Aqua Lymphatic Therapy in Managing Lower Extremity Lymphedema

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Lymphedema of the lower extremity is a complication that follows treatment for gynecologic cancers.[1] The prevalence of lower extremity lymphedema in women treated for these malignancies reportedly is 30%. However, among women with vulvar cancers who undergo removal of the inguinofemoral lymph nodes and radiotherapy, the prevalence increases to 47%.[1,2]

The risk factors for lymphedema includes early complications that occur after lymphadenectomy (eg, wound breakdown or infection, lymphocyst formation, early lymphedema).[3] Signs and symptoms for leg lymphedema are pain, swelling, reduced range of motion, muscle weakness, genital lymphedema, and difficulty with such activities of daily living as sitting or walking.[4]

However, this condition does not cause only physical discomfort. Chronic lymphedema produces high levels of psychological stress, because patients perceive themselves to be different from their peers and often cannot continue their usual activities.[5] Therefore, maintaining the stability of the lower extremities may promote better mental health and quality of life.

Traditional treatment for lymphedema consists of an acute, or intensive, treatment phase and a maintenance phase. In the acute phase, the physical therapist performs complex lymphatic therapy (CLT), which consists of decongestive massage, compression, exercise, and skin care.[4,6] Acute-phase treatments are performed on most days of the week until limb volume is reduced and stabilized optimally; this typically occurs within 2–3 weeks,[7,8] although Boris et al[9] reported a lower extremity lymphedema reduction of 62.7% after the acute phase.

Once volume is stabilized, the patient enters the self-directed maintenance phase, which may include compression by low-stretch elastic stockings, continued skin care, remedial exercises, and repeated self-massage.[10,11] Because lymphedema is a chronic disorder, the major shortcoming of the maintenance phase is sustaining the patient's compliance with required preventative techniques.[8,11]

A novel approach to the lymphedema maintenance phase is aqua lymphatic therapy (ALT), which provides patients in the maintenance phase of lymphedema with the opportunity to treat themselves in a group setting. The program is directed by a physical therapist only once weekly. However, lymphedema must be treated on a daily basis; thus, the ALT is an active method performed entirely by the patient and not by the physical therapist. During the weekly group session, the physical therapist measures girth before and after each treatment session to monitor the effectiveness of treatment and to enable patients to track and modify their individual maintenance plans. Although aquatic therapy has been used to reduce edema in patients with musculoskeletal conditions, no researchers have studied this technique for lymphedema reduction in that population.[12,13]

ALT combines the inherent properties of water with self-massage, exercise, and compression to provide patients with an effective, pleasurable, and inexpensive method to control lymphedema.[14] This article will describe the ALT technique using a case description of a woman with vulvar cancer.

Case Description

A 49-year-old woman (Mrs. J) was diagnosed with vulvar cancer in August 1998. She subsequently underwent vulvectomy with bilateral inguinofemoral lymph node dissection; adjuvant radiotherapy resulted in grade 1 burns to the anus, lower abdomen, and inguinal area. Two months after radiation therapy ended, she developed lymphedema.

The limb volume of Mrs. J's lymphadematous left lower extremity was 1,739 mL higher than that of her right lower extremity (difference between limbs, 20%; stage II moderate lymphedema).[10] The initial physical therapy evaluation revealed swelling

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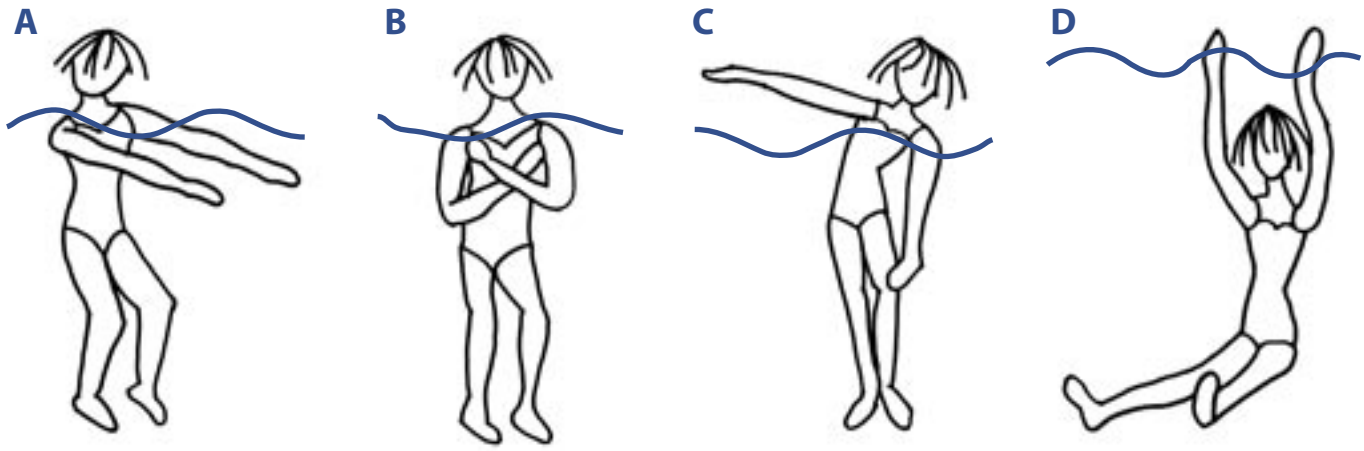


Figure 1 Movements in Aqua Lymphatic Therapy

(**A**) This chest breathing exercise clears the lymph reservoir (starting position). (**B**) Clearing the axiliary lymph nodes involves squeezing from the chest up into the armpits (starting position). (**C**) Proximal movements; the side bend activates the latissimus dorsi and quadratus lumborum muscles for proximal work. (**D**).Diving causes water massage upward over the skin and changes in hydrostatic pressure on the lower limbs.

and fibrosis in the genitals and in the involved lower extremity, especially around the radiated inguinal area. The fibrosis in the inguinal area restricted thigh extension beyond neutral. Her medical history also included atopic urticaria and rhinitis.

For approximately 2.5 years, Mrs. J had received CLT; during that time, however, she suffered from exacerbations and compliance difficulties. She was introduced to ALT during her self-maintenance phase, when she attended a lecture on lymphedema self-management at the hydrotherapeutic center near her home and consulted with a lymphedema specialist.

As she began the ALT group therapy program, Mrs. J had a 16% excess volume in her left lower extremity as compared with her right lower extremity (stage I mild lymphedema).[11] She attended the group sessions once weekly for 18 months. Further, she wore a compression garment only during the daytime hours between sessions and continued swimming twice weekly. Measurements were taken of her involved limb before and after each session and of her right, healthy limb three times during the 16-month period.

Principles of ALT

ALT uses the physical properties of water, self-massage, and exercise to maintain the positive effects of lymphedema reduction achieved during the intensive treatment phase of CLT. Each ALT session includes the following elements:

- *Skin care:* Patients apply a silicone cream to protect the skin before each session.
- *Manual element:* Patients perform self-massage and water massage.
- *Compression element:* The hydrostatic pressure of water at 32°C increases lymph flow and evacuation of fluid.[15] The hydrostatic pressure of water gradually increases with greater depth; thus, the limb benefits from pressure gradients, which influence the direction of lymphatic flow.
- *Exercise element:* Exercises are performed in the pool to allow the patent to benefit from the properties of the water itself.[14] The viscosity of water provides resistance to body movement, which promotes strengthening and improves lymphatic clearance. Since water resists movement in any plane, a variety of limb movements may be used to provide differing pressures on the skin; this may improve pumping of the lymphatic vessels.

Other factors inherent to the treatment itself are important to the success of ALT.

WATER TEMPERATURE

Water conducts heat; therefore, capillary vasodilation and swelling may be prevented by using thermoneutral water. The recommended water temperature ranges are 29°C for vigorous activities (eg, swimming) and 33°C for light activities (eg, walking).[16,17]

Water temperatures below 31°C should be avoided during moderate-intensity water activities, since insufficient energy or heat is produced from such exercise, and resultant shivering may cause muscle spasms. Therefore, ALT is conducted at a temperature range between 31°C and 33.5°C.[13, 15]

THE POOL

The hydrotherapeutic pool is a 11 x 15-m vessel with a graduated depth of 1.2–1.6 m. It is monitored for pH (7.02), chloride concentration, bacteriologic control, and water clarity. Participants with active infections are not allowed to enter the pool; they must receive physician clearance before they can return to ALT.

SUPERVISION AND ORGANIZATION

The ALT sessions are held in a group situation, which has shown advantages over individual programs.[18,19] During each session, a maximum of 8 people are allowed in the pool. The

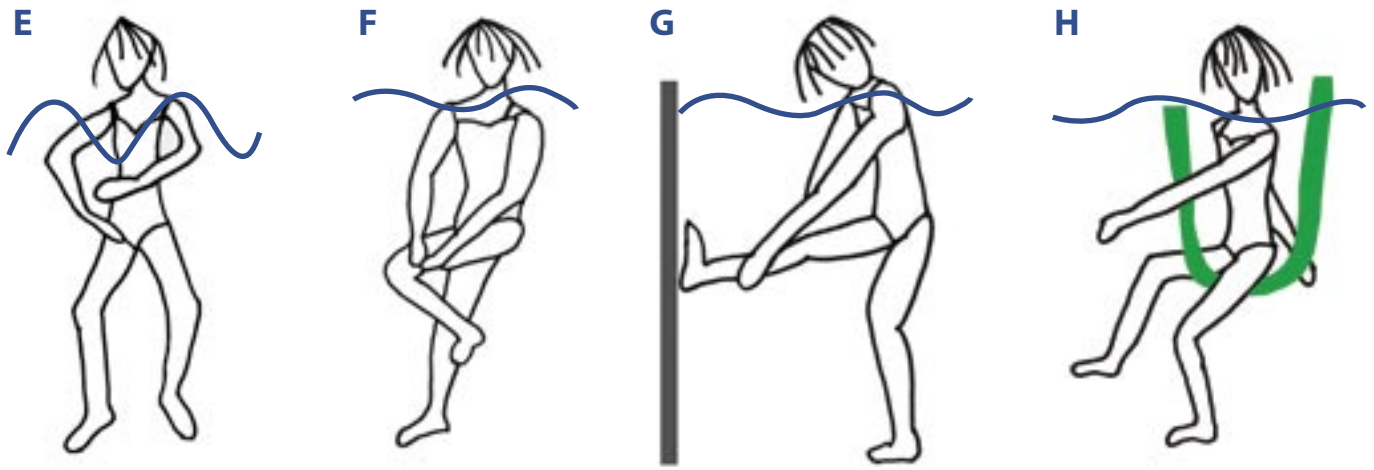


Figure 1 Movements in Aquatic Lymphatic Therapy (continued)

(**E**) Turbulence exercise; the hands cause turbulence, which massages the skin from the chest lymphotome to the abdominal lymphotome. (**F**) Self-massage of the lower limb is done step by step. First, the thigh is massaged; next, the calf to the thigh, up to the axilla is massaged. (**G**) Self-massage continues by stroking the toes, metatarsals, ankles, and areas up to the axillary lymph nodes. (**H**) Distal movements of the ankle and knee joints in an open-chain exercise move lymphatic fluid to the healthy lymphotomes.

physical therapist, who is a certified lymphedema therapist, stays in the water during the entire session to supervise and instruct patients. Each session is held for 1 hour once weekly.

ASSESSMENT OF LIMB VOLUME

As will be discussed, patients' limbs are measured regularly using a tape measure. The volumeter is considered to be the gold standard for measuring lymphedema. However, this tool is not used clinically, because it is time-consuming to operate, is not portable, and may be unhygienic. In any case, the validity and reliability of the standard measurement tape have proven to be quite sufficient for clinical use in patients with arm lymphedema.[20]

The circumferences measured at each point then are calculated as six different truncated cones and subsequently are added together to calculate the individual's limb volume.[5,11,16,20,21] The lymphedema volume is calculated and reported as a percentage of the healthy limb*; the standard error of measurement during sessions has been 33.54 mL, with a coefficient variant of 0.01 and a standard deviation of 82.16 mL.

Description of a Typical Session

The involved limb(s) are measured before and after each session. Therapists measure the patients at seven points (ie, every 10 cm from the foot to the groin) using a tape measure. During the first session, both the healthy and the involved limbs are measured; thereafter, only the affected limb is measured regularly. Healthy limbs are remeasured as required (eg, with changes in weight or sudden changes in limb volumes). Measurements are taken at the same hour of the day at each session and on the same day of the week.[22]

ALT is based upon principles of conventional treatment and on a particular sequence of slow rhythmic movements. During the first part of each session, exercises emphasize proximal work; in the second part, they emphasize distal-to-proximal activities.

PART I: PROXIMAL WORK

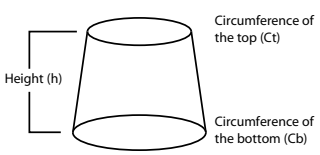
Standing in water up to the chest moves lymphatic fluid into the thoracic area; these proximal healthy areas must be cleared first. Initial exercising begins with slow breathing to clear reservoirs in healthy proximal lymphotomes (Figure 1A) followed by clearance of axillary lymph nodes (Figure 1B). The next areas exercised are the shoulder girdle, the scapular stabilizers, the abdominal muscles, and the back extensors. In particular, the patient emphasizes clearance of the lymphatic reservoir, working the proximal muscles in closed-chain movements (Figure 1C). Diving under water and exercising at a greater depth creates a higher change in total tissue pressure and improves lymphatic pumping (Figure 1D).

The water massage created by movements through the water and by water turbulence enhances the actions on the limbs (Figure 1E). The self-massage should move from the affected lymphotome to the healthy ones; specifically, at the beginning, the massage direction moves from the affected lower limb lymphotome to the ipsilateral healthy chest lymphotome and into the axillary lymph nodes (Figure 1F).

PART II: DISTAL-TO-PROXIMAL WORK

After clearing the proximal areas, the patient then begins working distally to proximally. The stroking sequence pro-

* The volume of the limb may be estimated from the number of segments considered to be truncated cones: volume of the limb = h × ([Ct × Ct] + [Ct × Cb] + [Cb × Cb])/12 × π



gresses between the toes and around the malleoli and then it proceeds laterally around the calf and thigh, up to the chest, and into the axillary lymph nodes (Figure 1G).

Distal-to-proximal exercises in water involve the hips, knees, and ankle joints. Patients may use floating aids during these activities (Figure 1H). The exercises begin with work at the gluteal muscles to move lymphatic fluid to the healthy lymphotomes.

The session ends with the participants repeating exercises that clear the proximal lymph nodes and then performing breathing exercises to relax.

Case Treatment Modifications and Outcome

Mrs. J had one involved lower limb, which she massaged using the techniques learned during training sessions. In addition, she massaged around her genital area, targeting strokes from the genital area to the buttocks and up to the axillae. Mrs. J also worked on extension movements at the hip joints that included walking backward; she used self-massage techniques to stretch the inguinal area and strengthen the gluteal muscles.

Eventually, Mrs. J progressed from low-resistance exercises to high-resistance exercises that included the use of floating devices. After 16 months of ALT, she improved objectively and achieved reduced volume of the involved limb and softening of the fibrosis groin area; as a result, her movements were no longer restricted. Overall, her endurance increased enough that she could work for an entire day. Instead of having to wear her compression garment every day, she eventually was able to wear it only 3 days per week without experiencing swelling of the involved limb. Overall, Mrs. J met her goals for well-being.

Discussion

ALT uses the properties of water—specifically, buoyant force, hydrostatic pressure, water viscosity, and water temperature—to maintain or improve reductions in lymphedema that are achieved during the intensive treatment phase of CLT. This effectiveness of this method may result from the ability of water's hydrostatic pressure to remove fluid and of self-massage and exercises to promote protein removal and clearance through use of healthy lymphotomes. The activities that patients follow as they treat themselves include muscular exercise, which contrasts with conventional treatments that use passive techniques.

ALT also promotes self-advocacy. This method educates patients about using a particular sequence and the slow rhythm of appropriate exercises to reduce edema and to take control of their own care. And because the patients learn and practice the method with others, they enjoy the advantages of being part of a support group that addresses qualitative issues.[14]

The ALT program includes weekly monitoring of the participant's limb volumes and monthly reports to assess the effectiveness of the individual's self-maintenance protocol regularly. This monitoring and feedback enable participants to adjust their self-maintenance protocols as needed for optimal results.

Further studies could supply more information on the effect of ALT on noncompliant patients treated with traditional maintenance protocols. In addition, they could enlighten clinicians on the effect of monthly feedback charts on compliance and success in maintaining appropriate self-treatment protocols. Other areas that also must be evaluated are the differences in costs between traditional maintenance protocols and ALT; the association between participation in a group therapy session and adherence to treatment protocols; the results of CLT used alone as compared with its use with ALT; and the effect of ALT on strength, range of motion, and cardiovascular endurance.

Currently, the ALT program has been used successfully in Israeli and Canadian hydrotherapeutic facilities. Certified CLT therapists are studying the ALT protocol to gather additional data on its effects on individuals with lymphedema. However, further clinical research is needed to provide evidence on its usefulness in patients with lymphedema resulting from other medical conditions and to modify and refine the techniques for treatment of various patient populations.

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