Nonoperative Treatment of Lymphedema

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Abstract

Keywords

- complex decongestive therapy
- reduction
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Complex decongestive therapy is the mainstay of lymphedema (LE) therapy. It consists of two phases: an intensive volume reduction phase, principally involving low-stretch bandages and manual lymph drainage (MLD), followed by compression garment use to maintain the reduction achieved. Adjunctive treatments include the use of a sequential gradient pump, LE-specific exercises, skin and nail care, as well as risk-reduction precautions. Herein the techniques are described and the evidence for their effectiveness is reviewed.

Lymphedema (LE) occurs due to obstruction of normal lymphatic flow leading to lymphatic fluid stasis. The presence of this lymphatic fluid results in inflammation, followed by fibrosis and sclerosis, then adipose tissue differentiation, and finally progression to chronic irreversible LE. Complex decongestive therapy (CDT) consists of both an intensive volume reduction phase, followed by a maintenance phase to stabilize the limb volume¹ (► **Table 1**). The mainstay is compressive therapy using low-stretch bandaging for reduction of pitting edema, manual lymph drainage (MLD), skin and nail care, and exercises.^{2–4} After stable maximal lymph volume reduction is achieved, with minimal or no pitting edema, this is followed by maintenance therapy using compression garments, exercises, skin care, as well as patient education for risk reduction.⁵

Wrapping with Low-Stretch Bandage

Wrapping with low-stretch bandage is the major component of the intensive volume reduction phase, achieving rapid volume reduction in those with significant pitting edema. The low-stretch bandage is wrapped in multiple layers after

covering the affected limb with padding composed of foam (► **Figs. 1 and 2**). The bandages exert a high pressure during activity, and a low but even pressure during rest, and are worn on a 23-hour basis during active treatment. The bandaging should be taught by a therapist, applying the bandage without undue pressure, which can lead to pain, from distal (hand or foot, including the fingers or toes if affected) to proximal (axilla or groin, respectively), and continued until the patient learns to perform it self-directed. Overnight bandaging is recommended during the long-term maintenance phase while a compression garment is worn during the day; an alternative is using a compression device with foam liner or fill, such as a CircAid Graduate (mediUSA) device or Jovi Pak (BSN medical). During this phase, follow-up visits are scheduled every 6 months, and then annually thereafter, and wrapping supplies need to be replaced every 3 to 6 months to maintain correct compression. The aim during the maintenance phase is to minimize recurrence of the edema, and adherence is key to achieving a stable volume reduction.⁶ The use of compression should be avoided in those with arterial insufficiency, acute cellulitis, or uncontrolled congestive cardiac failure, and should be used with caution in diabetics with peripheral neuropathy.

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Table 1 Phases of CDT

Intensive reduction phase	Maintenance phase
Low-stretch bandage (or adjustable compression garment)	Compression garment
MLD	Exercises
Sequential gradient pump	Skin care and risk precautions
Exercises	MLD (if required)
Skin care and risk precautions	Sequential gradient pump (if required)

Abbreviations: CDT, complex decongestive therapy; MLD, manual lymph drainage.

Manual Lymph Drainage

Manual lymph drainage is a technique used to increase the lymphatic fluid transport rate, develop new routes for lymphatic drainage from congested areas to adjacent nonedematous regions, increase the activity of macrophages to breakdown protein deposits, and mechanically break up fibrotic tissue. It is indicated in patients with significant pitting edema of the extremity, trunk, or chest wall, with fibrotic or sclerotic tissue changes, and in those with significant symptoms including heaviness or tightness. Several techniques for MLD have been described (Vodder, Földi, Leduc, or Casley-Smith methods).⁷ It is a purposeful, two-way superficial tissue stretching technique that is performed with varying degrees of pressure. It is performed in sequence from proximal to distal, starting with the nonedematous quadrant of the trunk, then the edematous trunk quadrant, next the proximal aspect of the edematous extremity, and lastly the distal part of the edematous extremity. Soft tissue

release techniques are performed for a short time before MLD if adhesions are present that are impeding lymph fluid flow. MLD sessions usually last around 60 minutes and are performed at least three times a week for at least 4 weeks. MLD is an adjunctive treatment performed during the intensive reduction phase of CDT, immediately prior to bandaging.⁸ It is particularly useful for LE of areas that are not easily amenable to compression, including the breast, trunk, and head and neck.^{7,9} It can also be a component of the maintenance phase, where it is performed by patients in self-directed fashion as necessary. It is contraindicated in patients with untreated neoplasia, decompensated right-sided heart failure, untreated deep vein thrombosis (DVT), acute cellulitis, acute asthma, or uncontrolled hypertension.

Sequential Gradient Pump

Pneumatic compression mechanically stimulates the flow of the lymph fluid to functional lymphatics and should be used adjunctively with bandaging during the intensive reduction phase, as well as for maintenance in conjunction with compression garments to reduce, then control, pitting edema.^{5,10} The effectiveness in volume reduction of the addition of pneumatic compression to CDT for LE of the upper or lower extremities is well established.^{11–17} Unlike MLD that is typically delivered by an LE therapist, intermittent pneumatic compression therapy can be performed unaided at home. Patients remove their compression garments when using the sequential gradient pump. Devices consist of multiple chambers, with sequential inflation of chambers to propagate flow,^{11,18} and vary in the amount of pressure applied, the pattern of delivery, and the total time of compression (► **Fig. 3**). Lymphatic vessels are known to collapse when pressure exceeds 30 mm Hg, obstructing the drainage, and for this reason the upper extremity is treated with 30 mm Hg pressure and for the lower extremity

Fig. 1 Technique of wrapping with low-stretch bandage for the upper extremity. The low-stretch bandage is applied from the fingers to the axilla, wrapped in multiple layers after covering the affected limb with padding composed of foam.

Fig. 2 Technique of wrapping with low-stretch bandage for the lower extremity. The low-stretch bandage is applied from the toes to the groin.

pressures range from 35 to 40 mm Hg. The recommended duration of treatment is 1 to 2 hours per day.^{19,20} Although the pump is effective at removing the fluid, MLD still needs to be performed before using the pump to remove the protein component. The pump is also effective at reducing the development of fibrotic tissue within the interstitial tissues; however it is less effective once fibrotic tissue, which causes poor tissue compliance, has developed.²¹ Pneumatic compression therapy is contraindicated in patients with an active infection or DVT in the limb, or local malignancy, or who receive scheduled anticoagulant therapy.²²

Exercises

Cardiovascular exercise and specific LE exercises are an important component of CDT, in particular for breast cancer-related LE of the upper extremity.² LE exercises increase

the rate of return of the lymphatic fluid to the venous circulation three to four fold. Exercises are performed during the intensive reduction phase, while the patient is wearing low stretch bandaging or their compression garment so that muscular contraction against the compression facilitates lymph transit.^{22,23} During the maintenance phase, patients continue self-directed LE-specific regular daily exercises.

Exercise of any intensity is recommended for patients with LE, as it does not worsen the LE and may prevent or improve it.^{24–26} Exercises should be progressive in intensity and repeated, under the supervision of a therapist, to avoid fatiguing the limb, injury, and swelling.

Skin Care and Risk Precautions

All patients need to be educated in the importance of meticulous skin care and nail management, as well as other risk precautions, to reduce the risk of cellulitis. Cellulitis can be life threatening, and recurrent episodes lead to rapid worsening of fibrosis and sclerosis of the lymphatic vessels. Daily skin cleansing and application of moisturizer should be performed to avoid drying and cracking of the skin and to maintain the correct pH of the skin under the compression garments. Patients should inspect their affected arm or leg daily and to seek medical help right away if they develop any redness, tenderness, or warmth. Patients need to avoid any injury to the affected limb and to treat any cuts, burns, bites or scrapes immediately to avoid infection. Sensible precautions include wearing long oven mitts while cooking, gloves while gardening or doing yard work, and high-factor sun block or long-sleeved clothing to avoid sunburn. Patients should use insect repellent spray when outside, avoid using a razor and instead use an electric shaver or cream for hair removal, avoid moving or carrying very heavy objects or fatiguing the limb, and avoid sauna use. General risk reducing

Fig. 3 Use of a sequential gradient pump system for lymphedema of the upper extremity. The device consists of multiple chambers, which sequentially inflate to propagate lymphatic fluid flow.

behavior includes maintaining an active lifestyle and healthy weight and beginning a weight-loss program if overweight.^{27–30} Blood pressure readings and blood draws from the affected arm are safe although patients may prefer to use their non-affected arms where practical to do so.^{31–33}

Compression Garments

Lifelong compliance with a compression garment of suitable fitment and compression is essential to control the edema and prevent progression of LE during the maintenance phase. Compression garments may also be used as the first-line treatment for recent onset LE,³⁴ or an adjustable compression garment can be used. Garments are typically worn throughout the day, with wrapping performed at night, or a nonelastic compression device can be worn for nighttime compression.

Compression garments deliver pressures of 20 to 60 mm Hg, with grading differing between manufacturers and garment types. It is important that garments of sufficient compression and circumference are used to increase the interstitial pressure so that the capillary filtration is decreased to prevent the extracellular fluid from reaccumulating;^{35,36} adequate compression is achieved once there is minimal or no pitting edema. The compression requirements may differ between patients and need to be individualized. This need is evaluated frequently by the therapist during the first 12 months, including the necessary frequency of ordering of new garments and the degree of compression required.

Garments differ between manufacturers and are either woven as flat-knitted with a seam, or circular knitted garments without a seam, and may be custom-made or ‘off-the-shelf’; the higher compression classes are typically flat-knitted. Attention to the compression class (CCL) is of central importance. Compression garments for the arm and hand are usually ordered in CCL 2 (23–32 mm Hg), although for long-term maintenance CCL 1 (15–21 mm Hg) garments may be sufficient. Compression garments for the leg are typically CCL 3 (34–46 mm Hg) or CCL 4 (49+ mm Hg). Under certain circumstances, multilayer garments can replace the need for a thicker, very high compression garment. Standard garments are easier to measure and available straightaway; however, they do not conform as well to many limbs as custom-made garments, nor do they provide homogenous compression. Custom garments have the advantage of optimal fitment to the contours of the extremity although require a skilled therapist or manufacturer representative to measure for them, and there is a delivery time of 2 to 3 weeks (– Fig. 4). If fitment of the garment is not ideal, manufacturers offer a return time window for necessary adjustments. Many patients are, therefore, best served by custom-made garments. Most importantly though, patients need a garment that they can tolerate and will maintain compliance.

For the arm, garments may include the hand or fingers, or a separate gauntlet can be worn. For legs, garments can include the whole leg, including the foot, or only below knee, or thigh-only. The top of the garment may differ, such as having a silicon band or belt for around the waist. Adjunctive

Fig. 4 Customized compression garment for the upper extremity.

devices can be used to facilitate donning of the garment, and undersleeves can be used to improve comfort.

Patients need to understand the need to replace the garments on a regular basis to maintain sufficient compression. Each garment should be washed daily to restore the compression and replaced after 3 to 6 months of continuous use, although very active patients may require these to be changed sooner. For custom garments, it is, therefore, prudent that after good fitment of a new garment is confirmed, a second is ordered so that the garments can be alternated daily. Garments are remeasured on each occasion, with the aim of continual gradual reduction in circumference, or maintenance.

Other Therapies

Several other treatment modalities have been suggested, including electrostimulation, acupuncture, Kinesio Taping, low-level laser, deep oscillation, and ultrasound, however, there is insufficient evidence currently to recommend their use.³⁷ Pharmaceutical therapies, including diuretics and benzopyrones, are not recommended for LE treatment.¹⁰

Conflict of Interest
None.

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