VIA MEDICA

ABSTRACTS

Acta Angiol
Vol. 22, No. 2 pp. 60–70
Doi: 10.5603/AA.2016.0010

ISSN 1234–950X
www.journals.viamedica.pl/acta_angiologica

I[st] Conference of the Lymphological Section of the Polish Phlebological Society

Wroclaw 22–23.04.2016

Lymphedema — pathophysiology, diagnosis and treatment

ABSTRACTS

The influence of local platelet-rich plasma therapy on the bacterial population of chronic lymphovenous crural ulcers

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Introduction. The long-term nature of crural ulceration advantages colonization, and synergistic reactions between microorganisms slow down the healing process. The aim of the study was quantitative and qualitative analyze of microbiological flora in lymphovenous crural ulcers during local platelet-rich plasma therapy-(PRP).

Material and methods. In the years 2013–2015 27 patients with lymphovenous crural ulcers were treated by local PRP. Specimens for bacterial ulcer culture were collected from the surface of ulcer at each patients before and 3 weeks after the PRP treatment.

Results. The analyzed group of patients included 18 women and 9 men of the age 47–90 years (mean age 68.51, SD 9.82). Ulcer area ranged from 3 to 85 cm^2 (mean 32.03 cm^2). The duration of the ulceration was between 11 and 192 months (mean 61.4). After local PRP treatment clear improvement in healing was observed in 20 patients (74.1%) — group A, and the lack of improvement in the remaining 7 cases (25.9%) — group B. From the specimens, witch were taken before the therapy 66 stains were isolated, after the treatment their number has increased to 91 (mean number per patient has increased from 2.15 to 3.4). Comparison of changes in the number of isolated stains in both groups showed significant differences. In the group A after the PRP treatment there was an increase from the 43 stains to 68 (mean increase from 2.15 to 3.4). In group B, the number of isolates (23) both before and after the treatment did not change, however, was initially higher — 3.28. The most common bacteria before and after treatment were Pseudomonas aueruginosa and Staphylococcus aureus.

Conclusions. Use of local PRP therapy causes an evident increase in the variety of species of microorganisms, however the healing process is not affected.

Involvement of the lymphatic system in hypertension in humans

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Introduction. Mechanisms of salt sensitive blood pressure have not yet been clarified. Recent studies, mainly on animal models, have suggested that glycosaminoglicans (GAGs) and bonded to them atoms of sodium (Na^+), macrophages and lymph vessels in the skin interstitium act as extrarenal control of sodium, body volume and blood pressure. It was presume that salt-sensitive hypertension may result from exceeding the capacity of the skin to buffering the amount of Na^+ in the body.

The aim of the study was to prove the hypothesis that lymphatic system and macrophages influence skin salt storage and regulate blood pressure.

Material and methods. We examined 89 patients of the Department of Surgery who had elective surgery with abdominal skin incision. Among them 55 were hypertensive (42 had essential and 13 had refractory hypertension) and 34 formed a control group. Mean age in these groups estimated accordingly 65.40 and 61.97; p = 0,166.

The groups were compared in respect of the content of: 1) Na^+, water, number of macrophages (CD68), density of lymphatic vessels (D2-40) and blood vessels (CD31) in the specimens of abdominal skin taken before surgery, 2) concentration of GAGs in 24-hour urine collection and 3) concentration of indicators of salt-sensitivity in plasma (NT-proANP, VEGF-C, VEGF-D).

Results. The groups with and without hypertension differed in skin expression of CD68 (7,192 vs. 4,285; p = 0.005), in plasma concentration of NT-proANP (3.4 vs. 2.43 nmol/l; p = 0.024) and VEGF-C (4633 vs. 5366 pg/ml; p = 0,009).

After the division of the whole group of study patients to the groups with CD68, NT-proANP, VEGF-C and VEGF-D above and below the median of these values, the results were as following: the group with higher expression of CD68 had greater expression of CD31 (5.26 vs. 4.50; p = 0.015), concentration of GAGs in urine (184.3 vs. 113.4 mg/l; p = 0.0215) and concentration of NT-proANP in plasma (3.67 vs. 2.44 nmol/l; p = 0.005); the group with higher concentration of NT-proANP had greater expression of CD68 (7.90 vs. 4.36; p = 0.002) and concentration of GAGs in urine (181.5 vs. 112.7 mg/l; p = 0.04); and the group with higher level of VEGF-D had greater concentration of Na^+ in the skin (435.4 vs. 224.8 mg/kg; p < 0,0001).

The division of the hypertension group for the groups with CD68, NT-proANP, VEGF-C and VEGF-D above and below the median of these values, gave the results as follows: the group with higher expression of CD68 had greater percentage of water in the skin (58.20 vs. 42.33%; p = 0,036), plasma concentration of VEGF-C (5086 vs. 4196 pg/ml; p = 0,0487) and NT-proANP (3.98 vs. 2.87 nmol/l; p = 0,02); the group with higher concentration of NT-proANP had greater expression of CD68 (9.05 vs. 4.97; p = 0,018); and the group with higher concentration of VEGF-D had greater expression of D2-40 (5.25 vs. 4.42; p = 0.011).

Conclusions. There are some significant relations indicating that lymphatic system may be involved in the pathogenesis of salt-sensitive hypertension in humans. Decreased levels of VEGF-C in patients with hypertension suggests that impairment of the protective function of the lymphatic system may play a role in the pathogenesis of hypertension.

The impact of compressotherapy on quality of life (QoL) in patients with chronic venous insufficiency

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Introduction. Chronic venous insufficiency is an important health, social and therapeutic problem. Symptoms and signs resulting from this pathology can have an important impact on patients QoL by reducing their functionality. The most important treatment, besides behavioral modification, is compressotherapy because of its effectiveness in preventing edema.
The aim of the study was QoL assessment in patients with chronic venous insufficiency treated with compressotherapy.
Material and methods. We assessed 47 individuals (25 women) with chronic venous insufficiency but without venous ulcer, who were treated with supportive compressotherapy. Patients were qualified by practitioners to the 2nd class of the compression. Polish version of CIVIQ was used to assess patients' QoL. This assessment was done before therapy and 4 weeks after beginning.
Results. Patients mean age was 54.4. The results confirmed improvement in QoL in patients within all tested areas. The level of the QoL after compression treatment rose by 22.25% ($p = 0.01$). The largest improvement was reported for pain relief (44.31%), the lowest in mental sphere (13.13%). In social and physical sphere improvements were observed by 30.36% and 22.2% respectively.
Conclusions. Compressotherapy, as an supportive therapy, is an effective method in chronic venous insufficiency treatment. This method improves QoL in all of the tested areas.

The use of thermal imaging in the diagnosis of lymph edema

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Introduction. Increasingly, in addition to the classical methods of diagnosing lymph edema apply thermal vision using a difference of temperature distribution in the superficial tissues, which may also depend on the size of lymphoedema.
The aim of this study was to evaluate the usefulness of thermal imaging in the diagnosis of lymph edema. It was assumed that the temperature of superficial tissues is associated with the size of edema, so that thermography can be a complementary method of existing test methods.
Material and methods. The study was performed in 51 women after breast cancer treatment in middle age 64 years ($SD = 7.4$). There was arm edema in 20 of them. The swollen was measured based on the volume difference limbs. It was calculated using the program Limb Volumes Professional version 5.0.
There was recordings superficial body temperature with infrared camera ThermoVision A20M cooperating with a personal computer equipped with a program Therma CAM Researcher 2.8, in all women.
Results. It shows a higher surface temperature of the upper limb on the operated side relative to unoperated and in women with lymphoedema compared to women without lymphoedema after breast cancer treatment.
Conclusions. Due to differences in the distribution of surface temperature of the upper limbs thermography can be considered as a complementary diagnosis method of lymph edema.

Effectiveness of compression in the treatment of massive primary lymphedema of the lower limb

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Introduction. We present a case of a young man with massive, primary right lower limb edema, effectively treated with complex lymphatic therapy.

Material and methods. 44-year old man with massive right lower extremity lymphedema, obesity and hypertension was admitted to the Department of Internal Medicine of 4th Military Hospital in Wroclaw, Poland goal the use of the complex lymphatic therapy. The lymphedema appeared in a patient 30 years of age and gradually grew. The patient was repeatedly hospitalized due to edema and recurrent skin infections, no significant improvement. With the current admission to the hospital the patient does not move by itself. The skin in the area of edema was thickened, horny, with numerous deep folds of thick and hard skin. The skin of the heel deep ulcer was present.

Results. The treatment uses a complex lymphatic therapy (lymph drainage, compression bandaging, exercises decompressive), antibiotics and pneumatic massage. Before discharge from the Clinic patient's family trained in compression bandaging. After two cycles of a complex therapy of lymphoid (lasting eight weeks, respectively, and 4 weeks) yielded reduce the maximum thigh circumference of 132 cm to 83 cm, reduce the maximum circumference of the lower leg from 125 cm to 79 cm, weight reduction from 213 kg to 156 kg, reduction in the volume of right lower extremity 39 liters and the healing of sores on the skin of the heel. The patient can walk independently.

Conclusions. Comprehensive lymphatic treatment remains the primary method of treatment of lymphoedema. This method, carried out under hospital ward, enables effective treatment even in patients with difficult and complicated lymphedema.

ACT and connect to make your life better. Quality of life in women with lipoedema — contextual behavioral approach

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Introduction. Lipoedema is chronic, progressive condition of unknown etiology. It is relatively common (it affects about 11% of women irrespective of body size) but underdiagnosed or misdiagnosed and therefore undertreated. The main symptom consists of the accumulation of the fat in lower parts of the body, usually from the waist to just above the ankles with associated oedema [1]. Lipoedemic fat cannot be lost through diet and exercise and with time it becomes painful. The quality of life (QOL) in women suffering from lipoedema may be affected by many factors, ie.: unfamiliarity of the condition to the majority of medical providers; chronic pain; comorbidity (obesity, lymphoedema, arthritis); psychological consequences linked to weight stigma, body dissatisfaction and helplessness; disordered eating, depression and anxiety [2].

Contextual Behavioral Science proposes a novel approach to human suffering that proves useful in relation to chronic disease, stigmatization, body dissatisfaction and weight management. It offers two promising treatments aimed at improving of psychological flexibility (PF) and social connection (SC). PF is the ability to be open to difficult thoughts and feelings while engaging in value-based action. Enhancement of PF is the goal of Acceptance and Commitment Therapy (ACT) [3]. Increasing SC is the goal of Functional Analytic Psychotherapy (FAP) [4].

The objective of this study was to answer if contextual behavioral factors mentioned above contribute to the QOL in women with lipoedema.

Material and methods. We conducted an internet-based cross-sectional study that consisted of several measurements: satisfaction with life (SWLS) and quality of life (WHOQoL-Bref) BMI, symptom severity, psychological flexibility (AAQ-II), body image flexibility (BI-AAQ), self-compassion (SCS), social connectedness (SCS-R), intimacy (FAP Intimacy Scale) and committed action (CAQ) body shape preoccupation (BSQ, disordered eating (EDE-Q). One hundred twenty women

with lipoedema from the United States, the United Kingdom and Australia participated in the study. We present only those results that are most important from the practical point of view.

Results. We checked whether AAQ-II and SCS-R scores predicted quality of life scores on the SWLS and the WHOQOL-BREF measures beyond those accounted for by symptom severity. Final model explaining SWLS variance accounted for 13.1%, and was significant ($F(3; 110) = 5.42$; $p = .002$). With respect to the WHO-QOL-BREF — model was significant and explained 44% of variance ($F(3; 108) = 28.74$; $p < .001$).

Conclusions. Irrespective of the symptom severity, SC is related to higher satisfaction with life and QOL in women with lipoedema and PF is related to higher QOL in this group of women. Therefore we may assume that both ACT and FAP may be useful as treatments to improve QOL of women with lipoedema. Taking into account the importance of SC, support groups might play special role in improving QOL in this particular group of women. However further research in this area is needed.

Oedema prevention and treatment in pregnant women: current knowledge

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Often hereditary, lower limb oedema ensues also from cancer or chronic venous insufficiency (VI); it occurs in nearly 80% pregnant women (PW) during the 3rd trimester, mostly due to abnormalities in the venous system. Pregnancy increases the risk of venous thrombosis and may trigger primary oedema (in its late presentation) in PW in the high-risk group, i.e. those with reduced lymphatic transport reserves, obesity, overweight, sedentary lifestyle, or hereditary VI as per family history. The paper aims to review current knowledge of risk factors, prevention and treatment of lower limb oedema in PW.

Current guidance on the prevention and treatment of thromboembolic disease in high-risk PW recommends proper diagnostics, graduated compression hosiery, physical therapy, and pharmacological treatment. In women after C-sections or thrombosis, intermittent pneumatic compression or bandaging is endorsed, too. Compression is a basic prevention and treatment method in venous-lymphatic insufficiency. As of now, few authors have looked at the effectiveness of compression therapy in PW; however, their conclusions have testified to its favourable effect on PW's venous system. Further research into PW's oedema-preventive compression and quality of life is urgently called for.

Nutritional recommendations for obese patients with lymphedema

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Lymphedema (lymph) is a swelling of the tissue caused by excessive accumulation in the intercellular space the interstitial fluid rich in protein.

The most common cause of lymphedema is cancer. In addition, lymphedema is a common complication of the chronic venous insufficiency (CVI). It was also shown that obesity prevalence is associated with a higher incidence of severe swelling degree of tissues. The prevalence of obesity is the cause of deterioration in the functioning of the lymphatic system as well as edema occurence is a common complication of obesity. In addition, obesity has a significant, negative impact on the: lymphatic transport, dendritic cell migration and also on the architecture of the lymph nodes.

It has been demonstrated that patients with a impaired lymphatic system have a higher mean values of body mass index (BMI) compared to the patients with normal lymphatic system function.

In an obese patient treatment with lymphedema it is important to strive to achieve a healthy weight. The

main goal in the treatment of obesity is to establish to the proper energy intake and estimation the realistically weight reduction in the range of 5–15% of the initial body mass during half a year.
Another step of the obesity treatment is to determine the structure of energy intake from macronutrients such as: protein, fat and carbohydrates energy intake and introduce a balanced and varied diet, taking into account food preferences of the patient and his financial capabilities. Furthermore, if the patient lead a sedentary lifestyle should be encouraged to the physical activity of low intensity, such as walking, swimming, yoga, adapted to the individual physical abilities. It is also important to have regular rehabilitation exercises to help in draining the lymph.

Implementation of pneumatic massage with MOBIDERM in the treatment of arm lymphedema

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Introduction. Secondary Lymphoedema is the result of Breast cancer treatments. Appearance of Secondary Lymphoedema depends on the type of surgery and Radiation Therapy and the time of observation. When lumphodema occurs is treated with full-scale conservative treatment therapy.
Kinesytherapy treatments combined with pulsed pneumatic compression or compression lymphatic drainage produce the desired results . In the study for the compression was used MOBIDERM material according to the protocol for it use.
The purpose of the study: Is comparison of efficacy single-chamber pneumatic massage with the Mobiderm to the single-chamber pneumatic massage.
Material and methods. The study was conducted in Department of Rehabilitation in Institute of Oncology (the Maria Curie-Skłodowska Memorial Cancer Center) in Warsaw. In the study attended two Group of patients — 30 people each. Average age in study Group (A) was 56.3. In the control group (B) was 58.
Group A (study group) — 30 patients who undergo single-chamber pneumatic massage with the compression (Mobiderm). Value of pressure: 40 mm Hg, time of treatment — 30 minutes. Classification of patients: size of lymphoedema, limb circumference is higher by 10–20% of a healthy limb, consistency soft or medium hard 0.09.
Group B (control group) — 30 patients who undergo single-chamber pneumatic massage. Value of pressure: 40–80 mm Hg, time of treatment — 40 minutes. Classification of patients was the same as in the Group A.
In both groups measurements were made twice:
1. Before the treatment.
2. 14 days after the treatment.

A tailor centimeter was used to measure arm circumference. Study was carried out according to upper arm edema survey card ruled by Rehabilitation Department.
Results. Group I improvement: shoulder: 1.733, forearm: 0.90 hand: 0.85. Group II shoulder: –0.07, forearm: 0.12 hand: –0.08.
Result of study. Discussion of results: using compression (with MOBIDERM) in the lymphoedema therapy it shows significant improvements over the treatment without compression. In the measurement arm — the results show an improvement of about 2 cm. and on the forearm and hands — about 1 centimeter.
Conclusions. 1. Using the embrace-compression during single-chamber pneumatic massage improve that therapy. 2. Compression plays a very important role in the conservative treatment of lymphoedema.

The effects of Kinesiotaping on the extent of lymphedema in women after axillary lymphadenectomy due to breast cancer

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The aim of the study was to assess the effects of Kinesiotaping application (KT) on the extent of lymphedema of the upper extremity after axillary lymphadenectomy. The study group consisted of 28 women who underwent the procedure due to breast cancer. The extent of lymphedema was measured with the use of centimeter tape and Limb Volumes Professional software. The whole programmme lasted 5 weeks. The measurements

of the extremity with lymphedema were performed 4 times: the first measurement was the taken during the qualification to the study, the second — control examination time (period without KT application) and the next measurements assessed the reduction of lymphedema after KT application. The measurements of the healthy extremity were performed 2 times. Lymphatic application was performed using a spiral technique around the upper extremity. Additionally, the patients were divided into two sub-groups: the one group performed physical exercises and the other group did not.

The control period (between the first and second measurement) showed no statistically significant differences in the size of lymphedema. A significant reduction in the extent of lymphedema ($p < 0.05$) was achieved after KT, both for the group as whole, as well as separate subgroups. The physical exercises did not increase the effectiveness of therapy. In addition, significant reduction of lymphedema occurred only in the first week of KT.

The Kinesiotaping application can be used as a supportive method of physiotherapy in the treatment of lymphedema in women after axillary lymphadenectomy due to breast cancer.

Compression in the prevention of lymphedema in women after breast cancer. Preliminary report

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Introduction. Breast cancer survivers are at increased risk for the development of breast cancer related lymphedema (BCRL). At the present time is a lack of randomized controlled trials evaluating compression in BCRL prevention. The aim of this study was to evaluate the potential role of arm compression sleeves for reducing the incidence of postoperative BCRL.

Material and methods. 48 patients (mean age 58.3 yrs, BMI 26.9 kg/m^2) undergoing breast cancer surgery were enrolled in this ongoing prospective randomized clinical trial. Here we present the outcome of 41 patients who were pre-operatively randomized into one group with compression (Compression group, CG) or into a group without compression (Non compression group, NCG) and who were followed up to 6 months postoperatively. CG group received preventive circular — knit sleeves in the I class (15–21 mm Hg) (medi Bayreuth) for a daily wear. Both groups underwent a standardized physical exercise program. Arm volumes were assessed by circumferential measurements before surgery and after 1, 3, 6 months. The two groups were comparable concerning basic characteristics and type of surgery and additional therapeutic modalities (chemio, radiotherapy).

Results. Compared to the preoperative arm volumes the NCG group showed an increase after 6 months in 20/21 patients, the CG in 7/20 patients. The median % change of the arm volumes after 6 months was –1.1% (IQR –2.9 to +2.9) in the CG group versus +4.6% (IQR +3 to +6.9) in the NCG group ($p < 0.005$). Volume increase in the range of 10–20% defined as mild lymphoedema was observed in 2/20 patients in CG, and in 7/21 patients in NCG. The median pressure values of the sleeves measured at mid-forearm were 17 mm Hg (IQR 13–18).

Conclusions. Arm sleeves are able to reduce the risk of lymphedema in women after breast cancer.

Lymphangiosarcoma — sarcoma derived from the lymphatic vessels. Diagnostic difficulties — case

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Lymphangiosarcoma is a highly malignant angiosarcoma developing in chronic lymphoedema. Extremely rare, it is usually reported as a complication of mastectomy. The aim of this study is to present the case of a 54-year-old patient with lymphoedema of the left leg associated with oncological treatment of melanoma on patient's left thigh, and to describe diagnostic problems with the hyperplastic lesion developing in the tissue of the swollen limb.

Left leg oedema occurred 6 years after oncological treatment. Apart from this symptom, physical examination revealed the following: a subcutaneous nodular lesion located in the anteromedial part of the lower leg and ulceration (ca. 10 mm in diameter) with serosanguineous exudate in the epidermis.
Differential diagnosis considered: metastatic melanoma, benign papillary lesion, venous ulceration of the limb with lymphoedema, lymphangiosarcoma.
Hystopathological examination of collected samples revealed the following:
"Poorly differentiated, non-epithelial neoplasm. IHC test: pCK/-/ Melan A/-/ S-100 /+//-/ Ki 67 — 2%. More specific diagnosis cannot be made on the basis of the test samples and obtained clinical data".
Lymphangiosarcoma was diagnosed in the discussed case, due to the following evidence: absence of the Melan-A protein in IHC, absence of pigmentation in the neoplastic cells, occurrence on chronic lymphoedema. The evolution of the disease in the discussed patient indicates high malignancy of the lesion. The patient died 6 months after the diagnosis. In case of patients with chronic lymphoedema, special attention must be paid to atypical skin lesions and rare complications such as limphangiosarcoma must be taken into consideration during differential diagnosis.

Is modern medicine capable of preventing postoperative lymphedema?

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Introduction. Lymphedema (LO) of the upper limb affects about 10 to 35% of the female patients subjected to lymphadenectomy and/or radiotherapy during the treatment of breast cancer. This is the most frequent complication, and yet it has not been established why it occurs only in some of the female patients.
Assessment of the available results of research into the prevention of lymphedema following the surgical management of breast cancer.
Material and methods. The analysis comprised papers published in 2012–2016 and selected using the MEDLINE-Ebsko, the MEDLINE-OVID, and the PubMed databases, as well as the Google Scholar scholarly literature browser.
The review included 7 original papers and 3 review articles.
Results. 1. Lymphatic outflow malfunction in the region other than the one affected by oedema suggests genetic aetiology of LO. Genetic mutations that modify the inflammatory response may increase the risk of LO. 2. In prevention, the significance of Axillary Reverse Mapping is emphasized. 3. Contradictory observations can be found with regard to the effectiveness of manual lymphatic drainage performed either as an autonomous procedure or in combination with active exercise, as well as with regard to the application of compression at an early stage. 4. It has been observed that female patients after the surgical management of breast cancer have little awareness of the threat of LO and the risk factors that contribute to its development.
Conclusions and implications for practice. 1. It is not possible to distinguish the group that is particularly vulnerable to LO from among the oncological patients. 2. It is difficult to recommend one model of preventive approach to LO — the treatment is always case-oriented and based on the individual patients' multiple needs. 3. The patients must have better access to information on the risk factors and prevention, and they must be more encouraged to self-control in this regard, including by support groups.

The effect of physical stimulation of microcirculation on selected parameters of muscle fatigue

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Introduction. In athletic training a single physical exertion of high intensity is a significant burden for the hu-

man body and skeletal muscles. In consequence, it leads to muscle fatigue or delayed onset muscle soreness (DOMS). The ability to compensate changes resulting from intense exertion depends on numerous factors, with blood flow regulation in microcirculation being the main factor. The continuous capillary exchange in the venous, arterial and lymphatic systems allows maintaining adequate tissue nutrition and restoration of post-exercise balance [1, 4, 7, 9, 12]. The function of the lymphatic system, playing a role in adaptation to effort and elimination of post-exercise muscle fatigue is still unknown. Assessment of the role of individual microcirculation elements, initially based on the so called sterling rule, is still evolving, especially in the context of lymphatic system impact increase [8, 13].

Material and methods. The study assessed the effect of physical approaches to lymph drainage (MLD, manual lymph drainage), electric stimulation of smooth muscles (BF, bodyflow) and deep oscillation (DO) on the process of post-exercise regeneration of forearm muscles in mixed martial arts (MMA) competitors.

Changes in perfusion unit (PU), pain threshold, maximal muscle strength, muscle tone, lactate (LA) concentration and creatine kinase (CK) activity were analyzed in the process of post-exercise recovery. The sample comprised 80 males involved in MMA training. All the participants were randomly assigned to one of the four experimental groups: MLD < BF < DO and the control group.

Results. The study found that Physical methods of lymphatic drainage (PMLD) contribute to changes in perfusion unit (PU) and increase venous outflow rate, eliminating post-exercise muscle soreness and increased muscle tone. Analyzing biomechanical indices, such as maximal strength, pain threshold & muscle tone, we can conclude that there are statistically significant differences between the study groups and placebo group (P). These differences were most significant during the first day of the study (Rest 20 min). Moreover, FMLD were found to have a favorable effect on changes in LA concentration and CK activity, however, in the case of CK n statistically significant differences were noted.

Conclusions. The results indicate that there is a need for involving methods stimulating the microcirculation to accelerate muscle fatigue reduction and thus, eliminate the risk of injuries.

Type of method	Flow rate in the cephalic vein	Perfusion Unit (PU)
Rest Flow (RF)	15.57	11.8
Deep Oscillation (DO)	26.89	108
Body Flow (BF) electric stimualtion	23.60	25.6
Manual Lymph Drainage (MLD)	29.30	41.7

The incidence and severity of obstructive sleep apnea. Apnea patients with lymphedema

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Introduction. Lymphedema is an illness which (regardless of its etiology) lymph gather in the extravascular space. Compression therapy is an acknowledged method to treat this condition (the use of external pressure with the help of bandages and pneumatic apparatus) [1, 2]. This leads to the movement of the liquid from intercellular space to endovascular area and subsequently to the extraction of its excessive amounts afterwards. Obstructive sleep apnea (OSA) is an illness as a result of which the upper respiratory tract gets temporarily narrowed or completely closed while asleep. This leads to apnea, shortness of breath and periods of nocturnal hypoxia. It is estimated that about 13% of men and 6% of women in the overall population suffer from severe OSA [3] and its occurrence is drastically higher by patients afflicted with illnesses involving liquid retention such as heart failure and stage kidney disease [4]. The aim of our work was to assess the frequency of occurrence and the degree of severity of OSA with a group of patients suffering from lymphedema and to analyze the results of the compression therapy treatment on OSA.

Material and methods. 26 patients (21 women and 5 men; average age = 58 years; average body mass index [BMI] = 43 kg/m^2) with identified lymphedema of both lower limbs were admitted to Internal Diseases Clinique with the intention to use compression therapy (intermittent pneumatic compression 30 minutes a day, pressure 120 mm Hg, complex pressure therapy according to ISL). Prior to the treatment both lower limbs were measured. The patients were interviewed according to the surveys Epworth and STOP-BANG. BMI measurement and polysomnography examination was performed (with Embla Gold apparatus; the recording time 8 hours; registration of airflow in the airways; chest and abdominal movements registration; pulse oximetry). The average time of hospitalization was 13 days.

After the treatment the lower limbs were measured again, BMI was rechecked, by 17 patients polysomnography examination was conducted (14 women and 3 men; average age = 58 years). By patients by whom OSA was identified in the initial examination CPAP therapy was not introduced. Collected data was saved into an Excel file which was subject to statistical analysis (Statistica®).

Conclusions. Indeed, OSA occurs more often among patients with lymphedema than in the general population. In the group of examined patients OSA was diagnosed in 69% of cases. 42% suffered from mild apnea, 27% from moderate or severe one.

Discussion. There is no data of the frequency of occurrence of OSA among patients with lymphedema. The examination conducted in 4th Military Teaching Hospital in Wroclaw showed the co-existence of OSA among majority of such patients. It is known that OSA is co-related with obesity. Earlier studies showed that the frequency of OSA occurance among the obese is about 59% [5, 6].

Our patients had average BMI 42 kg/ m^2. It is probable that the obesity itself is not the only reason for such a high occurrence of OSA in this group of patients. Despite the lack of control group it is worth mentioning that no other studies on the obese resulted in such a high percentage of OSA identification as in our group (59% vs. 69%). In the available literature an substantive deterioration of AHI results among patients with liquid retention was observed. This resulted from the movement of some amounts of liquids from the lower to the upper body parts while in lying position at night [7]. This led to gathering of the liquids in the area of throat which increased the tissue pressure and, subsequently, caused narrowing of the upper respiratory tracks. Some other studies point to the improvement of breathing parameters during the sleep after the use of squeeze knee socks during the daily activity time [8, 9].

The use of continual compression therapy while treating lymphedema in the initial treatment phase (the reduction of edema) causes the shift of substantive liquid amounts from the extra- to the endovascular area which can result in OBS escalation due to the scenario described above. It seems that in the further stage of the treatment (the phase of the preserve of the effects of edema reduction after intensive compression therapy) the amount of liquids in the lower body parts and its movement are reduced during the night time. This can hypothetically positively influence the OSA indicators. The minor AHI increase can also be the result of specificity of lymphedema and its treatment [10]. Due to malfunction of lymphatic system the position of body does not affect the liquid migration to such an extend as in the case of circulatory insufficiency. Moreover, the

Table 1. Summary of results

Parameter	Average ± standard deviation
Age (years)	58.12 ± 13.45
Sex (F/M)	21/5
Result in Epworth Scale	6.7 ± 4.41
Result in Stop-Bang Scale	3.33 ± 1.43
Duration of compression treatment (days)	13.88 ± 5.99
Initial BMI (kg/m^2)	42.91 ± 10.94
Δ aggregate volume of both lower limbs (l)	4.29 ± 5.67
% AHI > 5	69.2
Average AHI in the initial examination (1/hour)	13.66 ± 15.01

Table 2. The number of the ill in the initial polysomnography examination divided according to AHI results

AHI (1/hour of sleep)	Number of patients (n)
< 5	8
5–15	11
15–30	3
≥ 30	4

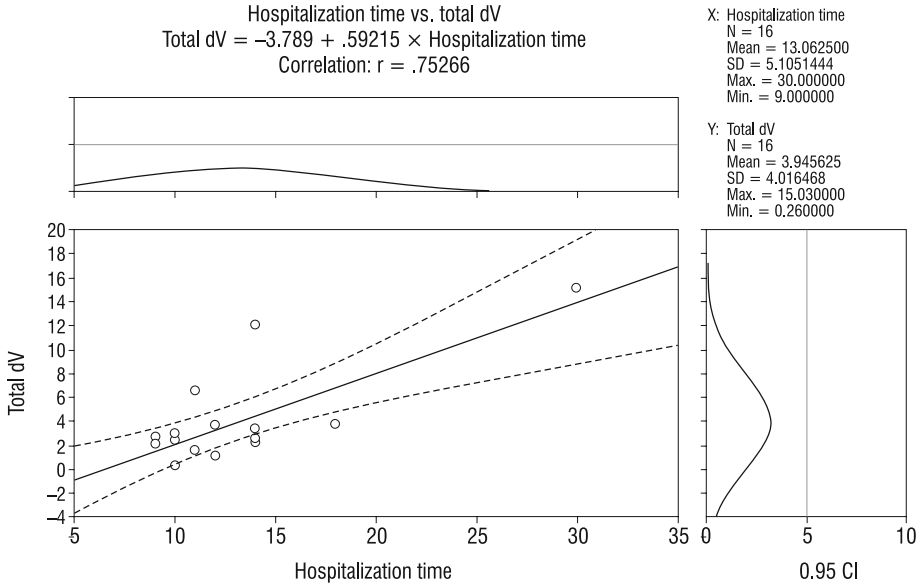

Figure 1. The relation between the volume change of the lower limbs and the duration of hospitalization (dV — volume change)

strongest compression is implemented during the daytime activity of the ill, so the liquid movements during the nighttime are limited. This, however, needs to be confirmed in he further studies and needs longer observation period. What seems indisputable is the fact that patients with lymphedema should be diagnosed for OSA

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