

# PHYSICAL ACTIVITY IN THE PREVENTION AND TREATMENT OF LYMPHATIC INSUFFICIENCY

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## Abstract

**Introduction:** Regular, intensive physical effort performed within an adequate period of time is considered to be an important factor in the prevention and treatment of lymphatic and vein insufficiency. Untreated lymphedema regarded as a result of the mechanical insufficiency (low output failure) of the lymphatic system, always has a tendency to progression and in the later stages of the disease causes physical, mental and social disabilities.

**Aim:** The purpose of the paper was to present current knowledge on the importance of physical activity in the prevention and treatment of lymphatic insufficiency.

**Methods:** The first part of this article provides an outline of the pathophysiology and aetiology of lymphedema and its treatment, the next discusses the significance of physical exercise in the prevention and treatment of this condition, the mechanism of the muscle pump and the optimal exercise program. The third part presents different types of physical activities which are recommended or non recommended.

In literature there is agreement on the indispensability of physical effort as a preventive and therapeutic factor in the management of lymphedema. However, the type, intensity and frequency of exercises safely reducing swelling are not fully defined.

**Conclusion:** Both a lack of physical effort as well as too vigorous and prolonged sporting activity are factors increasing the risk of developing or increasing oedema.

**Key words:** *Lymphatic system, lymphedema, lymphoedema, chronic venous insufficiency, compression therapy, physical exercise*

There is no doubt that physical activity plays an important role in the prevention of diseases caused by contemporary civilisation. Regular, intensive physical effort performed within an adequate period of time is considered to be a factor in the prevention of lymphatic and vein insufficiency alike.

## What conditions normal lymph flow?

The lymphatic system performs two basic functions: it maintains a balance between fluids in the interstitial and intravascular spaces and participates in immunological processes.

In explanations of mechanisms which regulate the formation and lymph outflow we can use Starling's traditional hypothesis describing existing forces causing the flow of fluid resulting from differences between hydrostatic and oncotic pressures in capillaries, interstitium and lymphatic vessels.

The endothelial cells in lymph capillaries forming a filtrating barrier, have intracellular connections and possibilities of active transport of large molecular substances and they are under complex neurohumoral regulation.

90% of Interstitial fluid is reabsorbed in the venous end of capillaries. A small amount of fluid containing large proteins returns to the lymphatic system.

Starling's hypothesis is right as a general model, but according to another model the microcirculation of most tissues is normally in a state of slight filtration and dwindled absorption.

Constant fluid outflow is conditioned by many factors: muscular contractions in lymphatic vessels (contractions of lymphagions, intrinsic pump), an efficient valve system, muscle pump activity (extrinsic pump), respiratory movements of the chest increasing negative pressure and aspirating action which influences the lymph and vein vessels, arterial pulsation, movements of the diaphragm .

## Etiopathogenesis of lymphedema

Lymphedema, lymphoedema regarded as a result of mechanical insufficiency (low output failure), resulting in decreased transport capacity may be a result of abnormalities of structure and function of the lymphatic vessels (primary lymphedema), injuries, inflammation or related to cancer (secondary lymphedema).

Lymphedema with a vein component often accompanies cancer . It may occur in consequence of the occlusion or compression of lymph vessels by the disease process, it may result from aggressive oncological treatment. In people without advanced cancer, after surgery or radiotherapy which included lymph

nodes, there is sometimes latent, subclinical lymphatic insufficiency. This group of people is at risk. Evident lymphoedema can develop in these people when stimulated by factors such as excessive physical effort, injury, infection,

Lymphedema may occur as a consequence of prolonged pressure on the lymphatic system – this occurs in chronic vein insufficiency when owing to an increase of hydrostatic pressure in the veins, a lot of the fluid formed cannot be transported to the circulation by the lymphatic system, which in time causes an impairment of the valve system and lymphatic vessels.

### **Therapeutic management**

Because of the chronic nature of the illness and the lack of possibilities to be cured, prevention, patient education and their family play an important role. This prophylactic management includes skin care, appropriate physical effort, elevation of the limb and body weight control.

In developed lymphedema a fundamental role is played by Complex Physical Therapy. It consists of two phases: an intensive phase (early): the purpose is edema volume reduction in a short period of time mainly by removing accumulating fluid in the interstitial spaces, and a maintaining phase (later), to the end of life, the purpose of which is supporting the effects which were obtained during the intensive phase.

During the intensive phase the main methods applied are: manual lymph drainage (MLD), intermittent pneumatic compression (ICP) and compression bandaging (CB) connected with physical and breathing exercises. These are used to decrease lymphedema and to fit compression garments appropriately which are used with exercises during the maintaining phase.

### **The importance of physical effort in lymphedema prevention and treatment**

A significant part of prevention and treatment are physical exercises activating the muscle pump which depends on efficient muscle influencing the deeper part of the lymphatic system (subfascial).

Physical exercises should be applied both during the intensive and the maintaining phase of treatment.

### ***The mechanism of the muscle pump***

The deep lymphatic system (internal) is located under the fascia, it is less developed and is connected with the superficial system on the lymph node level and by lancinating vessels, when the fluid displaces from deep vessels to superficial.

The deep lymph vessels run near muscles, arteries and veins. Muscle contraction causes pressure on the lymph vessels and the fluid outflows centrally not moving back because of valves. When the muscles are relaxed the light of the vessel dilates and the fluid

is pulled into the vessel. This mechanism is called the muscle pump and is activated mainly during dynamic physical efforts, which enhance the physiological lymph outflow in the same way as MLD stimulates lymphagiomotoricity and makes absorption to the vein easier. Without movement and exercises lymph flow falls to a very low level. It is probable that lymphatic contractility (the intrinsic pump) fails, so extrinsic pumping must play a far greater role. It is accepted that muscle activity is able to increase lymphatic flow by a factor of 15. Researches on the pathogenesis of chronic vein insufficiency has proved that the muscle pump plays an important role in the decrease of vein pressure.

### ***Physical exercises in prevention and treatment of lymphedema***

Every patient who has experienced oncological treatment suffers latent lymphatic insufficiency after surgery. These patients are at increased risk and should therefore be introduced to prevention, including appropriate skin care and physical activity. Both a lack of physical activity as well as too vigorous and prolonged sport activity are factors increasing the risk of developing oedema.

In women after breast cancer, limb function impairment, decreased shoulder and arm mobility, reduction of muscle strength of the upper limb on the operated side, incorrect body posture and general decrease in physical fitness are observed.

Limitation in the range of motion caused mainly by the postoperative scar and post radiation fibrosis in the armpit is one of the indirect factors in upper limb lymphedema development.

In these patients physical activity should include exercises maintaining or improving the range of motion in the shoulder, strengthening muscles, generally increasing fitness and maintenance of body weight.

Severe lymphedema limits limb function, disturbs the proper functioning of kinetic, nervous and cardio-respiratory systems, decreases the range of motion in the joints, weakens muscles and hand manipulation, and disturbs walking and good posture.

The aim of the exercises in developed lymphedema is limb function improvement and increased physical fitness.

An optimal exercise program should include exercises activating the mechanism of the muscle pump, exercises based on dynamic physical efforts: active, alleviated and self-supported exercises. In people with developed lymphedema they should be performed in bandaging or compression garments like a sleeve or stocking to improve the effectiveness of muscle work in a short period of time, with a small number of repetitions, several times during a day (15-20 minutes in one go) so as not to tire muscles and cause local

congestion which can cause edema after physical effort. For these reasons it is often advised to avoid high-intensity or prolonged physical activity of the affected limb. Exercises start from proximal part of the body and finish distally.

Some studies show that high-intensity physical effort (stretching, aerobic, resistance exercises, weight training) may be beneficial in patients with lymphatic insufficiency, but there is no research to prove this.

Recent research shows that exercises for the upper limb with weights increase limb volume and physical symptoms in some cases, while 10 minutes of active exercises connected with deep breathing reduce limb volume and physical symptoms.

High-intensity and prolonged physical effort, especially without appropriate preparation may cause increased or developing lymphoedema but physical effort performed progressively under control, doesn't have to be harmful.

### ***Breathing exercises***

An adjunctive part of prophylaxis and the whole physiotherapeutic program are breathing exercises performed before, during and after physical exercises.

Breathing movements with using negative pressure in the chest, deep breathing during manual lymph drainage activate the work of the chyle cistern and cause outflow of the fluid to the vein in the chest.

### ***Other forms of activities***

The other form of activity recommended by the American College of Sports Medicine are aerobic exercises (walking, biking, swimming, jogging) prescribed 3 to 5 days per week, at moderate intensity (60 -80% maximal heart rate), activating the cardio-respiratory system and improving physical fitness.

A form of outdoor activity based on walking with sticks and introduced by Finnish trainers is Nordic Walking. It is a very popular form of activity in the Scandinavian countries, Germany, Switzerland and in our country too. This form of exercise may be performed by people independent of age, sex, physical fitness, by sportsmen and people undergoing physiotherapy. Nordic Walking involves all the muscles of the lower limbs and most muscles of the upper limbs. It is a natural and safe form of activity for older and overweight people. It seems to be an ideal form of recreation for people with upper and lower limb lymphoedema.

### ***Physical efforts not recommended in lymphoedema***

Despite research showing the benefits of intensive effort, different therapeutic schools in Europe and in the world (Földi, Schingale, Asdonk, Leduc Cavezzi, Casley-Smith) highlight the positive influence of physical effort at a moderate intensity for an adequate

period of time on lymphoedema reduction. Some kinds of exercises, for example isometric exercises, are controversial. Some authors consider that isometric exercises which rely on a change of muscle tension without a motor effect, (muscles fibres remain the same length and joints are at rest) influence beneficially on lymphoedema reduction while the others think the contrary, owing to lack of internal self drainage and local congestion. These exercises cause an increase of filtration and in consequence an inflow of fluid.

An increase of filtration may be observed in all anaerobic physical efforts like short distance running, resistive exercises (weight lifting) and some asanas in yoga.

This form of physical activity increases lymph flow and intensifies lymphoedema and should therefore be avoided.

Many patients have a serious problem related to practising favourite sport. It is difficult to decide whether they should continue practicing it or not.

It depends on many circumstances related to treatment. If somebody has been practicing a sport before surgery, after treatment he doesn't have to resign from this sport on condition that he adapts his physical effort to his general physical fitness and that he tries to avoid high-intensity physical exercises. It is very difficult to forbid different forms of outdoor or indoor activities, especially regarding children suffering from lymphoedema and deprive them of the joys of life.

Patients shouldn't practice sports with people who have a very high physical efficiency and high technical skills as this may encourage them to uncontrolled, excessive physical effort (especially in team games).

Regular, systematic and intensive physical effort adapted to the patient's ability is recommended in people at risk and with developed lymphoedema. Progressive increase of physical exercises doesn't have to intensify it.

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