the same regimen at home for the following 4 weeks (at week 3 and week 9).

The CDT consists of four components: MLD, compression therapy, meticulous skin care and remedial exercises.

Treatment sessions consisted of thirty min of MLD.

Manual lymphatic drainage (MLD) is a gentle specialized technique that applies very gentle pressure, and stretch on the tissues in the form of massage strokes applied in a distal to proximal direction. The limb is massaged in segments starting proximally and moves distally down the limb. The skin of the treated area and the massaging hands should be clean of any lubricating material or talcum powder.

Light pressure is applied in such a way that directs lymph to lymphogenous anastomosis and facilitates drainage into the venous circulation. The compression technique also stimulates the opening of alternative lymphatic tracts, improves the effectiveness of muscle and joint pumps during activity. Prevents re-accumulation of evacuated lymph fluid, conserves the results achieved during MLD, and helps break up and soften deposits of connective and scar tissues. In this study, none of the patients received pneumatic compression therapy. Our patients used compressing gloves or socks, which were worn all the day, except during the MLD and during sleep.

Patients are taught critical elements of skin and nail care including the use of moisturizers.

The fourth and last component of CDT is remedial exercises for the affected limbs and deep breathing to help promote venous and lymphatic flow.

Home program involves thirty min of self lymphatic drainage twice daily, exercises and the use of the compressing sleeves or socks.

Assessment and Outcome Measures

Baseline and demographic data were recorded for each subject and included the age, limb circumference duration of lymphedema, side of the swelling.

The follow up measures were recorded at week 12.

Limb Circumference Measurements

Upper limb (UL) circumference measures

Upper limb (UL) circumference measures were made at three points: the metacarpophalngeal joints (MCP), 10 cm below the olecranon and 10 cm above the olecranon.

To account for the natural asymmetry of the upper limbs as a result of right or left handedness, the circumferential measurements were made in 10 healthy control subjects(8 females, 2 males) with median age of 44.7 years (range 29.9-51.2 years).

The mean difference in the circumference between the dominant UL and the non-dominant one in the control group was calculated for each measurement point. This was subtracted from the measurement of each patient's dominant UL at the corresponding measurement point.

After the correction of the effect of right and left handedness, the measurements of each UL were summed. The difference in the circumference between both sides was expressed as fractions of the corresponding UL circumference on the non- affected side.

Lower limb (LL) circumference measures

Lower limb (LL) circumference measures were made at three points: the metatarsophalangeal joints (MTPJ), 10 cm below the tibial tuberosity and 20 cm above the tibial tuberosity. The measurements of each LL were summed and the differences in the circumference between both sides were expressed as fractions of the corresponding LL circumference on the non- affected side.

Statistical Analysis

Patients were classified in two groups: those who had unilateral UL lymphedema (n = 14) and those who had unilateral LL lymphedema (n = 12).

The non involved limb of each patient was taken as a control to the same patient. Testing the differences between the measurements of the involved limb and the control limb of the same patient was done using the "student's" *t* test. The mean differences between pre- and post-treatment values were recorded for both, the UL and LL, and compared using the paired *t* tests.

Significant result was assumed to occur when the difference between the statistical groups achieve $p < 0.05$.

The patients' data and statistical analysis were made using the SPSS statistical package version 15.

Results

Patient Characteristics

Twenty-six patients with unilateral extremity lymphedema were enrolled in this study. They were divided into two groups: Those who had lymphedema of the UL (n = 14) who all were having secondary lymphedema and those who had lymphedema of the LL (n = 12) who were mainly having primary lymphedema (83.3%) as proven by the lymphoscintigraphy. The mean duration of lymphedema was 24.9 months for upper limb cases and 37.7 months for the lower limb cases.

Table l shows the demographic data of the studied patients.

Treatment Outcomes

All the recruited patients received the CDT program as designed in the study.

There was a significant difference ($p < 0.05$) in the circumferential measures of the affected UL (85.14 ± 7.48) as compared to the non-affected control UL (78.15 ± 8.07). However, as regard the LL, no significant difference ($p > 0.05$) in the circumferential measures of the affected LL (113.71 ± 26.91) as compared to the non- affected control

LL (103.41 ± 22.02) was found. This might be explained by the fact that most of our upper limb cases were secondary; either to mastectomy with axillary lymphadenectomy (92.9%) or traumatic injury of the affected arm (7.1%). Hence, they had more severe progressing lymphedema compared to lower limb cases.

Table 1. The demographic data of the studied patients.

	UL Lymphedema (n = 14)	**LL Lymphedema (n = 12)**
Age (years)		
Mean ± SD	49.9 ± 11.9	46.8 ±10.3
Range	27-68	22-67
Gender n (%)		
Female	13 (92.9)	10 (83.3)
Male	1 (7.1)	2 (16.7)
Lymphedema Type n (%)		
Primary	0 (0)	10 (83.3)
Secondary	14 (100)	2 (16.7)
Affected Limb n (%)		
Right	8 (57.1)	6 (50)
Left	6 (42.9)	6 (50)
Lymphedema Duration (Months)		
Mean	24.9	37.7
Range	3-120	3-120

UL = Upper limb; LL = Lower limb; SD = Standard Deviation

Table 2 shows the mean differences in the circumferences (cm) between affected and non-affected limb in both groups.

Table 2. Differences between the involved and control limbs' measures in both groups.

Limb	**Mean ± SD**	***t***	**P**
Affected UL	85.14 ± 7.48	2.378	< 0.05
Control UL	78.15 ± 8.07		
Affected LL	113.71 ± 26.91	1.026	> 0.05
Control LL	103.41 ± 22.02		

UL = Upper limb; LL = Lower limb; SD = Standard Deviation

After treatment (after week 12), there was significant reduction ($p < 0.05$) of the circumferential measures of the involved UL and LL (79.69

± 11.92) and (107.68 ± 24.98), consecutively, as compared to the pre-treatment measures.

Of, 85.14 ± 7.48 for the upper limbs and 113.71 ± 26.91 for the lower limbs as measured before the treatment.

Table 3 shows the pre- and post- treatment measures in both groups.

Table 3. Pre- and post-treatment measures in both groups.

Limb	Mean ± SD	*t*	P
UL Pre-Treatment	85.14 ± 7.48	2.2	< 0.05
UL Post-Treatment	79.65 ±11.92		
LL Pre-Treatment	113.71 ± 26.91	2.66	< 0.05
LL Post-Treatment	107.68 ± 24.98		

UL = Upper Limb; LL = Lower Limb; SD = Standard Deviation

Discussion

This study revealed that the modified course of CDT - consisted of 6 sessions of 30 min MLD, compression therapy with regular compressing stocks and sleeves. In addition to meticulous skin care and remedial exercises applied on the 26 lymphedema patients resulted in a significant reduction of the circumferential limb measures compared to pre-treatment values.

Several studies had examined the effects of different physical therapy methods (including the CDT) on the lymphedema cases, either primary or secondary.

In a review done by Devoogdt *et al.*[19], ten randomized controlled trials, one pseudo-randomized controlled trial and four non-randomized experimental trials were analyzed. They found that CDT can be considered as an effective treatment modality for lymphoedema. Bandaging the arm was effective, but there was no consensus on the effectiveness of MLD. The effectiveness of skin care, exercises, wearing a compression sleeve and arm elevation was not investigated by a controlled trial. Intermittent Pneumatic Compression was effective, but once the treatment is interrupted, the lymphoedema volume increases.

Furthermore, a systematic review of the common conservative therapies for arm lymphedema secondary to breast cancer treatment was conducted by Moseley *et al.*[20]. The review included the following

treatment: CDT, MLD, pneumatic pumps, oral pharmaceuticals, low-level laser therapy, compression bandaging and garments. All the reviewed studies demonstrated that a reduction in limb volume and/or percentage edema can be achieved with standard CDT, CDT plus pump therapy and a combination of therapies. Five studies[9,12,22-24] demonstrated a continued volume reduction at follow up (range 1–12 months). The optimal treatment period for CPT appears to be 1 month, however, two studies[9,27] achieved a volume reduction at the end of 7-8 days of treatment.

A Cochrane review was conducted to assess the effect of physical treatment programs on the volume, shape, condition and long-term control of edema in lymphedema limbs.

Preston *et al.*[27] included three controlled trials, which randomized a total of 150 adults to different levels of physical treatment. One study randomized 42 women with unilateral lymphoedema of the upper limb following treatment for breast cancer into 2 groups. One group received eight sessions of MLD in two weeks and training in self-massage. Both of these groups and the control group wore flat-knit compression sleeves. The reductions in excess arm volume and symptoms were similar in the two groups.

A second trial involved 25 women from a local follow-up breast clinic. They were trained in self-administered massage and randomized to wear an elastic compression sleeve or no additional treatment. The dropout rate was high, particularly in the control group, although, the authors concluded that wearing a compression sleeve was beneficial. The third trial involved 83 participants, mostly female from a lymphoedema clinic. Around two thirds had upper limb edema. They were all taught self-administered massage. One group received a 19-day bandaging course before being fitted with hosiery. The other group wore hosiery from the start of the trial. The reduction in excess limb volume was consistently greater in those who started with multi-layer bandaging[28].

Experts in the field of lymphology generally agree that the initial treatment for lymphedema should be CDT, which is a two-phase program. The first phase consists of meticulous skin care and treatment of any fungal infections/ulceration of the skin, MLD, exercises that mimic the pattern of lymphatic drainage appropriate for the individual

patient, and compression with multi-layered, short-stretch bandages. Phase 2 focuses on conserving and optimizing the reduction in lymphedema achieved in Phase 1. This is accomplished by patient compliance with a self-care program[28].

Up till now, there is no consensus on the optimal duration of CDT sessions. The European model of CDT included two daily sessions, for an average of 4 to 6 weeks. Due to heath care constraints, the North American model is usually limited to a once a day session for an average of 3 to 4 weeks to treat a patient with lymphedema of the upper limbs, and for 4 to 6 weeks to treat a patient with lymphedema of the lower limbs[29].

The duration of treatment for our patients (thirty min per session for six sessions) was shorter than prior studies.

In the study of Bonnie *et al.*[15], patients received a single course of CDT in which the treatment session lasted approximately 2 h per day, and was administered for an average of 18.7 sessions in the range of 10-34 treatments

Koul *et al.*[12], enrolled 250 cases with post mastectomy lymphedema in their study. Treatment of the patients with CDT lasts for 1 h daily for up to several weeks depending on the severity and response.

In this study, the multilayered bandaging in phase one of the CDT was replaced by compressing stocks and sleeves. The reasons for doing such modifications are as follows: 1) The lack of funding and the unavailability of the special short elastic compressive garment for such cases; 2) The need for the absorption of more lymphedema patients and encouraging them to take the active roles in the treatment of their condition.

The significant reduction in lymphedema volume is consistent with previous studies.

Karadibak *et al.*[29] had incorporated sixty-two women with breast cancer-related lymphedema into a protocol of CDT. The women were given 12 weeks therapy program once daily for 3 days per week. A home care program was recommended. After the CDT, there was a significant ($p < 0.05$) reduction of lymphedema volume and percentage.

In the study of Hamner and Fleming[30], a total of 135 female patients with breast cancer-related lymphedema were provided a protocol of CDT, with twice weekly sessions for 8 weeks and the maintenance therapy was individualized to the patient needs. CDT reduced lymphedema volume and percentage from 709 ml and 31% to 473 ml and 18%, respectively.

Twenty patients with post mastectomy unilateral lymphedema were enrolled in Mondry *et al*.[31] study. Each patient was given 30-60 min of CDT sessions for 5 days per week for 2-4 weeks. The maintenance phase was started after the patients' limbs reach a measurement plateau. Mondry *et al.*[31] found reduction of the girth and volume of treated limbs.

In the prospective study of Liao *et al*,[32], thirty women who had unilateral upper or lower limb chronic lymphedema after breast of pelvic cancer therapy were enrolled in this study. All the patients received one daily session for 4-21 sessions. After the intensive CDT, the limb circumference, calculated volume and edema ratio were significantly reduced, compared with their pretreatment values ($p < 0.000$).

Andersen *et al.*[33] found no significant effect of MLD as one component of CDT in the edema reduction investigated the effect of eight sessions of MLD over 2 weeks. In addition to the standard program of compression garments, skin care, exercises and information, in forty-two women with breast – cancer related lymphedema.

There are a number of limitations of the present study that need to be acknowledged. The study was designed to determine the effect of treatment on lymphedema volume over 12 weeks duration with no further follow up. Extremity range of motion (ROM) was not assessed as part of the present study. Future studies should consider monitoring the extremity ROM as subjects with limited limb. ROM has less muscle pump action to assist in the lymphatic drainage. The effect of treatment on the quality of life was not assessed and would be an essential component in determining clinical significance.

From this study, it can be concluded that the use of CDT is beneficial for primary and secondary lymphedema. The data are encouraging and should remove the reluctance of treating lymphedema cases depending on the feasible resources.

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فعالية برنامج علاج مزيل الاحتقان المتكامل المعدل في علاج حالات الوذمة اللمفية

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جدة – المملكة العربية السعودية

المستخلص. يهدف هذا البحث الى الكشف عن فعالية برنامج علاج مزيل الاحتقان المتكامل المعدل على تحسين القياسات المحيطية للأطراف المصابة بالوذمة اللمفية الابتدائية أو الثانوية. التحق بهذه الدراسة الوصفية التدخلية ستة وعشرين مريضًا من الذين يعانون من وذمة لمفية في طرف واحد، سواء كانت أولية أو ثانوية. جميع المرضى تلقوا ٦ جلسات من علاج مزيل الاحتقان كاملاً وهو برنامج يتكون من مرحلتين. المرحلة الأولى تتكون من العناية الدقيقة بالبشرة، تصريف السائل اللمفاوي يدويا، والتدريبات التي تحاكي نمط التصريف اللمفاوي المناسب للمريض، وضغطًا بالضمادات. المرحلة الثانية تتركز ببرنامج الرعاية الذاتية. تم اختيار قياس محيطات الطرف المصاب كمؤشر للتحسن، حيث تم مقارنة تلك القياسات قبل العلاج و بعد ١٢ أسبوعًا. وقد أدى تطبيق العلاج المتكامل المعدل لإزالة الاحتقان إلى انخفاض كبير في قياسات محيط الطرف المصاب في كل من الوذمة اللمفية الابتدائية والثانوية. وكانت القياسات بعد العلاج (٧٩,٦٩ ± ١١,٩٢) للطرف العلوي، و (١٠٧,٦٨ ± ٧,٤٨) للطرف السفلي، مقارنة بالقياسات السابقة

للعـــلاج والتـــي كانـــت (٨٥,١٤ ± ٧,٤٨) للأطـــراف العلويّـــة، و (١١٣,٧١ ± ٢٦,٩١) للسفلية. وقد خلصت هذه الدراسة إلى أن تطبيق علاج مزيل الاحتقان المتكامل وفقا للإمكانيات المتاحة، حتى لفترة قصيرة، أو تعديل نظامه، يمكن أن يكون مفيدا في حالات الوذمات اللمفية الابتدائية والثانوية في الأطراف.