

Aqua Lymphatic Therapy for Postsurgical Breast Cancer Lymphedema

Dorit Tidhar, BPT, Aqua Lymphatic Therapist, Hydrotherapeutic Center of Shaar-Hanegev, Israel

Avi Shimony, MD, Soroka University Medical Center, Israel

Jacqueline Drouin, PT, PhD, Assistant Professor, Physical Therapy Department, The University of Michigan-Flint, USA

ABSTRACT

Background and Purpose. Women who undergo surgery for breast cancer are at high risk for developing lymphedema. The conventional treatment for lymphedema is complex lymphatic therapy (CLT). Complex lymphatic therapy has good outcomes during the intensive phase of lymphedema treatment, but it is often difficult to preserve these results through the maintenance phase. The purpose of this case report is to present a novel method that shows how women can take control of their lymphedema in a group setting by practicing lymphatic exercises and self-massage in a water pool. **Case Description.** Following CLT for lymphedema from mastectomies with axillary node dissections, 3 females were referred to aqua lymphatic therapy (ALT). The ALT protocol was performed once or twice per week. Circumferential measurements were taken before and after each session with measurement tape at 6 points, then calculated as 5 different truncated cones, and subsequently summed together into the individual's limb volume. Lymphedema volume was calculated as a percentage of the healthy limb. **Outcomes.** These 3 females participated in ALT for 14 months and did not experience lymphedema exacerbations during this time. Moreover, limb volumes in the affected arms decreased further by 249 ml, 116 ml, and 326 ml, respectively. **Discussion.** This case report provides a description of the ALT protocol that promotes adherence to self-treatment protocols and offers women a pleasurable and effective way to take control of managing their lymphedema.

INTRODUCTION

Lymphedema of the arm is a well-known complication following treatment for breast cancer. The common treatments for breast cancer include surgery and adjuvant therapies such as chemotherapy, radiotherapy, and hormonal and biological treatments. Of these breast cancer treatments, surgery and radiotherapy are most commonly associated with the development of lymphedema. Breast cancer surgeries, such as mastectomies and lumpectomies, often require differing degrees of axillary lymph node dissection. When there is obstruction of lymph flow, and the pressure in the affected lymphotome rises, this pressure pushes lymph fluid through the collaterals into healthy lymphotomes.^{1,2} Since the axillary lymph nodes drain the lymphotome for the skin of the affected arm, the front of the chest, and the upper back, removal of these axillary lymph nodes places the associated lymphotome at risk for developing lymphedema as well as infection.

The prevalence of lymphedema is reported to be between 6% and 70%.^{3,4} The main risk factors for lymphedema are obesity^{5,6} and irradiation of the axilla.^{3,7} Symptoms and signs consist of

pain, swelling, reduced range of motion, weakness, chest lymphedema, difficulty with activities of daily living, and psychosocial problems such as low self esteem and self image.⁸

When a woman seeks help for her lymphedema, she undergoes 2 phases of treatment. The first phase is the intensive treatment phase. During the intensive treatment phase, complex lymphatic therapy (CLT) is performed approximately 5 times per week in order to reduce her edema as much as possible.^{9,10} The second phase is the maintenance phase, which begins after her arm volume stabilizes, and aims to conserve and optimize the results obtained in Phase I. The maintenance phase consists of compression by a low-stretch elastic stocking or sleeve, skin care, continued remedial exercise, and repeated light massage as needed.¹¹

The maintenance phase can be achieved in 3 ways. The first approach is to continue treatment at the clinic; however, this method does not enable the woman to take full responsibility for managing her care. Moreover, since the clinic treatment is passive, the patient becomes dependent on the physical therapist to manage and control her lymphedema. The second approach is the self-treatment method. Self-treatment is the preferred method since the woman has full control of managing her care through exercises, self massage, and bandaging or compressive garments. Since lymphedema is a chronic disorder that requires life long care, the major shortcoming of the self-treatment method is maintaining the high degree of motivation required to adhere to the management protocols. Several studies suggest that failure to adhere to maintenance protocols may result in exacerbations of the lymphedema, and that these subsequent exacerbations may result in greater degrees of swelling than the initial lymphedema.^{8,11} The third approach, which is described in this article, is called aqua lymphatic therapy (ALT). The ALT is a pleasurable way for women to take control of the management phase of their lymphedema through promoting adherence to self-treatment protocols.

LITERATURE REVIEW

When a woman initially seeks treatment for lymphedema, she traditionally receives complex lymphatic therapy (CLT) or complex decongestive therapy (CDT), which includes 4 elements: skin care, compression therapy, massage technique, and exercises. It is recommended that the physical therapist be certified as a lymphatic therapist and this was a prerequisite for using the method discussed in this case report.^{2,12}

Although aquatic therapy is used to reduce edema in musculoskeletal conditions, there have been no reported studies on using this technique for lymphedema reduction.^{13,14} The hydro-

static pressure of water causes fluid transport from the interstitial tissue to the lymph and blood vessels, thereby reducing the edema. With lymphedema, the hydrostatic pressure of water alone may not be sufficient to clear the lymphatic channels. In lymphedema, the lymphatic vessels are blocked and the proteins that are too large to enter the blood flow accumulate in the interstitial tissue. The hydrostatic pressure may remove only the fluid, leaving proteins behind to re-exacerbate the edema.² With ALT, the properties of water are combined with self-massage, exercise, and compression to provide women with an effective, pleasurable, and low cost way to control their lymphedema.

METHOD

Aqua lymphatic therapy is a method that provides women in the maintenance phase of lymphedema, self treatment in a group setting. With guidance from a physical therapist, women are free to develop a program that best fits their individual needs. The women receive a chart containing their arm measurement results once each month and from this chart they decide how best to continue their individual plan. The women have the tools they need to carry out self treatment at their convenience. The physical therapist serves as a resource, but does not direct the individual plans of care. In this method, the women are provided active opportunities for self-directed care that may enhance self advocacy, independence, and self-esteem. Studies have shown that women who develop lymphedema exhibit higher levels of psychological, social, sexual, and functional morbidity than women with breast carcinoma who do not develop lymphedema. Therefore, maintaining the arm in a stable state promotes improvements in these women's quality of life since the development of lymphedema can bring with full force the emotions associated with feeling ill, feeling different from peers, or feeling that "I will never be able to get on with my life."³

The following case reports will describe the use of ALT and the results experienced by 3 women survivors of breast cancer and surgery (mastectomy/lumpectomy) with axillary lymph nodes dissection.

CASE DESCRIPTIONS

Participants

The participants were 3 women who developed lymphedema of the upper limb following breast cancer surgery. Each of the women received conventional physical therapy consisting of CDT and was looking for other options to maintain and possibly improve their lymphedema condition. Data for each of the women who participated in the ALT protocol is summarized in Table 1.

Participant 1

The first participant was a 57-year-old woman, diagnosed with right breast cancer 4 years earlier. This participant subsequently underwent mastectomy surgery with axillary lymph node dissection and received adjuvant chemotherapy and radiotherapy. Her treatment was complicated by an abscess that required drainage and autologous graft tissue transplantation. A short time after the mastectomy, she developed lymphedema in her right upper extremity, which was also her dominant limb. Other medical history of note for this participant was that she had mild mitral valve stenosis. This participant began treating her lymphedema a year after the mastectomy with conventional CPT. In her maintenance phase, she was introduced to ALT at a group meeting on the subject of self management for lymphedema. She had also been wearing a compression garment during the day following completion of the intensive treatment phase.

This participant's physical activity included walking 3 nights per week. At the start of the ALT group therapy, she had a 21% excess volume in her right upper limb as compared to her left healthy upper limb, which is defined as Stage II Moderate

Table 1. Patient Characteristics

	Patient 1	Patient 2	Patient 3
Age (y)	57	55	63
Gender	Female	Female	Female
Type of operation	Right mastectomy (1998) with axillary dissection	Left mastectomy (1998) with axillary dissection	Left mastectomy (1996) with axillary dissection
Adjuvant therapy	Chemotherapy and radiotherapy with complication of abscess	Chemotherapy and radiotherapy	Chemotherapy and radiotherapy
Medical history	Mild mitral stenosis	Lumbar discopathy	Osteoarthritis both knees and lumbar and cervical discopathy
Suspected trigger of Lymphedema	Surgery (short while after the mastectomy)	Unknown (6 months after the mastectomy)	Cellulitis of the arm (3 years after the mastectomy)
Prior treatment for lymphedema	* CDT	* CDT	* CDT (3 series)

* CDT indicates complex decongestive physiotherapy

Lymphedema.⁹ She also had hard swelling under her axillary area and a large scar crossing horizontally from the right chest wall to her back, ending at the medial border of her right scapula. During her initial evaluation, she complained of continuous arm pain and mentioned that she had to put her arm up on a pillow to massage it to relieve the pain. This participant also had hypoesthesia and complained of heaviness in her right arm and in the back of her right shoulder.

This participant diligently attended the group sessions, twice each week during the initial 8 months of her self treatment. And then, once a week for 6 more months thereafter. Measurements were taken of her arm before and after each session. Her expectations from this treatment were to reduce her pain and to strengthen her arm. She wanted to be able to perform the tasks that she had performed before her lymphedema developed, which included cooking, without fear of aggravating the lymphedema.

Participant 2

The next participant was a 55-year-old woman, diagnosed with left breast cancer 4 years earlier. She subsequently received a mastectomy with axillary lymph node dissection, and underwent adjuvant chemotherapy and radiotherapy. Six months after her mastectomy she developed lymphedema in her left upper limb. Her other medical history included a L4-L5 discopathy. Since there were no physical therapists in her area, she was only able to begin CDT treatment one year after developing lymphedema. Upon completion of her CDT treatment, she wore a compression sleeve and a gauntlet (a compression glove). During her maintenance phase, this participant was introduced to the ALT at a group meeting on the subject of self management for lymphedema. She started the group therapy with an excess volume measurement of 1% as compared to her right healthy upper limb, which meant that her arm was not in fact clinically swollen. However, during the first assessment, she complained of hypoesthesia and heaviness in her left arm and at the back of her left shoulder, and presented with swelling under her axillary area. She attended the group sessions on a regular basis of once per week for 14 months. Her expectations from this treatment were to maintain the existing results from her initial CDT treatment, and to manage without the compression sleeve.

Participant 3

The final participant was a 63-year-old woman, diagnosed with left breast cancer 7 years earlier, who subsequently underwent a mastectomy with axillary lymph node dissection. She received adjuvant chemotherapy and radiotherapy. Three years after her surgery, she developed lymphedema following an episode of cellulitis in her left arm. Her other medical history included severe lumbar discopathy, severe osteoarthritis in both knees with swelling in both legs, and severe cervical discopathy. This participant began treating her lymphedema with conventional CPT and required 3 different series of CDT treatments prior to beginning ALT. Although, she had a compression sleeve, she chose not to wear it. Her other physical activity was aquatic aerobic exercises twice per week. In her maintenance phase, she was introduced to ALT at a group meeting on the topic of self manage-

ment for lymphedema. When this participant began the group therapy, she had 13% excess volume in her left arm as compared to her right healthy upper limb, which is defined as Stage II Minimal Lymphedema.⁹ She also had swelling under her axillary area. This participant diligently attended the group sessions twice per week for 8 months, and then, once per week for 6 more months thereafter. Her expectation from the ALT was to reduce the lymphedema from her arm and from under her axillary area.

PRINCIPLES OF AQUA LYMPHATIC THERAPY

Aqua lymphatic therapy is a method that uses the physical properties of the water, self-massage, and exercise to maintain the positive effects of lymphedema reduction achieved during the intensive treatment phase by CLT/CDT.

The aqua lymphatic therapy session includes the following factors:

- *Skin care:* Women are advised to apply a silicon cream before each session to protect the skin in the pool. The pool water must be properly cleaned and women are instructed that any active infection is an absolute contraindication for pool exercises.
- *Manual element:* The manual element includes self-massage, massage by a fellow participant, and water massage by the movement of the affected arm through the water.
- *Compression element:* Hydrostatic pressure is the force exerted on the arm by the specific gravity of water. According to the principles of hydrostatic pressure, when the arm is positioned vertically in the water, the pressure gradually increases from the fingers to the shoulder. This graduated method of compression promotes lymphatic return from the periphery to the trunk.
- *Exercise element:* Exercises are performed in the pool where the properties of water that include hydrostatic pressure, the buoyant force, and viscosity are used to enhance the exercise effects to improve edema reduction, strengthening, and range of motion.

The Pool

The hydrotherapeutic pool was a 4.5 x 6.5 meter pool with a constant depth of 1.3 meters for the entire pool area. The pool was monitored for pH (7.02), chloride concentration, bacteriologic control, and clarity of the water. The temperature of the water was thermo neutral at 31°C to 33°C.^{13,14} The balance of heat loss and heat production is maintained in the warm water (33°C), therefore relatively warm water is desirable when prolonged water exercises are performed at low intensity.¹⁵

The ALT group was the first group to enter the pool each day. Women with active infections were not allowed to enter the pool and required physician clearance before they could return to the water activities.

The Supervision and Organization

The maximum number of women allowed in the pool was 8 during each session. The physical therapist, who was a certified lymphedema therapist, was in the water for supervision and

instruction during the entire session. The frequency of the sessions was once or twice each week with each session lasting for one hour.

Physical Properties of Water

Aquatic lymphatic therapy uses the physical properties of water to achieve the same goals as CLT. The principle benefits from performing sessions in the water were from the hydrostatic pressure, the buoyant force, the viscosity of water, and the temperature. The following describes the properties of water that are useful in ALT.

• *Buoyant force*

When a woman stands in the pool, the buoyant force of water enables her to hold her shoulder in the 90° range of flexion and abduction. Shoulder movements in this particular range of motion are especially difficult to achieve when a weakened arm is subject to the forces of gravity as in land activities. Women can successfully perform assisted active movements for more than half of a session with the help of the buoyant force. However, the lymphedematous tissue contains many fat elements, and women report feeling unbalanced in the water between the affected floating arm and the healthy floating arm due to the difference in density and specific gravity of the tissues.

• *Viscosity of the water*

The viscosity of water provides resistance to body movements to promote strengthening and improve lymphatic clearance. Water resists movement in any plane and therefore, a variety of limb movements promotes differing pressures on the skin that alters total tissue pressure and improves pumping of the lymphatic vessels. In addition, the amount of resistance can be controlled by each individual through varying her speed of movement or changing her movement surface area. For example, increasing the size of the forward area of the limb moving through water causes higher resistance, therefore, adding water devices such as flippers will increase the total frontal surface area and raise the resistance to promote strengthening.¹⁰ It is important however, to improve strength gradually in order to prevent exacerbations of the lymphedema; therefore ALT begins with minimal resistance and progresses to faster movements with larger frontal surface areas. Fitness progression also is developed from low levels gradually up to higher levels that are well-tolerated by the individual participant.

• *Hydrostatic pressure*

The hydrostatic pressure of water at 32°C increases lymph flow significantly, supporting the potential importance of water for lymph evacuation.¹⁵ The hydrostatic pressure from water increases as the depth increases, therefore, when the affected arm is positioned vertically in water, the limb benefits from pressure gradients that can influence the direction of lymphatic flow. When a woman positions her arm vertically in water, the pressure on her fingers is above 40 mmHg, which is higher than that of a compression sleeve at 20 to 30 mmHg. Additionally, axillary and chest wall swelling is difficult to bandage, but since the hydrostatic

pressure equally influences all parts of the axilla and chest wall, it becomes suitable and effective treatment for these areas.

• *Water temperature*


An additional consideration of using water for lymphedema is that water conducts heat and therefore capillary vasodilation and swelling can be prevented by using thermo neutral water. Recommended temperature ranges are 29°C for vigorous water activities like swimming, and 33°C for light water activities such as walking.¹⁷ Temperatures lower than 31°C during moderate water activities may result in shivering or muscle spasms because moderate activity does not produce sufficient energy or consequently, heat. Therefore, the ALT is conducted in a temperature between 29°C and 33°C.

DESCRIPTION OF A TYPICAL SESSION

Measurements

Measurements of the involved arm were taken before and after each session on all participants. During the first session both the healthy and the affected arms were measured, thereafter, during subsequent sessions, only the affected arm was measured. Measurements were taken with a measurement tape, at 6 points. These are the same points used to measure a limb for a compression sleeve. This method was efficient for measuring a large group of women in a short period of time. The circumferences measured at these points were then calculated as 5 different truncated cones and were subsequently summed together into the individual's limb volume.^{8,11} The lymphedema volume was then calculated as a percentage of the healthy limb. The 3 equations that were used for the calculations are summarized in Table 2. Once each month, a participant was given a feedback chart and could decide, with the physical therapist's advice, how to proceed or adjust her individualized self-treatment program.

Table 2. The Volume of the Limb can be Estimated from Number of Segments Considered to be Truncated Cones¹¹

Equations	
1. Volume of the limb = $h*(Ct*Ct+Ct*Cb+Cb*Cb)/12*\pi$	
2. % Edema = $100*(F-N)/N$	
3. %Change in edema = $(F-I)/(I-N)$ if $NF=NI$	
F=Final Volume I=Initial Volume N=Normal Volume	

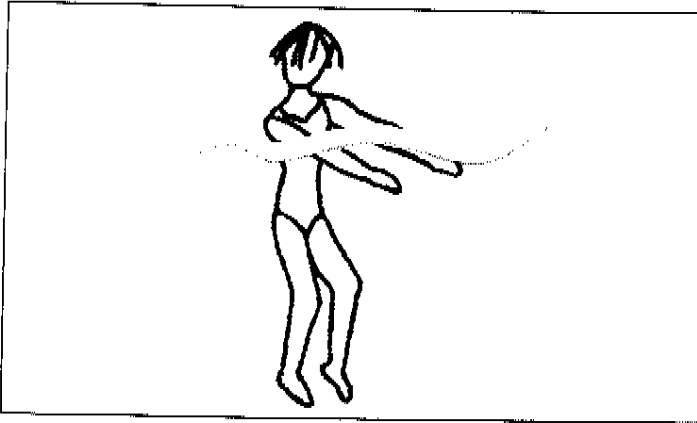
Group Therapy

The ALT is based on the principles of conventional treatment and on a particular sequence of slow rhythmic movements. Both of the sequence of the movements and the slow rhythmic pace are essential for the success of the treatment and are the guide for the group therapy sessions. First, the slow rhythmic pace is used for performing the exercises, the self massage, and the breathing activities. Second, the sequence for performing the group therapy movements was from proximal and then from distal to proximal. In the first part of the session, the exercises emphasized proximal work and in the second part, the emphasis was from distal to prox-

imal. This sequence is very important. First, healthy lymphotomes are activated proximally in order to clear the reservoir, and then second, work is performed to clear the affected lymphotomes into the healthy ones. A description of the sequencing of the work is as follows:

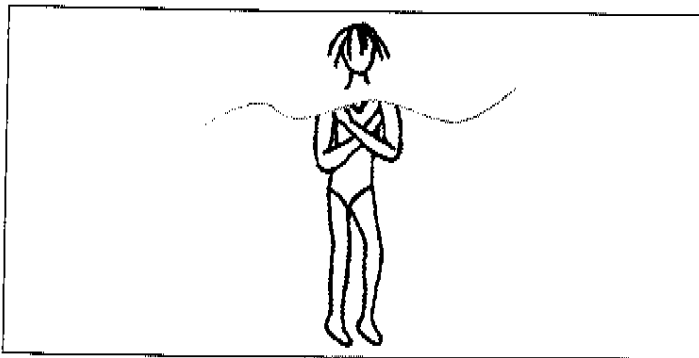
First part: proximal activities

- **Breathing:** The initial exercising begins with slow chest and abdominal breathing to clear reservoirs in healthy proximal lymphotomes (Figure 1).



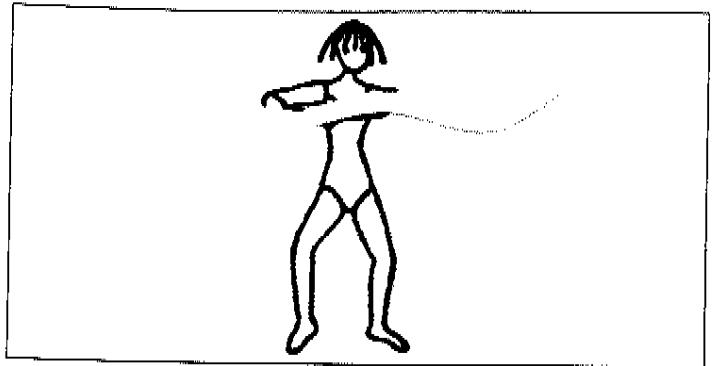
©Figure 1. Starting position of a chest breathing exercise.

- **Lymph Node Clearance:** The second proximal activity concentrates on the clearance of subclavicular, axillary, sternal, and inguinal lymph nodes (Figure 2).



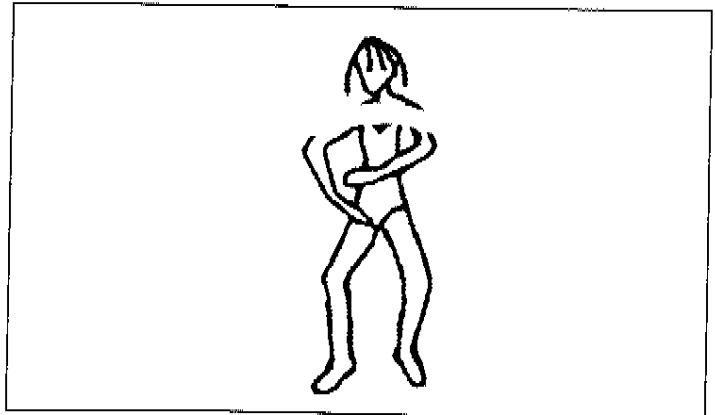
©Figure 2. Starting position of clearing the auxiliary lymph nodes.

- **Proximal Movements:** The next area that is activated is the shoulder girdle, the neck, and the scapular stabilizers. With the arms afloat in the water horizontally, for limited influence of the hydrostatic pressure, we emphasize the clearance of the lymphatic reservoir with no excessive lymph load on the upper limb.
- **Manual Technique:** In the manual technique, self massage is performed in a consistent sequence again by clearing the proximal areas first and then working from distal to proximal (Figure 3). The direction of the self-massage is from the affected lymphotome to the healthy ones. Specifically, the

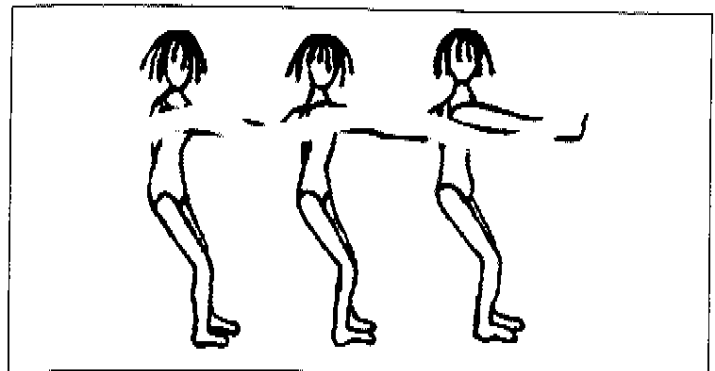


©Figure 3. Starting position of a water massage exercise.

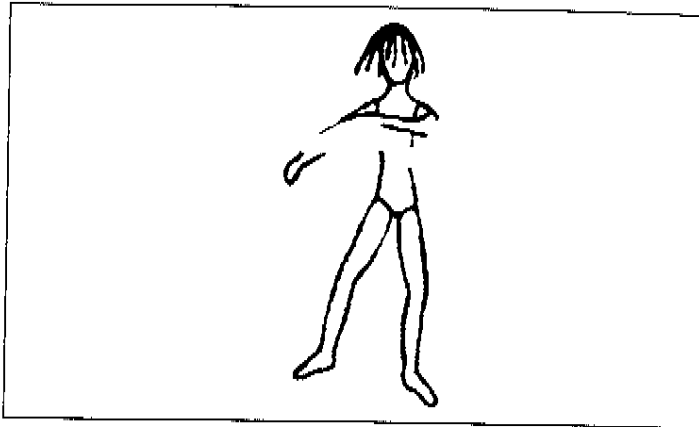
direction of massage is from the affected chest lymphotome to the healthy chest lymphotome (and into the axillary lymph nodes) and to the abdominal lymphotome on the affected side (into the inguinal lymph nodes). The water massage created by movements through the water and by water turbulence enhances the self-massage (Figure 4 & 5). Massage also can be performed by fellow participants (Figure 6).



©Figure 4. Turbulence exercise: water massage from chest lymphotome to abdominal lymphotome.



©Figure 5. Fellow participant massage: stroking from the affected posterior chest lymphotome into the healthy posterior chest lymphotome.

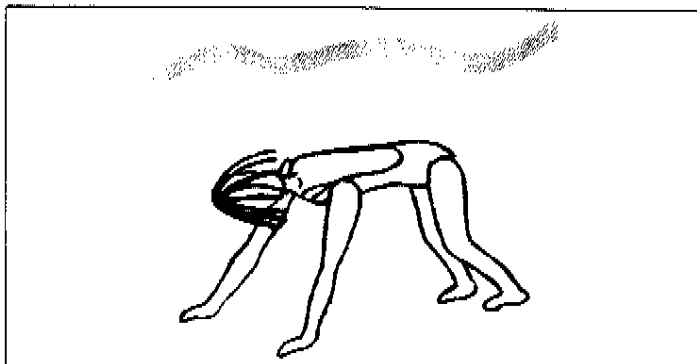


©Figure 6. Self massage of the upper limb is done step by step from proximal and then distal to proximal.

Second part: distal to proximal

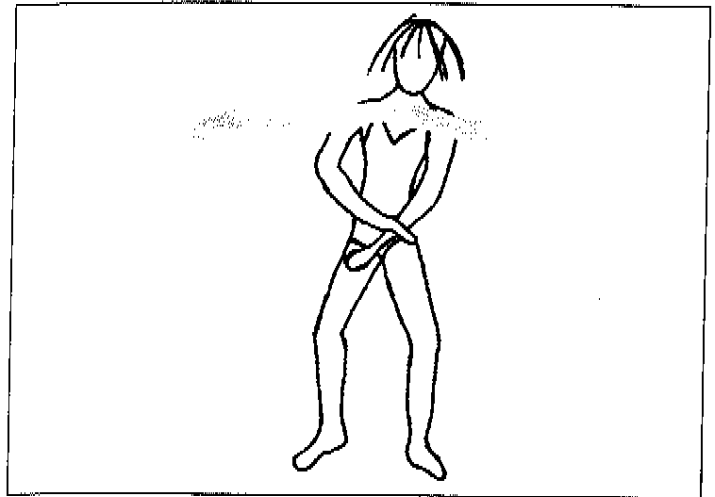
Vertical positioning of the arm in the water uses the gradients of hydrostatic pressure to move lymphatic fluid from the distal to the proximal part of the immersed arm (diving under and coming up, will probably cause a greater change in total tissue pressure from using a position that is at an increased depth in the water) (Figure 7). The 2 primary activities performed in this part of the treatment are:

- *Distal movements:* The distal movements involve movements at the elbows, wrists, and fingers.
- *Self massage:* In this part, self massage is performed using the maximum hydrostatic pressure of the water so the limb is vertically positioned in the water. Participants are instructed to perform fist movements, which consist of opening and closing the affected hand repeatedly during this portion of the therapy session. Stroking massage also is performed step by step again beginning in the proximal region and continuing from distal to proximal into the subclavicular and healthy axillary and inguinal lymph nodes (Figure 8).



©Figure 7. The 'frog' exercise using maximum hydrostatic pressure on the hand. The direction of flow from distal to proximal.

The session ends with the participants repeating the breathing exercises to clear the proximal lymph nodes, and then the relaxation or cool down period.



©Figure 8. Self massage – stroking step by step from proximal then from proximal to distal with maximum hydrostatic pressure.

Overview of Treatment Modifications for Each Patient

Patient 1: The fellow participants massaged this participant's back diagonally towards the healthy inguinal lymph nodes due to the big circular scar crossing the chest from the sternum to the angle of right scapula. Extra attention was given to the chest for lymphedema under the armpit. This participant continued wearing a compression sleeve during the day, and some nights she also wore compression bandages.

Patient 2: Emphasis was placed on activating the transversus abdominals muscle due to her L4-L5 discopathy, and on rotation movements of her lumbar spine in the water. Exercises that caused pain were modified according to her needs.

Patient 3: To prevent aggravating her leg edema, the direction of self massage towards the abdominal lymphotome was avoided. Because of her severe lumbar discopathy, emphasis was placed on activating her transversus abdominals muscle, and on rotation movements of lumbar and thoracic spine. In addition, due to severe cervical discopathy, attention was paid to head posture during the exercises. Full knee flexion was avoided especially in the diving exercises due to her osteoarthritis. Exercises that caused pain were modified to fit her needs.

TREATMENT OUTCOMES

All patients improved objectively by reduction of arm volumes. Subjective improvements also were reported for arm strength, overall endurance, and general well-being for each participant (Figures 9, 10, 11).

Mean Reduction of Lymphedema after a Session

The circumferences of the lymphedematous limb were taken before and after each session during the 14 months of the program. After completion of each individual session, participants demonstrated a reduction in the percentage of edema compared to the healthy limb volume as follows (Figure 9):

- Patient 1 had a mean reduction of 13% (55.5 ml) per session for the whole period.

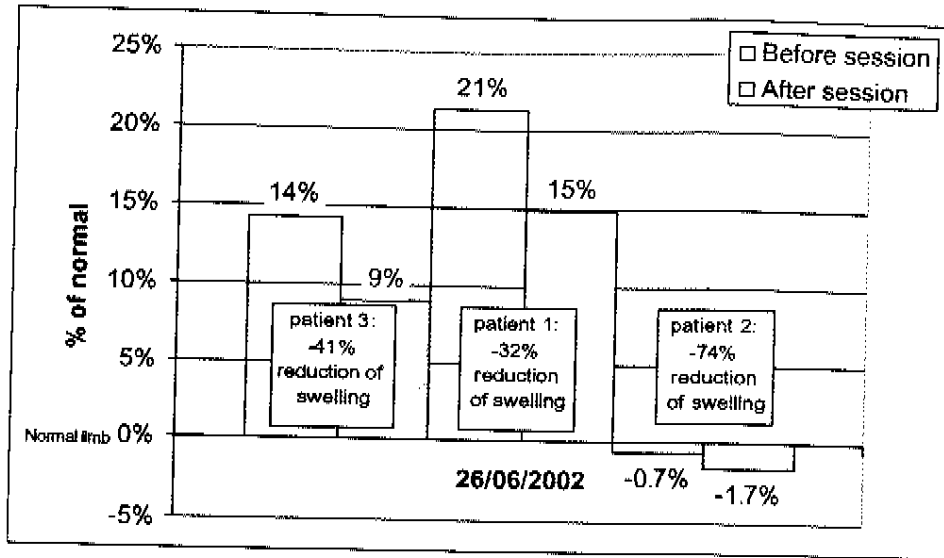


Figure 9. Lymphedema as percentage of the healthy arm before and after class. Example-26/6/2002.

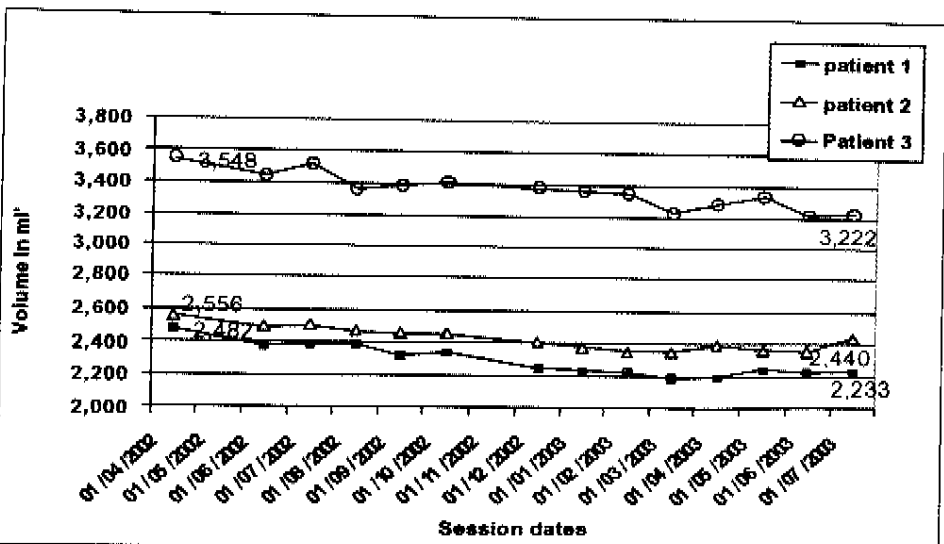


Figure 10. volume of the lymphedematous arm in millilitres during 14 months of lymphatic therapy.

- Patient 2 had no swelling, but her mean reduction was 32.9 ml per session for the whole period.
- Patient 3 had a mean reduction of 22% of the edema (87 ml) per session for the whole period.

Mean Reduction after 14 months

Patient 1: Initially, this participant's affected right arm volume was 2,482 ml compared with a volume of 2,058 in her healthy left arm. After 14 months of ALT, she achieved a volume of 2,233 ml, which was a reduction of 249 ml. She began the sessions with a 21% increase in edema compared with her healthy side and after 14 months she demonstrated only an 8% increase in the affected side. Her compliance was very good; she wore a compression sleeve between sessions, and sometimes bandaged at night. The

lymphedematous area under her armpit became smaller and softer, and subjectively she reported that she did not require supporting her arm on a pillow to massage away pain any longer.

Patient 2: Initially, this participant's affected left arm volume was 2,556 ml compared with a volume of 2,522 ml in her healthy right arm. After 14 months in ALT, she achieved a volume of 2,440 ml, which is a reduction of 116 ml. She began the ALT program with 1% edema in her affected left arm as compared to her healthy right arm. After 14 months, she demonstrated a -5% edema in the affected left arm as compared to her healthy right arm and the lymphedema under her axillary area was smaller and softer. Subjectively, she reported that her arm was stronger and that she was more confident in using her arm in functional tasks than before the self-treatment program. Additionally, this participant went on 2 long vacations of 1-month duration, using air travel and although she forgot to take her compression garment, her lymphedema did not return.

Patient 3: Initially, this participant's left arm volume was 3,548 ml compared with a volume of 3,148 ml in her healthy right healthy arm. After 14 months in the ALT program, she achieved a volume of 3,222 ml, which is a 326 ml reduction. This participant began the program with a 13% increase in edema in her affected arm as compared to her healthy right arm. After 14 months, her edema in the affected arm decreased to 2% in comparison to the healthy arm. Additionally, the lymphedema under her axillary area disappeared.

DISCUSSION

The ALT protocol described in this article provides women in the maintenance phase of lymphedema with an effective and pleasurable method to promote adherence to self-treatment methods. Aquatic lymphatic therapy provides women with the following benefits: first, ALT uses the properties of water, specifically the buoyant force, hydrostatic pressure, water viscosity, and water temperature, to maintain or improve lymphedema reductions achieved during the intensive treatment phase with CDT. The ALT method may be effective because the hydrostatic pressure of water has the potential to remove the fluid and then the self-massage and exercise promote protein removal using healthy lymphotomes. Second, ALT promotes self-efficacy by educating the participants to use the sequence and the slow rhythm of appropriate exercises so the participants can take responsibility for performing their individualized protocol.

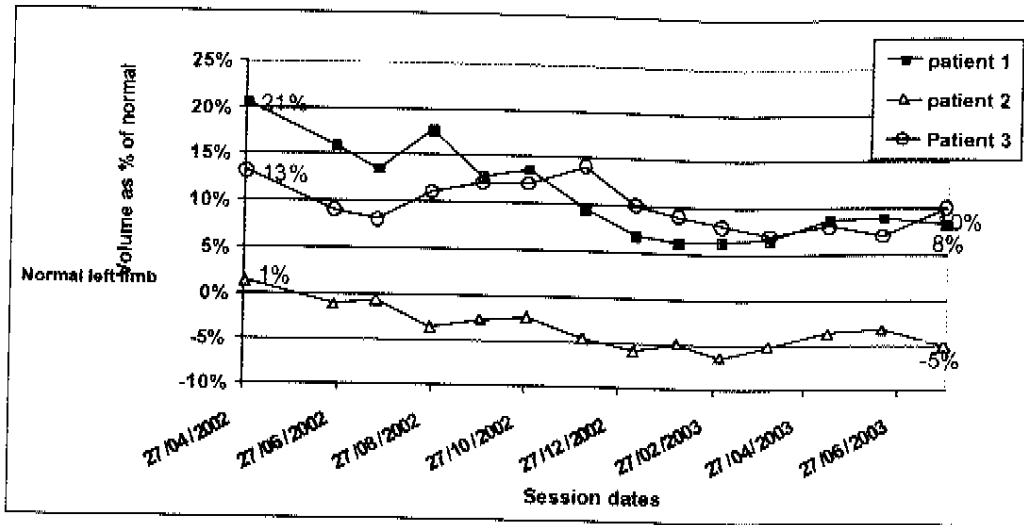


Figure 11. Lymphedema of the arm as percentage of the healthy limb during 14 months of Aquatic Lymphatic Therapy.

Third, ALT provides women with a support group with all of its advantages.¹⁶ Fourth, this program includes monitoring by a physical therapist to address changes on an individualized basis, and the use of feedback charts to empower a woman to monitor her status and to develop appropriate self-treatment strategies. Finally, there is active self treatment as the participants use their muscles throughout the entire session, in contrast to conventional treatments using passive techniques.

The ALT was used in these cases as an effective tool during the maintenance phase of lymphedema when a woman is responsible for treating herself. The maintenance phase also may consist of daily compression with a low-stretch elastic sleeve, skin care, continued 'remedial' exercises, and repeated light massage as needed.⁷

All 3 women demonstrated good adherence with the ALT program. Two of the participants (Participant 2 and 3) were considered nonadherent with conventional maintenance phase treatments, since they did not wear their compression garments or perform the self massage and exercises. However, adherence to this method of maintenance was high for both of these participants. Lastly, the summer temperature in Israel can reach up to 40°C with heat waves even in April and May. In spite of the changes in the climate through the 14 months, the amplitude of changes in the volume of the lymphedematous limbs were not acute. During April 2003 there were no sessions due to pool reconstruction, but as seen in Figures 10 and 11, the effect on the patients' conditions was a brief one and didn't last.

CONCLUSION

These case reports demonstrate the benefits that are typically derived from ALT by women in the maintenance phase of lymphedema treatment. During the 14 months of ALT none of these participants experienced exacerbations of their lymphedema and all of these women demonstrated further reductions in the volumes of their affected arm. These 3 women represent typical types of women that participate in the ALT program.

Participant 1 represents women who develop lymphedema even after receiving proper care and exhibiting good compliance to traditional maintenance techniques. Of interest was the fact that participant 1 experienced further marked improvements in her lymphedema with ALT treatments, as traditional techniques did not appear to adequately control her condition. Additionally, women like participant 1 who develop lymphedema despite good care typically are required to wear a compression sleeves between self-treatment sessions as this participant was required to do.

Participant 2 represents women who achieve 100% reductions of their lymphedema after the initial intensive phase of the conventional treatment, or come for self-treatment to prevent the exacerbations of their lymphedema. Women like participant 2 are able to maintain good results with no further self treatment between sessions.

Participant 3 represents women who have lymphedema but struggle to adhere to traditional maintenance techniques. Participant 3 demonstrated good adherence to ALT and was able to show good improvements in her condition. This participant did not require a compression sleeve between sessions, like many women in the maintenance phase. For women similar to participant 3, ALT may be an additional tool in their maintenance phase for controlling lymphedema.

Further studies are needed to answer the following questions:

- What are the long-term and short-term physiological effects behind the ALT?
- Does ALT activate healthy lymphotomes or collateral vessels to take over the work for affected lymphotomes?
- How do the results of ALT compare to traditional land-based maintenance programs for lymphedema in terms of preventing exacerbations or further reducing lymphedema volumes?
- What are the differences in adherence between traditional maintenance protocols and ALT?
- Can this method be a successful alternative to the conventional methods for arm and leg lymphedema in places where conventional treatment is not available due to cost or availability or trained health care practitioners?
- What is the actual cost comparison between traditional maintenance protocols and ALT?
- Can ALT be used between phases one and two in order to improve outcomes in cases where a 100% reduction was not achieved by the CLT/CDT?

The ALT program has been successfully used at our facility for more than 2 years. We are continuing to gather additional data on the effects of aqua lymphatic therapy on patients. However,

further clinical research is required to modify, refine, and provide evidence for the utility of this approach in other groups of patients including those with lower extremity lymphedemas or lymphedema that is not the sequela of cancer treatments.

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