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Investigation of the Less Known Effects of Manual Lymphatic Drainage: A Narrative Review

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Abstract

AU4 ▶ ***Introduction:*** Manual lymph drainage (MLD), one of the components of complex decongestive physiotherapy, which is accepted as the gold standard in the treatment of lymphedema, is used for therapeutic purposes in many diseases. The most well-known feature of MLD is that it helps to reduce edema. In addition to reducing edema, MLD has many effects, such as increasing venous flow, reducing fatigue, and raising the pain threshold. To the best of our knowledge, there is no study examining the effects of MLD other than its effects on edema in detail. The aim of this study is to compile effects of MLD and to provide a better understanding of the effects of MLD.

Methods: A literature search was conducted in Medline, Embase, and the Cochrane Library in July 2019, to identify different effects of MLD. The articles were chosen by, first, reading the abstract and subsequently data were analyzed by reading the entire text through full-text resources. To undertake the study, we have collected information published about different effects of MLD over the last 30 years (1989–2019). According to our results, 20 studies met inclusion criteria.

Conclusions: This study suggests that MLD can be used in symptomatic treatment of various diseases (multiple sclerosis, Parkinson's disease) considering the effects of MLD on the systems.

Keywords: literature review, pain threshold, pain tolerance, fatigue

Introduction

AU5 ▶ Manual lymphatic drainage (MLD) was developed in 1936 by Danish biologist Emil Vodder and his wife Estrid Vodder[1] and matured by Földi et al.[2] MLD, one of the components of complex decongestive physiotherapy, is a treatment application mainly used to accelerate lymph flow.[2,3]

MLD, which is mainly used in lymphedema treatment, is also used in traumatic injuries, muscle fiber tears, dislocations, complex regional pain syndrome (sudeck disease), scar treatment, rheumatoid diseases, headache, and migraine in a wide range of diseases and symptoms.[3]

Special training is required to apply MLD. There are many schools offering MLD training (e.g., Vodder, Földi, or Leduc). However, the education provided by these schools shows a big deal of similarities. In all of them, superficial lymphatic vessels are stimulated primarily to remove excess fluid from the interstitial space. To do this, physiotherapist generally apply gentle grip at low pressure.[4]

When the literature is reviewed, a review examining the numerous effects of MLD has not been found. The aim of this study is to compile the effects of MLD and to provide a better understanding of the effects of MLD.

Methods

In this narrative review, a literature search was conducted in Medline, Embase, and the Cochrane Library in July 2019 to identify different effects of MLD. The articles were chosen by, first, reading the abstract and subsequently data were analyzed by reading the entire text through full-text resources. To undertake the study, we have collected information published about different effects of MLD over the last 30 years (1989–2019). According to our results, 20 studies met inclusion criteria.

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Results

MLDs effects on lymph system

MLD is applied gently on the skin to increase the contraction of the smooth muscles around the superficial lymphatic vessels, thereby increasing the lymph flow. MLD enables lymph and tissue fluid to move forward and also increases the frequency and amplitude of the contraction and relaxation movement of lymph collectors called lymphangiomotoric.[3]

Tan et al. evaluated lymphatic flow velocity and time to escape lymphatic fluid with near infrared (NIR) fluorescence before and after MLD to 22 subjects (10 subjects with a diagnosis lymphedema and 12 healthy control subjects). Indocyanine green was injected intradermally in bilateral arms or legs of these subjects and NIR fluorescence images were collected. Their results showed that average lymph velocity increased in both the symptomatic (23%) and asymptomatic (25%) limbs of subjects with lymphedema and control limbs (28%) of healthy subjects. Also, lymph fluid flow back time decreased in symptomatic (9%) and asymptomatic (20%) limbs of subjects with lymphedema, as well as in control limbs (23%).[5]

MLDs effects on nervous system

MLD is a very gentle and low-pressure technique. Patients often feel deep relief during treatment. This helps to reduce the firing rate of the sympathetic nerve (sympatholytic effect).[6] In the sympathetic state, the skin is moist and thus transmits more electricity. When the firing of the sympathetic nerve is reduced and the patient becomes more parasympathetic, the skin dries and transmits less electricity. The sympatholytic effect of MLD can be measured by the skin's resistance to electrical conductivity. Dr. Hutzschenreuter conducted experiments that measured the resistance of the skin by passing a small amount of electrical current through the patients' skin. He showed that Dr. Vodder's MLD technique increased skin resistance, which was an indication that sympathetic effect was reduced. This has a significant effect on the body, especially on the regions of the body that are innervated by the autonomic nervous system. Other effects on the nervous system include pain pathways. Analgesic effects may occur when MLD is administered correctly.[7]

MLDs effects on pain threshold and pain tolerance

The pain threshold is defined as the severity of the smallest stimulus causing pain in the person, while the pain tolerance is defined as the largest stimulus causing the pain that the person is ready to tolerate.[8]

Stroking applied to the skin with MLD has a painful stimulus effect. Touch receptors in the skin detect this stroking movement. Although touch receptors are only capable of generating action potential at the beginning and end of the contact, they adjust the ignition level according to the change in the level of contact. The nerve fibers of the touch receptors are key stations in the spinal cord. After the station stops, the warning goes to the cerebrum and is detected. In addition, inhibitory cells are located on the lateral side of the spinal cord. In addition, inhibitory cells are located on the lateral side of the spinal cord. These inhibitory cells are associated with the key cells of the pain pathway. If the touch receptors are stimulated, they are transmitted in the spinal cord, the inhibitor cells always turn this stimulation into inhibition, thereby inhibiting pain by affecting the key cells of the pain pathway in the spinal cord. Inhibition is initiated if the touch receptors are stimulated. The inhibitory effect will be stronger as neighboring touch receptors are also stimulated by the stroking movement. Each of these receptors creates action potential at the beginning and end of contact. These action potentials create inhibition on pain transmission. Thus, stroking with MLD may cause pain reduction. This inhibitory effect on pain transmission is limited. The inhibitory effect of stroking movements is too weak to affect very severe pain. However, pain and edema decrease with MLD in cases such as painful hematoma, edema, and Sudeck atrophy.[9,10]

Sung-Joong Kim applied MLD to 29 stressed people and measured the pain threshold of these individuals with an algometer before and after MLD. He reported a significant increase in pain threshold after MLD.[11]

MLDs effects on musculoskeletal system

In their study, Schillinger et al. loaded healthy individuals up to the anaerobic threshold on the treadmill. After the loading, one-session MLD was applied to the treatment group, while no intervention was applied to the control group. Then, biochemical markers of skeletal muscle cell integrity of individuals in both groups were analyzed. Compared with the control group, the treatment group showed a statistically significant decrease in blood lactate dehydrogenase and aspartate aminotransferase concentrations immediately after a treatment session and immediately after a 48 hour observation. The decrease in serum levels of skeletal muscle enzymes following MLD indicates the potential of potential regenerative and repair mechanisms for skeletal muscle cell integrity following structural damage associated with physical activity.[12]

Vairo et al. suggests that in their systematic reviews MLD may be efficacious in the resolution of enzyme serum levels associated with acute structural skeletal muscle cell damage.[13]

MLDs effects on heart rate and blood pressure

Leduc et al. reported that there was no significant change in blood pressure after applying MLD to nine patients with heart failure, but there was a significant reduction in heart rate.[14]

Ramos et al. reported that there was no significant change in systolic and diastolic blood pressure after MLD in 23 healthy subjects.[1]

Roth et al. found no significant change in mean arterial pressure after MLD in 14 patients with acute brain injury. In the same study, there was no significant change in heart rate during MLD administration, but the changes obtained during follow-up were significant.[15]

Esmer et al. in their study on 30 healthy individuals, neck, abdomen, anastomotic region, and different regions of the extremities after the drainage reported different responses. Controlled changes in heart rate and blood pressure have been reported after drainage of each area.[16]

MLDs effects on oxygen saturation

Oxygen is transported largely by binding to hemoglobin in the blood. A small amount of oxygen is dissolved in the blood. The amount of oxygen transported in the blood due to

hemoglobin is called oxygen saturation. Oxygen saturation (SpO_2) is ~97% in a normal healthy person with partial oxygen pressure (PaO_2) of 95 mm Hg.

In the study of Roth et al., it was reported that oxygen saturation increased significantly when MLD was administered to 14 patients with acute brain injury, whereas no significant change was observed in partial brain tissue oxygenation.[15]

Esmer et al. reported that there was no change in saturation after MLD applied to healthy individuals.[16]

MLDs effects of blood and lymph vessels on smooth muscles

Dr. Hutzschenreuter showed that MLD increases blood flow. This is thought to be due to the increase in vasomotion resulting from contraction of smooth muscles in the arterioles. The relaxation of the precapillary smooth muscle sphincters in the arterioles is achieved by the sympatholytic effect. This also causes an increase in blood flow. Unlike deep tissue massage, MLD is a very gentle massage and does not cause local blood pressure to increase.

MLD works in the opposite direction to deep tissue massage, does not increase blood pressure; but facilitates drainage from the tissue. MLD does not increase the accumulation of interstitial fluid in the tissue, and it may even cause a temporary reduction. Therefore, MLD is useful in patients with lymphedema in whom the amount of interstitial fluid increases. MLD is also beneficial in cases such as Reynaud's syndrome, as it increases blood flow without causing accumulation of fluid in the tissue. MLD is also effective on the smooth muscles of lymph vessel collectors.[17,18]

The walls of the lymph vessels include circular and longitudinally arranged types of smooth muscle fibers. One of the ways to contract these muscles is to stimulate the stretching reflex. When the muscle walls are stretched (e.g., when the inside of the lymph vessels are filled), the stretching receptors are stimulated. This causes contractions of smooth muscles. The special movements used in Dr. Vodder's MLD technique allow the stretching of the lymph vessels. This increases the frequency and amplitude of the contraction.[17]

The smooth muscles in the lymph collectors are innervated by the particularly sympathetic part of the autonomic nervous system. Decreased firing of the sympathetic nerve causes dilation and filling of lymph vessels. Dr. Hutzschenreuter has shown that MLD has similar effects on smooth muscles and sympathetic system. A similar mechanism exists in the gastrointestinal tract. When the walls of the intestine are stretched, the peristaltic wave of contraction is initiated. Mislin has described how special tensile forces stimulate the lymphatic motor system.[17,18]

MLDs effects on venous circulation

dos Santos Crisóstomo et al. demonstrated that venous blood flow increased in the superficial part of the deep femoral vein and vena saphena magna after MLD administration to healthy subjects.[19]

Guerero et al. evaluated the venous and arterial blood flow velocity by Doppler ultrasound after MLD application in patients with lymphedema of the upper extremity after breast surgery. As a result of their studies, there was no significant change in arterial blood flow velocity in the upper extremity, and the blood flow velocity in the brachial vein was significantly increased.[20]

In many studies, it has been reported that MLD is used in patients with chronic venous insufficiency because it increases venous blood recycling and it is a useful application.[2,19,21–23]

MLDs effects on fatigue

In the literature, only one study examining the effect of MLD on fatigue markers was found. In this study, 18 healthy women were divided into 2 groups. MLD was applied to one group after intensive exercise program and not to the other group. As a result of the study, it was shown that lactic acid and lactate dehydrogenesis levels in MLD patients decreased more rapidly. This suggests that MLD may help reduce fatigue after an intensive exercise program.[24]

MLDs effects on the development of lymphedema

Patients who underwent unilateral lymph node dissection due to breast cancer were divided into two groups. Seventy-nine patients were included in the intervention group and 81 patients were included in the control group. The intervention group received the necessary training on MLD, exercise therapy, and lymphedema prevention. The control group received other treatments except MLD. Both groups received treatment for 6 weeks. As a result of the study, it was determined that the patients with both groups developed lymphedema at a similar rate. As a result of the study, it has been reported that MLD may not have a protective effect on the development of breast cancer-related lymphedema.[25]

In another study examining whether MLD had a protective effect, breast cancer patients undergoing modified radical mastectomy were divided into two groups. Physical exercise group ($n = 500$) received curative exercise training and progressive weight training. Patients in the MLD group ($n = 500$) were asked to take 10 minutes of self-administered MLD 3 days a week in addition to physical exercise program. As a result of evaluations, it was reported that there was a significant difference between upper limb circumference measurements when patients in MLD group were compared with patients in exercise group. At the end of the study, it was stated that self-MLD applied together with exercise is beneficial in preventing upper extremity lymphedema.[26]

Conclusions and Future Studies

MLD affects many systems. Knowing these effects in detail can help us better understand the indications and contraindications of MLD. In addition, this information will help to make MLD more informed. This study also suggested that MLD may be effective in reducing symptoms such as pain and fatigue in multiple sclerosis and Parkinson patients. Therefore, future studies should investigate the effects of MLD on patients with Parkinson's and multiple sclerosis.

Ethical Considerations

This study is not reporting on experiments with human subjects, but is a literature review. Therefore, ethical approval is not applicable.

AU6 ▶ **Author Disclosure Statement**

No competing financial interests exist.

AU7 ▶ **Funding Information**

AU8 ▶ **References**

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