

## COMPLETE DECONGESTIVE PHYSIOTHERAPY WITH AND WITHOUT PNEUMATIC COMPRESSION FOR TREATMENT OF LIPEDEMA: A PILOT STUDY

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### ABSTRACT

*Lipedema is a disproportional obesity for which evidence-based treatment is not currently available. We studied whether complete decongestive physiotherapy (CDP) alone or combined with intermittent pneumatic compression (IPC) could improve the treatment outcome in women with lipedema using a prospective, randomized trial. Eleven patients received CDP (60 min) and thirteen CDP (30 min) plus IPC (30 min) once daily in a 5-day-course. Subsequent to drainage, all subjects received multilayered compression bandaging, physical exercise and skin care. Treatment efficacy was evaluated by limb volume reduction. Both groups achieved significant reductions in mean lower extremity volume ( $p < 0.05$ ). The addition of IPC is safe, although it provides no synergistic benefit to CDP in leg volume reduction under these study conditions.*

**Keywords:** lipedema, manual lymph drainage, intermittent pneumatic compression, lymphatic treatment, complete decongestive physiotherapy

Lipedema is a distinct clinical entity first described by Allen and Hines (1). It is a disproportional obesity that nearly always affects women. The main feature is the bilateral, symmetrical, biker's hosiery-shaped

fatty swelling of the legs (2-4). Arms may also be involved. Edema usually manifests on the thighs and buttocks or the upper arms and sometimes has an orthostatic prolongation. Lipedema is often combined with common obesity. Lipedematous tissue hardly or never responds to diet and weight-loss. Lipedema patients often complain of pain upon palpation that usually worsens with aging. The other noticeable hallmark is the frequent hematoma formation due to even minor traumatic injuries (2-4).

Lipedema is accompanied by local circulatory abnormalities. Excessive fat can provide low resistance to vessels, and lipedema is often associated with superficial venous insufficiency, although major venous dysfunction is rarely found (5). Massive subcutaneous fat is linked with microangiopathy, and increased blood capillary permeability leads to protein-rich fluid extravasation, which can further enhance lymph formation. Therefore, in early stages of lipedema, increased lymph flow is visualized by lymphoscintigraphy. Lymph vessels increase their transport capacity in response to augmented capillary filtration and increasing volume of interstitial fluid (6). On the other hand, morphologic studies with fluorescent microlymphography display lymphatic microaneurysms and dilated vessels in the uppermost lymphatic network, indicating that lymph vessels are also affected (7).

In longstanding lipedema, lymph vessels become overworked, and altered micro-circulation contributes to impaired lymph transport capacity and accumulation of lymph fluid. In advanced stages, lipedema may be combined with lymphedema and therefore labeled as lipo-lymphedema. High protein and fat concentration of lymph induces a low-grade inflammation and subsequent fibrosis leading to non-pitting edema characterized by Stemmer's sign. Pure lipedema is not associated with fibrosis (8).

The experience-based treatment of lipedema is complete decongestive physiotherapy (CDP) due to the lack of evidenced-based treatment (9), and intermittent pneumatic compression (IPC) has been applied as adjunctive therapy. CDP for lower extremities consists of manual lymph drainage (MLD), multilayered compression with short-stretch bandages, regular walking exercises, and meticulous skin care (10). Manual lymph drainage (MLD) is a gentle massage technique that is a standard and effective therapeutical tool against various forms of primary and secondary lymphedemas. Multilayered compression bandaging plays an important role in the further reduction of leg volume enhancing the continuous pumping mechanism using the active involvement of muscle pumps. Intermittent pneumatic compression (IPC) might be a supplementary treatment to MLD that mainly affects the improvement of venous flow. The intensive phase of the treatment is followed by the maintenance phase consisting of the daily use of standard or individually sized compression garments.

The use of pneumatic compression is rather controversial. Earlier use of pneumatic compression involved multiple therapeutic protocols, and inappropriate treatments were linked with several side effects (11). Some studies corroborated their usefulness, while others discounted effectiveness. Few schools of lymphedema therapy support their utilization as a part of the combined treatment regimen (12,13), while others are opposed to

this application (11,14). The consensus document of the International Society of Lymphology includes pneumatic compression pumps as belonging to optional treatments which may be applied as an adjuvant therapy to the classical CPT (10).

The main goal of the present study was to provide evidence in the treatment of lipedema. In addition, we were also interested whether the addition of pneumatic compression to standard CDP improved the therapeutic outcome in women with lipedema.

#### *PATIENTS AND METHODS*

This prospective study included 23 women who had developed bilateral leg lipedema. Patients were first seen at the lymphedema outpatient care unit of the Department of Dermatology and Allergology. Prior to enrollment in the study, each patient was examined to rule out previous deep vein thrombosis using physical examination and color Doppler ultrasonography of the legs. All patients signed a written informed consent approved by the Ethical Committee of the University of Szeged.

Patients were randomly enrolled into the two arms of treatment. The treatment groups were not significantly different from each other in the number of participants (13 and 10), mean age and range (51.3 years (32-65 years), 50 years (44-80 years)), and mean duration time interval from the patient's first notice of clinical manifestation to the treatment (9.1 and 10.2 years; all values, respectively). CDP consisted of 60 minutes of MLD by Vodder's method (8) performed by a specially trained physiotherapist followed by skin care with moisturizers, appropriate foam-padding, and multilayered short-stretch bandaging application. Those patients who received additional pneumatic compression therapy were treated with MLD for 30 minutes followed by treatment with Lympha Press Plus machinery (Mego Afek, Israel) using a long sleeve for another 30 minutes. According to our standard practice, a

maximum pressure of 30 mmHg was applied. The second group also received the same therapeutical modalities as the first group. Each patient underwent a 5-day-course of once daily treatment and all patients fully completed all components of therapies. After the cessation of a treatment cycle, patients wore standard or individually sized compression grade II or III medical compression stockings.

Leg volumes were measured using the classical Kuhnke's disc method (15) and circumferences obtained at 4-cm intervals beginning at the foot and ending at highest point of the inner thigh. Although not as accurate as the direct or inverse water displacement model, this is a very good way to approximate volume and to compare the volumes over time. Both legs were considered in limb volume measurements.

## RESULTS

Measurement of the limb volume reduction is the most common approach to quantify the extent of lipedema and evaluate the therapeutic success. In the CDP group, pretreatment mean leg volumes were  $17,760.08 \pm 4,692.9$  (right leg) and  $17,976.15 \pm 4,960.8$  cm<sup>3</sup> (left leg) which reduced to  $16,998 \pm 4,516.9$  (right leg) and  $16,866.46 \pm 4,474.2$  cm<sup>3</sup> (left leg) ( $p=0.0011$  and  $0.001$ , respectively). In the CDP+IPC treated group, the mean baseline leg volumes of  $15,331.8 \pm 2,767.5$  (right leg) and  $15,396.4 \pm 2,284.9$  cm<sup>3</sup> (left leg) decreased to  $14,240 \pm 2,907.9$  (right leg) and  $14,024.50 \pm 2,821.2$  cm<sup>3</sup> (left leg) ( $p=0.000958$  and  $0.00039$ , respectively). No significant difference was found between the two treatment modalities on either side ( $p=0.0706$  and  $0.071$ , respectively) and no side effects were detected during or after the therapeutic course.

## DISCUSSION

Lipedema is a disproportional obesity presumably associated with genetic back-

ground and hormonal dysfunction (4,8). It is easily distinguishable from other entities like lymphedema and phlebedema, and it shows an altered microcirculation pattern of the lymphatic system. Without appropriate treatment and adequate diet, lipedema is a rapidly evolving disorder that can cause severely limited mobility and can lead to associated lymphatic or/and superficial venous insufficiency. In pure lipedema, the amount of transportable interstitial fluid is higher compared to non-lipedematous limbs leading to an increased lymph flow (6). This increase in flow decreases the ability of the lymphatic system to handle further excess fluid, and even minor structural alterations can cause insufficiency and lymph accumulation. Superficial venous insufficiency can also intercede due to the weak connective tissue resistance exerted by enormous fat.

In accordance with our experience, the most successful therapeutic approach for lipedema is CDP and the crucial part of CDP is MLD (8). MLD is a technique of gentle massage, which stimulates the lymphangiomotoric activity. It opens and dilates the uninvolved lymph routes and then directs the lymph away from the edematous parts and reduces the volume of the limb by diminishing the persistent lymph. Besides lymph flow improvement, it reduces lymph stasis, increases protein resorption, and softens fibrosis. Intermittent pneumatic devices share similarities with MLD with respect to results. Furthermore, IPC has been reported to increase venous flow, improve tissue oxygenation, accelerate wound healing, and reduce relapse rate of leg ulcers (16,17). It has been utilized in a large variety among lymphedema patients. Richmand and his group safely used the pumps for upper limb lymphedema at high pressure (80-110 mmHg) for prolonged periods (6-8 hrs) (18). Despite this rigorous protocol, no signs of tissue destruction were detected. A similar protocol was applied by Pappas et al for 4-8 hours, where long-term responses were observed (19). Yamazaki's group followed another treatment protocol

where pneumatic compression was performed every second day through a full year course (20). They used a maximum of 80 mmHg pressure and achieved significant edema reduction in 57% of the total cases. Zanolla and his study group studied 60 patients with postmastectomy lymphedema. Intermittent pneumatic pressure up to 90 mmHg was employed for 6 hours each day in a full week period (21). Remarkable edema reduction was recorded. In the previous studies, no MLD accompanied the use of pneumatic pumps. Numerous side effects are attributed to the application of pumps (11): pumps do not evacuate fluid from the ipsilateral body quadrant; in lower extremity lymphedema, pumping can cause swelling of the external genitalia; and pumps may traumatize the superficial lymphatics. Some groups routinely apply the pneumatic machinery as an adjuvant treatment with MLD (12,13). Pumps must be used carefully, at relatively low pressure to avoid the collapse of superficial lymphatics (22), and as a part of a comprehensive program including MLD, bandaging, exercise and skin care.

Short-stretch compression bandages play an active role as patients use their muscle pumps. They maintain fluid balance and keep the pumping mechanism intact. In the maintenance phase, patients must wear compression grade II or III stockings to preserve the achieved volume reduction. The major and most highlighted effect of CDP is volume reduction that diminishes the sensation of heavy legs, improves joint mobility, and reduces accompanying symptoms such as tactile pain and hematoma formation.

To our knowledge, this is the first report on a comparative study implementing complete decongestive therapy in lipedema. Our study clearly verified the efficacy of the experience-based therapeutic approaches. Under the given experimental conditions, the two examined modalities were equally successful in limb volume reduction. Although IPC appeared to have no significant adjunctive role to CDP in lipedema

treatment, it may offer cost savings to some clinics due to reducing time demands on the therapist for MLD and in addition may also allow the treatment of more patients simultaneously.

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