Chapter 34
Lower Limb Lymphedema

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Introduction

Lower extremity lymphedema accounts for the majority of all lymphedema cases. Therefore, its treatment deserves more attention than treatment of any other part of the body.

Lymphedema is rarely found in its pure form because underlying pathophysiology (e.g., ischemic heart disease, diabetes, chronic venous insufficiency, etc.) and accompanying factors (e.g., administration of calcium channel blockers) may further affect the Starling equation. Chronicity is reached when the lymphatic drainage trying to overcome the increased load of extravasated fluid decompensates. The associated circulatory, lymphatic, and soft tissue changes therefore require a comprehensive management including the treatment of comorbidities.[1]

Basically, both primary and secondary lymphatic insufficiencies are incurable conditions that historically have been defied by predominantly compression- and physiotherapy-based therapeutic interventions against its progressive nature. Hence, the difference in their characteristics and behavior often influence the elements of treatment approaches.[2-4]

General Considerations

Manual lymph drainage (MLD)–based complex decongestive physiotherapy (CDP) is now the mainstay of the lower limb lymphedema treatment regimen. It consists of three different phases: intensive, transition, and maintenance phases. Each phase plays a unique role and has distinctly different aims to improve the condition; these were thoroughly reviewed in Chap. 27.

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B.-B. Lee et al. (eds.), *Lymphedema*,
DOI 10.1007/978-0-85729-567-5_34,

However, MLD as the first and major component of CDP still fails to clear lingering doubt regarding its real value; despite strong empirical evidence advocating the benefits of the MLD, there are few research data to wholeheartedly support MLD, and recent clinical studies doubt its decongestive effects.[5,6]

Nevertheless, MLD is now known to increase blood flow in arterioles and capillaries; has peripheral analgesic, central sedative, antiserotonin, and antihistamine effects; evokes vagotonic reaction[7]; and improves muscular recovery after physical exercise.[8]

Hence, proper application of MLD in various forms of leg lymphedema is worthy of a revisit to emphasize its unique efficacy. Indeed, different conditions of uni- or bilateral primary or secondary lymphedema significantly influence the proper application of MLD to lower limb lymphedema.

The treatment of "unilateral" primary leg lymphedema[5] should follow the appropriate steps of central treatment, either in the supine or prone position, followed by leg treatment, also in the supine position or prone position, with the correct regimen, which were also thoroughly reviewed in Chap. 28 and 29.

However, precise application of every step of each treatment in the right sequence, either in a supine or prone position, cannot be overemphasized. Leg treatment steps should be repeated so as to treat all regions several times.

Treatment of "bilateral" primary leg lymphedema[5] is also no exception. It is consistent with unilateral primary leg lymphedema treatment, but there is an exception regarding the following steps: central treatment in the supine position should include the axillary lymph nodes of both sides, and both lower edematous body quadrants should be decongested in the direction of the axillary lymph nodes of identical sides.

In the prone position, the treatment of inguino-axillary anastomoses on both sides should be incorporated, and the gluteal region should be decongested in the direction of the axillary lymph nodes of identical sides.

Treatment of "unilateral" secondary leg lymphedema[5] would follow the same rule as for the central treatment, either in the supine or the prone position, as well as the leg treatment, which is consistent with primary lymphedema care.

However, there are some exceptions in the treatment of "bilateral" secondary leg lymphedema,[5] which is generally consistent with unilateral secondary leg lymphedema treatment as follows: in central treatment in the supine position of axillary lymph nodes of both sides should be treated together, in addition to the decongestion of both lower edematous body quadrants in the direction of the axillary lymph nodes of identical sides. In the prone position, the treatment should include inguino-axillary anastomoses on both sides and also the decongestion of the gluteal region in the direction of the axillary lymph nodes of identical sides.

Intermittent Pneumatic Compression

In accordance with the International Compression Club (ICC) Consensus, a high level of evidence supports the use of intermittent pneumatic compression (IPC) in lymphedema (Grade 1B).[9]

Intermittent pneumatic compression is assumed to reduce edema by decreasing capillary filtration, rather than by accelerating lymph return. IPC alone is particularly effective in non-obstructive edema, while MLD is strongly recommended before IPC to stimulate lymphatic flow in obstructive edema. Clinical trials prefer the utilization of multichambered pumps to single-chambered ones,[10,11] but the pressures should be adjusted according to individual response. In general, pressures of 30–60 mmHg are mostly applied. However, higher pressures also improve limb edema and lower pressures (20–30 mmHg) are advised in palliative care. Duration of 30 min to 2 h daily is recommended.[12] IPC is very efficacious in the edema treatment of immobile patients.[13] It squeezes the water content of a lymphedematous extremity, without improving the lymphatic drainage. However, it would reduce to an adequate amount, leading to an increase in the oncotic tissue pressure, necessitating a continuation of compression therapy.[14] IPC may exacerbate or cause congestion at the non-compressed root of a treated limb and also in the adjacent genital region.[15]

Compression

Compression therapy has been thoroughly reviewed through Chap. 30.

Nevertheless, the fact that compression therapy is the most effective treatment modality among the CDP components, cannot be overemphasized. However, until recently, evidence of its efficacy was based mostly on empirical studies and experimental data concerning the effect of conventional compression therapy on lymphedema have been sparse. Lately, though, the International Union of Phlebology (IUP) guideline as well as the American Venous Forum (AVF) guideline for lymphedema management has endorsed this mode of the therapy with a strong recommendation fitting to Evidence 1A.[16] A meta-analysis of the ICC found that a high of level of evidence could be attributed to the application of bandages in lymphedema (Grade 1B).[9]

Patients with lower limb lymphedema with a reduced ankle–brachial pressure index (ABPI) of 0.5–0.8 should not receive sustained compression exceeding 25 mmHg. Patients with ABPI < 0.5 can receive only intermittent compression.[17]

The most common tools of compression are bandages, stockings, and Circ-Aid. Typical lymphedema compression with bandages is performed in a multilayer fashion.[4] To achieve optimal volume reduction, high initial interface pressures are necessary to compensate for the pressure decrease. The pressure drop is already significant after 2 h and mainly caused by volume reduction, explaining the need for a more frequent bandage change in the beginning of lymphedema therapy compared with current practice where a change of bandage is recommended once a day in the initial phase.[18]

In general, inelastic compression can be worn overnight without major influence on microcirculation; hence, sub-bandage pressure does not significantly interfere with capillary function in the supine position.

Unlike inelastic compression, elastic bandages are normally not prescribed for overnight wear because in a supine position interface pressure remains high, the

influence of gravity is excluded, and in the case of diminished arterial influx, serious side effects can occur.

Multilayer bandage systems may behave as inelastic systems even though the individual layers act as elastic materials due to the friction generated between bandage layers. Therefore, it is proposed that in the case of multilayer bandage systems and kits, the terms "high or low stiffness" should be used to characterize the behavior of the final bandage. Stiffness may be characterized by the increase of interface pressure measured in the gaiter area when standing up from the supine position. A pressure increase of more than 10 mmHg measured in the gaiter area is characteristic of a stiff bandage system.[16]

Use of Elastic Bandages

In some situations (ineffective calf muscle pump, phlebolymphedema, large volume loss is predicted), the inelastic bandages may be replaced with elastic ones. The stiffness produced by multiple layers produces high working pressure. However, the resting pressure is higher than with inelastic systems.

Special Compression Material

Inelastic adjustable compression enhancing comfort and patient compliance is an effective alternative to compression garments.[19]

Medical Compression Stockings

The main areas of compression garment utilization comprise long-term management of lymphedema in the maintenance phase, prophylaxis, initial treatment or may serve the only form of compression used in time-consuming controlled compression therapy, where interstitial fluid is gradually squeezed out from the affected limb by garment size reduction using a sewing machine or in a steady-state condition by ordering new stockings in decreasing sizes.[20] In general, most patients wear garments during waking hours, including exercise.

Prophylactic use of medical compression stockings for breast cancer related-lymphedema prevention seems to be of invaluably practical importance[21] and this concept has been partially extrapolated to legs as vulvar cancer treatment-related lymphatic impairment was successfully prevented with the use of graduated compression stockings.[22] Limbs with a relatively normal shape require round-knitted stockings, while flat-knitted stockings better fit limbs with an unusual shape or remarkable distorsion than round-knitted ones.

In general, compression stockings have a lower stiffness index than inelastic bandages, especially when these bandages are worn in a multilayered fashion. Superimposition of medical compression stockings (MCSs) has an increasing impact on practical lymphology. While upper limb lymphedema often requires interface pressure no more than 40 mmHg, in the case of leg lymphedema, particularly in primary lymphatic insufficiency, "subgarment" pressure measured at a medial gaiter area may even exceed 60–80 mmHg, corresponding to the superposition of two to even four medical compression stockings with various compression classes, properly retaining edema and maintaining reduced volume. MCSs drop their pressure to a much lower degree compared with compression bandages.[20,23,24]

Exercise

Exercise/movement should be tailored to the patient's needs, ability, and disease status. Compression should be worn during exercise whenever possible. Walking, swimming, cycling, and low impact aerobics are recommended. Exercise varies interstitial tissue pressure and influences both lymph propulsion and clearance, helping to transport fluid and inflammatory causing proteins from the site of formation and from the swollen limb or affected area.[25] Studies demonstrated that both mechanical limb elevation plus passive exercise[26] or 5 min of instructed deep breathing plus self massage followed by 30 min of isotonic and isometric limb exercises[27] can produce a reduction in limb volume and subjective improvements in symptoms. In aqua-lymphatic therapy the selection of the optimal water temperature is mandatory; hence, exercises at 28°C produce volume reduction, but a temperature of 34°C results in a slight increase in volume.[28] Underwater leg exercises proved to significantly enhance the efficacy of decongestive physiotherapy, especially from the perspective of patient's own perception.[29,30]

Lymphedema Severity-Adapted Forms of CDP

Initial management of leg lymphedema implements psychosocial support, education, skin care, exercise/movement, elevation, and management of any concomitant medical conditions, pain or discomfort and the utilization of various forms of compression.

Stage I Lymphedema

The pressure used should be guided by the patient's vascular status and their ability to tolerate compression and manage the garment. Skin care, exercise/movement, elevation and self-drainage should be taught alongside self monitoring and proper application, removal and care of hosiery. Patients should be examined 4–6 weeks

after the initial fitting, and then after 3–6 months if the response is satisfactory. The patient should be examined at each stocking order (every 3–6 months).

Stages II and III Lymphedema

Intensive treatment comprises the standard elements of CDP and can be tailored to patient ability and comorbidity status.

Standard intensive therapy (>45 mmHg) is undertaken daily with a sub-bandage pressure >45 mmHg.

Intensive therapy with reduced pressure (15–25 mmHg) corresponds to the previous therapeutics regimen. Patients are selected for this treatment when high levels of compression are either unsafe or difficult to tolerate (moderate peripheral arterial occlusive disease [ABPI 0.5–0.8], mild neuropathy, lipedema, cancer under palliative treatment, co-morbidities requiring less aggressive reduction in swelling).

References

1. Ely JW, Osheroff JA, Chambliss ML, Ebell MH. Approach to leg edema of unclear etiology. *J Am Board Fam Med*. 2006;19:148-160.
2. Papendieck C. Lymphatic dysplasia in pediatrics. A new classification. *Int Angiol*. 1999;18: 6-9.
3. Wozniewski M, Jasinski R, Pilch U, Dabrowska G. Complex physical therapy for lymphoedema of the limbs. *Physiotherapy*. 2001;87:252-256.
4. Lymphoedema Framework. *Best Practice for the Management of Lymphoedema*, International Consensus. London: MEP Ltd; 2006:3-52.
5. Strössenreuther RHK. Hinweise zur Durchführung der ML/KPE bei primären und sekundären Lymphödemen sowie weiteren ausgewahlten Krankheitsbildern. In: Földi M, Kubik S, eds. *Lehrbuch der Lymphologie*, vol. 5. München-Jena: Gustav Fischer; 2002:621-658: Chap. 19.
6. Badger C, Preston N, Seers K, Mortimer P. Physical therapies for reducing and controlling lymphoedema of the limbs. *Cochrane Database Syst Rev*. 2004;4:CD003141.
7. Hutzschenreuter P, Brümmer H, Ebberfeld K. Experimental and clinical studies of the mechanism of effect of manual lymph drainage therapy. *Z Lymphol*. 1989;13:62-64.
8. Schillinger A, Koenig D, Haefele C, et al. Effect of manual lymph drainage on the course of serum levels of muscle enzymes after treadmill exercise. *Am J Phys Med Rehabil*. 2006;85: 516-520.
9. Partsch H, Flour M, Coleridge-Smith P, et al. Indications for compression therapy in venous and lymphatic disease. Consensus based on experimental data and scientific evidence under the auspices of the IUP. *Int Angiol*. 2008;27:193-219.
10. International Society of Lymphology. The diagnosis and treatment of peripheral lymphedema. Consensus document of the International Society of Lymphology. *Lymphology*. 2009;42: 51-60.
11. Bergan JJ, Sparks S, Angle N. A comparison of compression pumps in the treatment of lymphedema. *J Vasc Surg*. 1998;32:455-462.
12. Szuba A, Achalu R, Rockson SG. Decongestive lymphatic therapy for patients with breast carcinoma-associated lymphedema. A randomised, prospective study of a role of adjunctive pneumatic compression. *Cancer*. 2002;95:2260-2267.

13. Partsch H. Intermittent pneumatic compression in immobile patients. *Int Wound J*. 2008;5: 389-397.
14. Miranda F Jr, Perez MC, Castiglioni ML, et al. Effect of sequential intermittent pneumatic compression. *Lymphology*. 2001;34:135-141.
15. Boris M, Weindorf S, Lasinski BB. The risk of genital edema after external pump compression for lower limb lymphedema. *Lymphology*. 1998;31:15-20.
16. Partsch H, Clark M, Mosti G, et al. Classification of compression bandages: practical aspects. *Dermatol Surg*. 2008;34:600-609.
17. Marston W, Vowden K. Compression therapy: a guide to safe practice. In: European Wound Management Association (EWMA), ed. *Position Document: Understanding Compression Therapy*. London: MEP Ltd; 2003:11-17.
18. Damstra RJ, Brouwer E, Partsch H. Controlled, comparative study of relation between volume changes and interface pressure under short-stretch bandages in leg lymphedema patients. *Dermatol Surg*. 2008;34:773-778.
19. Lund E. Exploring the use of CircAid legging in the management of lymphoedema. *Int J Palliat Nurs*. 2000;6:383-391.
20. Brorson H, Ohlin K, Olsson G, Svensson B, Svensson H. Controlled compression and liposuction treatment for lower extremity lymphedema. *Lymphology*. 2008;41:52-63.
21. Stout Gergich NL, Pfalzer LA, McGarvey C, et al. Preoperative assessment enables the early diagnosis and successful treatment of lymphedema. *Cancer*. 2008;112:2809-2819.
22. Sawan S, Mugnai R, de Barros Lopes A, Hughes A, Edmondson R. Lower-limb lymphedema and vulval cancer: feasibility of prophylactic compression garments and validation of leg volume measurement. *Int J Gynecol Cancer*. 2009;19:1649-1654.
23. Partsch H, Partsch B, Braun W. Interface pressure and stiffness of ready made compression stockings: comparison of in vivo and in vitro measurements. *J Vasc Surg*. 2006;44:809-814.
24. Larsen AM, Futtrup I. Watch the pressure – it drops! *EWMA J*. 2004;4:8-12.
25. Havas E, Parviainen T, Vuorela J, Toivanen J, Nikula T, Vihko V. Lymph flow dynamics in exercising human skeletal muscle as detected by scintigraphy. *J Physiol*. 1997;504:233-239.
26. Moseley A, Piller N, Carati C, Esterman A. The impact of the Sun AnconChi Machine Aerobic Exerciser on chronic oedema of the legs. *Aust N Z J Phlebology*. 2003;7:5-10.
27. Buckley G, Piller N, Moseley A. Can exercise improve lymphatic flow? A pilot trial of the objective measurement of fluid movement in subjects with mild secondary lymphoedema. *5th Australasian Lymphology Association Conference Proceedings*; 2004:37-42.
28. Johansson K, Tibe K, Weibull A, Newton RC. Low intensity resistance exercise for breast cancer patients with arm lymphedema with or without compression sleeve. *Lymphology*. 2005;38:167-180.
29. Tidhar D, Drouin J, Shimony A. Aqua lymphatic therapy in managing lower extremity lymphedema. *J Support Oncol*. 2007;5:179-183.
30. Carpentier PH, Satger B. Randomized trial of balneotherapy associated with patient education in patients with advanced chronic venous insufficiency. *J Vasc Surg*. 2009;49:163-170.