

IMPACT OF OSTEOPATHIC TREATMENT IN THE IMPROVEMENT OF THE FUNCTIONING OF THE LYMPHATIC SYSTEM

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Abstract

The lymphatic system is the second circulatory system of our body and an essential integrator of all tissue fluids. If for some reason the work of this system was to be stopped, a patient would die in 24 hours due to massive edema and impaired retention of metabolic toxins.

The aim of this article is to present osteopathic approach in assisting the treatment of lymphatic system insufficiency and the analysis of mechanism of lymphatic edema.

The paper presents the mechanism of insufficiency of the lymphatic system and the osteopathic approach in the treatment of lymphedema. Osteopathic treatment used in this case can be divided into two areas of procedures. The first is aimed at removing the barriers in the flow of lymph, and the second is aimed at helping in the drainage in areas where the dysfunction occurred. Authors also list the techniques used in specific dysfunctions coexisting with lymphedema.

Key words: lymphedema, osteopathy, angiology

Characteristics of the lymphatic system

The lymphatic system is a part of the cardiovascular and the immune system. It includes capillaries, collecting lymphatics, great lymph trunks and lymph nodes. It starts with lymphatic capillaries which drain the interstitial fluid and create lymph. They are found in subcutaneous connective tissue and mucous membrane. They have no valves and, as a result, lymph can be moved to any place. Capillary walls have so called inlet valves through which interstitial fluid, proteins and migrating cells can enter the lymphatic vessels and create lymph [1,2].

Next, lymph is transported to the vein system through lymphatic pre-collectors, lymphatic collectors and lymph trunks. Pre-collectors are found between capillaries and

collectors. Valves and smooth muscles are partially present, and they transport lymph to collectors. Collectors have valves and smooth muscles. We divide them into: superficial collectors and deep collectors. Superficial collectors are found in the subcutaneous fat tissue, and they are responsible for drainage of the skin and subcutaneous tissue. Deep collectors are placed interfacially, and they drain muscles, joints and ligaments. They are placed on a shared sheath along the veins and arteries. Visceral lymph collectors which along with organ arteries drain internal organs [1, 2].

Main lymph trunks include: lower body trunks consisting of the lumbar trunks (left and right) which drain lower extremities, part of torso and pelvic organs and the intestinal lymph trunk going to thoracic duct; upper body trunks include jugular trunk which drains the head and neck, subclavian trunk which drains lymph from upper quadrants of the torso, axillary nodes, breast glands and upper extremities, and also bronchomediastinal trunk which drains bronchus, lungs, mediastinum, and joins itself on the right side in the right lymph duct [1,2,3].

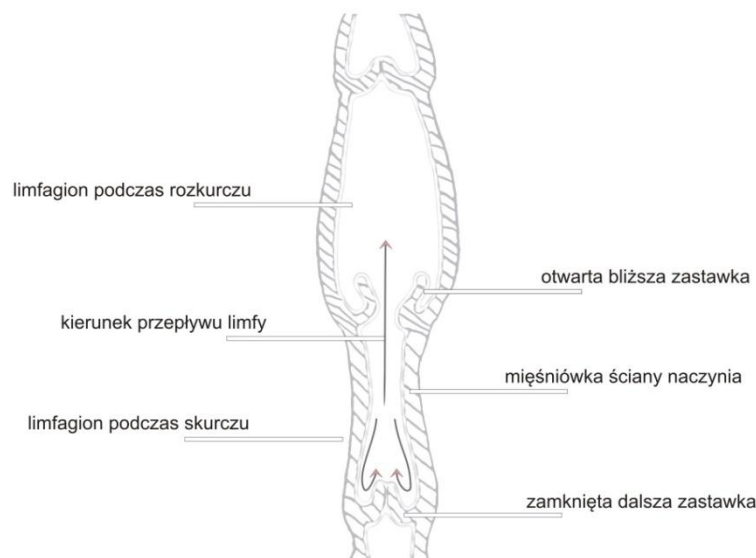


Fig. 1 Lymphangion contraction – cooperation of valves and lamina muscularis mucosae of vessel's walls.

The basic functions of the lymphatic system include the maintaining of interstitial fluid volume homeostasis, filtration and removal of extraneous elements from the interstitial fluid (i.e. bacteria). Another important function is the transportation of cells' products of metabolism and their residues, and also the transportation of triglycerides absorbed in the digestive tract [3, 4].

Lymphatic vessels of lower extremities consist of the superficial system transporting around 80% of lymph from the extremities and containing vessels running along great saphenous vein and small saphenous vein, and the deep system aligned with arteries and deep veins. Subfascial system of lymphatic vessels transports the lymph to deep inguinal lymph nodes. From there the lymph goes to iliac lymph nodes [2, 4].

The transportation of the lymph is dependent on the contraction of lymphangion which should be at the rate of 10/min. The motorics of lymphangion is influenced by the contraction of lymphangion's smooth muscles, the autonomic nervous system and the contraction of the arteries in lower extremities (subfascial lymphatic network is placed on a shared sheath with veins and arteries) [1, 2].

Lymphatic system is a passive system whose functioning depends on external factors.

Lymphatic insufficiency

Lymphedema is a tissue edema caused by the accumulation of interstitial fluid and lymph in the tissue space and lymphatic vessels as a result of primary or secondary damage to the lymphatic vessels [5].

The types of lymphatic obstruction can be divided into dynamic and mechanical. In the case of dynamic lymphatic insufficiency, also known as high-volume insufficiency, the netto volume of created ultrafiltrate (fluid load containing protein) is higher than the anatomical and functional transport capacity of a properly functioning system. This creates an extracellular edema. Mechanical lymphatic insufficiency (low-volume lymphatic insufficiency) is caused by the damage to the lymphatic vessels, and the transport capacity is limited [5,6,7].

Lymphedema caused by the mechanical insufficiency of the lymphatic system can be divided into primary and secondary. Primary edema is caused by hypoplasia or agenesis of lymphatic vessels. It can take the form of congenital (appearing before the first year of life), lymphedema praecox (appearing between the age of 1 and 35) and lymphedema tarda (appearing after the age of 35). Secondary edema caused by various factors damaging the lymphatic vessels can be categorized into: postinflammatory edema, postsurgical edema, post-cancer treatment edema, post-lymphadenectomy edema, post-traumatic edema, post-radiation edema, veno-lymphatic edema, parasite infection edema and edema in paralyzed and immobilized extremities [5,6,7,8,9,10].

Another cause of lymphatic malfunction is the insufficiency of the "safety valve". It is characterized by reduced transportation capacity of lymphatic vessels and the simultaneous

increased lymphatic load. It is caused by lymphangiosclerosis where lymphatic hypertension damages the vessels. hemodynamic insufficiency is caused by right ventricular insufficiency, inability to pump the blood to the pulmonary artery, which can lead to the blockage of blood flow in the right ventricle and the venous system. Ultrafiltrate is caused, lymphatic load increases, and the increased lymphatic fluid load exceeds limited transport capacity leading to cardiac edema [5,6,8,9,10].

The mechanism of interstitial fluids

There are several factors which determine the flow of lymph. One of them is the pressure of interstitial fluids. In proper conditions it reaches around -6,3mmHg. Any increase in the pressure causes the absorption of the lymph to the capillaries of the lymphatic system. If the increase reaches 0 mmHg, this can lead to the 20-fold increase in the lymph flow, which in normal conditions is 120ml/hour [7]. If the pressure goes above 0 mmHg, interstitial fluid pressure is increased and it becomes higher than the pressure in lymphatic vessels, causing them to shut and to impair the drainage.

Factors influencing the interstitial pressure are as follows:

- a) Increase in the capillary pressure (system hypertension)
- b) Reduced plasma colloid osmotic pressure (cirrhosis with lowered synthesis of plasma proteins)
- c) Increased protein presence in the interstitial fluids (hypoalbuminemia in starving people)
- d) Increased capillary permeability (due to the presence of toxins)

The other factor influencing the flow of lymph is the intrinsic pump. Lymphatic vessels have an internal mechanism of active lymph propulsion. When lymph enters the vessel, the latter is vasodilated, and vasodilated vessels have stimulated contraction of smooth muscle of the vessel, effectively pushing the lymph further. This cycle is repeated again and again. There are no smooth muscles in capillaries, but there are endothelial cells containing contractile fibers (myoendothelial fibers) which are responsible for the vasodilation of fluids in a similar way. The flow of lymph through the capillaries causes delicate negative pressure, sucking the lymph from the capillaries as a result of alternating state of vasodilation and vasoconstriction. Rhythm of vessel contractions in the extremity is around 6-8 seconds per cycle [12]. This represents 8-10 cycles per minute.

Another factor influencing the flow of lymph is the application of external pressure. Any increase in internal pressure exerted on lymphatic vessels increases the lymph flow. The

contraction of artery vessels in the vicinity of lymphatic vessels also increases the flow of the lymph [13, 14].

Breathing, and especially the work of diaphragm, is extremely important in the external influence on the lymphatic system. Tendon reflexes influence the cisterna chyli.

All movements of internal organs such as breathing, bowel movements, as well as extremity movements exert significant influence on the flow of the lymph.

Respiratory diaphragm not only massages the lymphatic system, but breathing causes the difference in pressure between the thoracic cavity and the abdominal cavity. This difference along with one-way flow of the lymph helps the lymph to get to the venous circulation. Slowing and acceleration of breathing will have an influence on the slowing and acceleration of the lymph flow.

Intensive physical exercise along with extremity, organ and diaphragm movements can lead to 15 to 20-fold increase in the lymph flow.

In normal conditions pelvic diaphragm works together with respiratory diaphragm. When both diaphragms work properly, normal lymph flow from the the lesser pelvis is ensured through optimal pressure difference caused by diaphragms' contractions. The floor of the pelvis must be elastic in order for the internal organs to function properly. If this area was stiffened, this would increase the pressure of the diaphragms movements on the internal organs, causing the impairment of their work and drainage functioning in the pelvic area and abdominal cavity. Alternate movements of diaphragms during breathing cause mechanical pump for lymphatic vessels and sinus venosus of pelvis, anus area and peritoneum. Body, for a better protection of this area, apart from levator ani is equipped with the second layer in the form of urogenital diaphragm [7].

Osteopathic treatment of lymphedema

Osteopathic treatment impacts all systems of the body, but a special impact can be observed in the case of lymphatic system. Andrew Still, the creator of osteopathy, considered the lymphatic system to be the most important system of our bodies and he was one of the first researchers in the world to consider this system in the treatment and prevention of diseases.

The treatment of lymphedema consists mainly of conservative treatment. Complete Decongestive Therapy recommended for adults and children includes: taking care of hygiene of one's skin and nails, manual lymphatic drainage, the use of elastic bands/anti-dema

bandages, exercises enhancing the muscle pump. Other manual osteopathic procedures can be found in English medical literature [13,14,15,16,17].

Osteopathic treatment of lymphedema can be divided into two broad types of procedures. The first one is focused on the removal of barriers in the lymph flow, and the second one on assisting the drainage in the areas affected by the dysfunction [14,15,16,18].

The aim of osteopathic therapy is to balance the lymphatic system that functions properly when there is no edema. The fact that the lymphatic system is a passive system means that it needs proper body movements and sufficient drainage. Osteopathic treatment can have a great influence on the improvement of the movements, and, in turn, it can facilitate proper fluids' dynamics [14, 15].

Osteopathic techniques can have a positive impact on various levels of our organism.

1. Activation of fluids flow

Activation of lymph circulation, indirect stimulation of capillaries in circulatory system, venous vessels, interstitial fluids, cerebrospinal fluid and synovial fluid.

Application of the techniques helps to “move” the blockage of fluids (edema, primary or secondary lymphadenopathy) in the skin, mucosae, muscles, internal organs, joints, cranial sutures, periosteum etc.

2. Osteopathic techniques drain:

- a) Toxins: as a element of therapy the techniques improve the regeneration of tissues, for example in the areas of scars, fractures, surgery
- b) Macromolecules (proteins): the techniques help to eliminate protein-rich fluids from the extracellular tissues, absorb the inflammations and edemas
- c) Fats: lipid molecules in the body are evacuated by the lymphatic system

3. They stimulate the immune system:

Enhanced lymph flow carrying antigens to the lymph nodes increases antigen/antibody contact. These techniques can be used as a preventive measure, but a positive effect was observed in cases of chronic inflammations and sub-acute states such as: bronchitis, sinusitis, tonsillitis, arthritis, eczema, chronic fatigue syndrome, autoimmune diseases etc.

4. They stimulate the sympathetic nervous system: stimulation of lymphatic system increases the activity of parasympathetic nervous system and decreases the activity of the sympathetic nervous system. This can be of great significance in the treatment of stress, depression and sleep disorders.

5. Pain reduction: osteopathic techniques reduce the stasis of fluids and they can suppress nociceptors
6. Reduction of increased muscle tension: hypertonic muscles, constipation etc. [14].

The aim of the osteopathic treatment of the lymphatic system is to properly balance it and avoid the edema. Due to the fact that the lymphatic system is passive, movement and proper lymph drainage become even more important.

Osteopathic therapy causes:

- Increased fluids resorption
- Enhanced circulation and respiration
- Decreased protein volume in endothelium
- Improved organism's pH balance

Fascia, creating a support for lymphatic, artery and venous vessels and the nerves, is of crucial importance for these systems. Fascia sprain, elasticity disorders, symphyses, splicing will cause lymph flow impairment. In scientific literature [16] we find four body regions in which changes in fascia system tension can be found: occipital bone-atlas, cervicothoracic junction, thoracolumbar junction and lumbosacral junction. Regions described by Zink are the junctions between the three main parts of our body, the head, the chest and the pelvis, along with their respective diaphragms. These are the regions where dysfunctions appear with the changes in the activity of the autonomic nervous system. These regions are also important for the transportation and the movement of interstitial fluids and air via differences in pressure in different body cavities. There are compensatory movement patterns which connect the spine with respective diaphragms and they connect all the regions with fascia system which creates a pathway for the vessels [16, 17, 21].

Conclusions

Osteopathic treatment of the lymphatic system is divided into two groups:

- a) Techniques removing the restrictions in the lymph flow
- b) Techniques facilitating and improving the lymph flow [17,19].

In clinical practice, during the treatment, the techniques from the two groups are used alternately, but always starting with the techniques removing the restrictions in the lymph flow.

The therapeutic protocol can be presented as follows:

1. Techniques of rib lifting or the inhibition of parasympathetic nervous system in Th1-L2 area. These techniques aim to reduce the increased activity of the parasympathetic nervous system affecting the workings of lymphatic vessels. The mobilization of ribs also improves the functioning of respiratory system.
2. The treatment of thoracic outlet syndrome. This area is the most important area for the functioning of the entire lymphatic system because this is where lymphatic trunks go into the veins of the chest in the area of carotid sinuses.
3. Loosening of the respiratory diaphragm. Diaphragm's functioning is improved along with its capacity for the creation of pressure difference between the chest and abdominal cavity.
4. Loosening of the pelvis area including the pelvic diaphragm and urogenital diaphragm. This area allows for the improvement of lymph's return from the lower extremities and the pelvis to the higher areas.
5. Fascial techniques of lower and upper extremities.
6. Stimulation techniques, improving the lymphatic drainage, such as lymphatic pumping, manual drainage, drainage of internal organs etc.

This is a general pattern of treatment and it can be modified, depending on the problems experienced by the patient [17, 18, 20, 21].

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