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A consequence of surgical interventions, of other secondary damages or of diseases of the vessels of the lymphatic system, the chronic lymphedema still represents an indication, that, from a therapeutic point of view, is looked at with pessimism. This very often results from an underestimation of the therapeutic possibilities known for long. In the foreground there is the "complex physical drainage therapy" (4).

The fundamentals of this therapy date back to the last century. In the first half of this year, it was Vodder who primarily systematized this way of treatment.

The elements of the "complex physical drainage therapy" (in German: "KPE") are:

- Manual lymphatic drainage,
- Compression therapy (during the phase of discharge with special

ACCOMPANYING THERAPY IN LYMPHEDEMA

KEY WORDS

Lymphedema, complementary therapy, free radicals, selenium

SUMMARY

Therapy of first choice in chronic lymphedema is the complex physical drainage therapy. Complementary measures serve the prevention of erysipelas, the treatment of secondary tissue damage and additionally existing diseases in the lymphedematous area. Some measures of physical medicine and drugs are discussed. Antioxidative therapy as a new principle is presented. It is used to decrease secondary tissue damages by free radicals and to prevent possible damage far from the lymphedematous area.

compression bandages: later, - for «conservation and optimization», with specially adapted compression socks),

- Kinesitherapy and
- Skin care.

Surgical interventions (e.g. transplantation of lymphatic vessels by means microsurgery) are not very wide spread and reserved only for specific indications.

Although an entire or at least a certain retrogression of the edema can be achieved in the majority of the cases, by correct diagnosis and consistent application of the «basic therapy», - KPE (in German) -, questions concerning other effective ways of therapy are justified. This also refers to methods in lymphedematous

extremities, which become necessary due to secondary diseases (e.g. pain due to degenerative or functional disturbances of joints or the spinal column).

Manual therapy, techniques of mobilization.

Disturbed statics and movements often result from the swelling of lymphedematous extremities. Very often the consequences are painful functional blockings in the joints of the spinal column or the extremities. In addition to physiotherapy and KPE, mobilization and manual therapy are methods in question, since, by these, the conditions for an

optimum kinesitherapy are provided in the sense of drainage therapy, and pain relieve can be obtained.

Ultrasound therapy

The therapeutic characteristics of ultrasound are based on physical effects. Ultrasound is known for heat production, especially at limiting surfaces (2).

But the thermal effect is by far lower than that of high-frequency therapy such as short wave or microwave therapy. For this reason, the thermal effect of ultrasound represents no contraindication to lymphedema. Due to its other effects, such as detension or specific pain relieve, ultrasound is considered to be a preferable way of therapy.

Its application is indicated in areas of the skin affected by fibrosis and sklerosis, or also for pain relieve in case of disturbances additionally caused by the locomotor system. Dosage should be 0.3 - 0.6 W /cm² (in exceptional cases even 0.9 W/ cm²), therapy time 3 - 9 min. Treatment frequency is determined by the common rules of physiotherapy (in acute cases daily, otherwise e.g. 3 times per week), in stationary treatment, in

certain cases, therapy may also be performed several times a day (2).

Hivamat

Now as before, therapy by the Hivamat is a matter of discussion. It is a combination of massage treatment – thus for lymphatic drainage, too – and electrotherapy.

The therapy is based on a biphasic low-frequency electromagnetic field, the intensity of which can be adjusted and the frequency can be varied from 5 to 100 Hz.

The therapist is electrically separated from the patient by a glove.

The physical phenomenon results in vibration at the surface (skin) as well as

in the deep tissue layers, which intensify the massage effects. The application of Hivamat showed positive results especially in indurated tissues.

By a medical investigation not yet published, we were able to prove that the combination of lymphatic drainage and Hivamat has significantly better results than lymphatic drainage without Hivamat.

Low-frequency and medium-frequency electrotherapy

The galvanic current, as well as pulsed currents with mono or biphasic pulses up to a frequency of 1 kHz, are considered to be low-frequency

Table 1

Examples for an efficient accompanying therapy in lymphedema. Physiotherapy is not mentioned since it is considered an essential element of KPE and, thus, represents no accompanying method.

<i>Object</i>	<i>Method or means</i>
Findings-oriented physiotherapy in case of disturbances of the locomotor system	Avoid methods providing hyperaemia.
Pain relieve, tissue relaxation	Ultrasound
Tissue relaxation, lymphatic drainage	HIVAMAT
Therapy and prevention of erysipelas	Topical or systemic antimycotics, skin care
Reduction of hyperaemia after removal of compression	Cold air, possibly lasting cold affusions
Stimulation of macrophage and lymphatic angiomotoricity	Unguentum lymphaticum, Venalot®
Antioxidative therapy	e.g. selenium (selenase®)
Weight normalization	Caloric reduction, normal nutrition
Surgical reconstruction of the lymphatic vessels	Microsurgery, restricted to individual cases

currents. The principle is that potential differences are caused at the excitable membrane under the electrodes. Especially with galvanic current there is a reduced excitation under the anode due to hyperpolarization and a triggering of excitation under the cathode due to depolarization. All low-frequency currents such as TENS, ultrastimulation current after Traebert and diadynamic current after Bernard have in common their analgesic effect. Since they cause irritation and hyperaemia of the skin, they should be applied in lymphedema very carefully. The same is valid for neuromuscular electrostimulation.

In medium-frequency therapy pulsed currents with frequencies from 1 to 100 kHz are employed, which are between the frequency ranges of low-frequency and high-frequency electrotherapy. At its base is the so-called Gildemeister-effect already described in 1944 (6). With frequencies higher than appr. 1 kHz there is no more periodically synchronous stimulation of nerves and muscles since it is impossible for these structures to follow the rapid current changes. Only by the summing-up of stimuli there may be a «reactive depolarization».

Table 2

«Status of radicals» in patients with chronic lymphedema in comparison to healthy individuals

<i>Parameter</i>	<i>Dimension</i>	<i>Patients (n=20)</i>	<i>Control group (n=20)</i>
GSH	µmol/l cells	1684	2040
GSSG	µmol/l cells	59	57
MDA	µmol/l serum	1,4	0,4
4-HNE	µmol/l serum	0,14	0,09

One form of medium-frequency current is the Interferential current, which results from the overlapping of 2 medium-frequency currents (4 electrodes). This way, the therapeutic effects are based on surging and other interferential effects in the area of the current overlapping rather than under the electrodes. The indications are similar to those of low-frequency currents. However, since medium-frequency currents overcome the capacitive resistivity of the skin better, skin irritations and hyperaemia are less intense. For this reason, medium-frequency currents are preferable for pain relieve in the case of lymphedema.

Thermotherapy, high-frequency electrotherapy

In general thermotherapeutic applications are considered as contraindications to

chronic lymphedema. The reason is hyperaemia caused by the heat development and the subsequent increase of interstitial liquids. Although lymphatic angiomotoric activity is enhanced by heat, clinic experience proved that lymphedema mostly deteriorate by heat. Whether this is the case still has to be scientifically approved. It is quite possible that some methods of diathermy (e.g. shortwave or microwave) could establish in therapy due to the selective heat production of individual tissue layers (9) they can provide in certain types of edema. However, so far all kinds of heat including warm bath, sauna etc. should be avoided.

Cryotherapy

Cryo-application in lymphedema is looked at with more tolerance than heat application. But one has to differentiate. E.g. all cryo-applications, the

physiologic mechanisms of which are related to providing reactive hyperaemia, are problematic, including several Kneipp's methods such as e.g. water treading, cold affusions, cold compresses – short-time cold stimuli in general. Although this thesis derived from physiology has to be confirmed, yet, we can proceed from the assumption that reactive hyperaemia, similar to heat applications, leads to an increase in interstitial liquid and, thus, possibly to a deterioration of the edema.

There is a different situation with cryo-applications that do not entail reactive hyperaemia. These, in general, include all lasting cryo-applications (10 minutes or longer), where, as is generally known, there is no hyperaemia. Accordingly, the methods of cryotherapy are appropriate and unproblematic, e.g. when it comes to treating an arthrotic irritative knee additionally present. But in therapy of lymphedema alone, too, cryo-applications can be useful. Frequently there are unpleasant sensations (itching, tingling) due to the hyperaemia setting in after a compression bandage has been removed. Many times this

is countered with cold affusions. But rarely cold affusions are applied longer than a few minutes, so that hyperaemia and its consequences cannot be excluded. Often, e.g. in massage practices, the installations necessary are lacking. Last but not least one has to consider that soaking the skin increases the risk of mycosis pedis that is very high in lymphedema of the leg, anyway. For this reason large-size cryo-applications working without water are preferable. Here modern cold air therapy units are very useful, which work either by liquid nitrogen or after the «refrigerator principle», for local, large-size 10-minute or even longer treatments. In an investigation (1) we were able to prove that this kind of cryo-application is not only subjectively very well tolerated and reduces the subjective malaises, but that, in the context with KPE, cold has a positive effect on the edema reduction, at least in summer. Chart 1 gives a survey over the most important results. What is worth mentioning is that edema reduction occurred only in days when KPE was applied in combination with cold air. This must be seen in connection with «rebound effects» as well

as with the hot ambient temperature in summer, when the investigation was made. When paying attention to the contraindications, cryotherapy and cold air therapy are recommendable in accompanying therapy in lymphedema.

Antimycotics and antibiotics

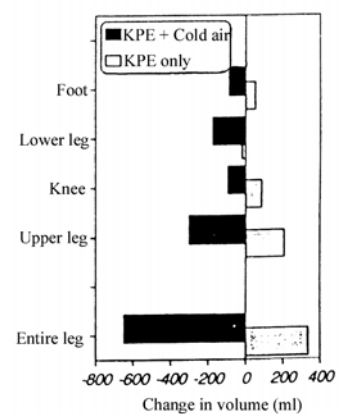


Fig. 1
Average change in volume in lymphedematous legs (primary and secondary lymphedema in stage II) following KPE only and following cold air and KPE in combination. It refers to mean values of 6 treatments in 7 patients. The examination was conducted in midsummer. There was a daily change between KPE and combination cold + KPE.

Mycosis pedis is a frequent complication of lymphedema in legs. In many cases much more serious infections start out from erysipelas, which

often drastically aggravates lymphedema. For this reason alone, all mycoses should be treated resolutely. Best prophylaxis against mycosis pedis infection and erysipela is consistent drainage therapy. This way there is a positive effect on the main cause of the infection – lowered resistance due to chronic lymphatic congestion. However, to ensure control of chronic mycotic infections, the application of antimycotics is often inevitable. This should be based on an appropriate mycologic diagnosis. Occasionally – particularly in case of mycosis of a nail – the systematic administration of antimycotics is indicated. It is the same matter with administration of antibiotics in recurrent erysipela in the context with chronic lymphedema. Of course every acute erysipela requires consistent antibiotic treatment, bed rest and interruption of a current drainage therapy etc. More problematic is erysipela prevention. In this connection drainage is the most important means, too, but very often not sufficient. Then an antibiotic long-term therapy is worth considering. Simple penicillin preparations are suitable now as before

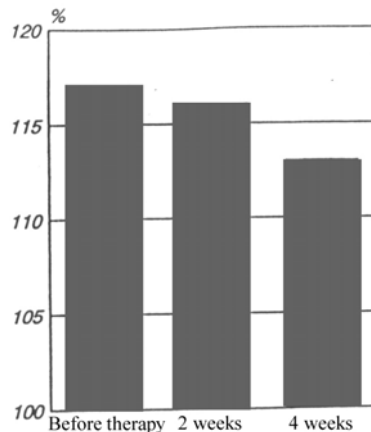


Fig.2 Slight reduction in edema volume in lymphedematic extremities (primary and secondary lymphedema in stage II) following the application of selenium only (n=5). The representations are in per cent, 100% is the volume in healthy legs.

and should be given preference due to their therapeutic range. In this context a change is quite possible in future, since it has been proved (7) that by radical catchers (the substance approved was anorganic selenit – preparation: selenase®) the recurrence of erysipela with chronic lymphedema can be avoided, too.

Preparations for stimulation of macrophage

As animal and clinical studies indicate, benzopyrones have an influence on parts of micirculation. They are said to enable an increase in lymphokinesis and lymphatic

angiomotoricity, influence permeability and stimulate macrophages. This way an increase in protein cleavage is said to establish. But the proteins deposited in the interstice represent the main problem in treating lymphedema, since they are usually eliminated with lymph. Moreover, they contribute to the secondary tissue damages in lymphedema, since they act as stimulants for proliferation of fibroblasts. Due to protein cleavage into smaller pieces by macrophages, smaller molecules constitute, which may be discharged through capillaries, which eases the load on the lymphatic vessel system. This mechanism occurs in all cases but has no quantitative effect. A stimulation of this mechanism may be appropriate particularly in fibrotic and sklerotic regions and is therefore considered a suitable completion.

Antioxidative therapy

A number of studies, some of them from our study group (8, 10), showed that there is a massive release of free radicals – especially oxygen radicals - in lymphedema. One of the

main reasons for this could be the local oxygen deficiency in lymphedema. On attainment of critical pO₂-values there is an increase in purine degradation and, in the reactions of xanthinoxidoreductase, an increased formation of free oxygen radicals (5). It is assumed that free radicals and their toxic secondary products (e.g. malondialdehyd. 4-hydroxynonenal) contribute to the genesis of the secondary tissue damages previously mentioned. Obviously, radical formation occurs to such an extent that there are significant changes in red blood cells, which indicates a chronic oxidative load. Not only did we find a manifest increase of malondialdehyd and 4-hydroxynonenal in blood, but we could also detect manifest changes in an important substrate in erythrocytes – glutathion. Especially the GSH-value of red blood cells was significantly lower. But increased formation of free radicals may also result in a degradation of edema, because the radicals contribute to increased vascular permeability (3). Furthermore, this chronic load of radicals – as will have to be proved, yet – seems to be relevant for the organism outside the

actual edema region, too. The significant increase in potassium level in blood plasma, in alkaline phosphatase and in transaminase SGPT indicates that free radicals and their secondary products may cause damages on the membrane e.g. of parenchymatous organs. These indicators as well as the possible asymptomatic ECG findings (disorders in stimulus conduction) are enough reasons to think about accompanying antioxidative therapy in chronic lymphedema. In principle several substances are suitable, as e.g. ascorbic acid, alpha-tokopherol or also beta-carotene. Due to the fact that we found manifestly lower selenium levels in the blood of a part of the lymphedema patients, we decided for selenium as an antioxidants for testing. Germany may in general be considered a region with latent selenium deficiency. Another reason why we selected selenium as our therapy agent was the fact that selenium is a constituent of glutathioneperoxidasis – which means that it is involved in a system of which significant changes have already been proved. We used selenium in the form of anorganic sodium selenite (preparation: selenase[®]). It was proved that by administration of

selenase (first 800µg, later 400µg daily) there was not only tendency of normalization of biochemical parameters in blood, but that there was a (slight but) significant reduction in edema volume even without further therapy (fig.2). Antioxidatives cannot replace KPE, but it may be a suitable completion. In particular, as Kasseroller (7) proved, since there obviously is a reduction, possibly even an interruption of recurring erysipela by selenase[®]. Possibly lower doses are sufficient (e.g. 100µg per day in long-term therapy), although no toxic reactions are to be expected even with the higher doses initially employed by us, at least in temporary application. The question of dosage remains to be clarified exactly as the question if other antioxidants are suitable for accompanying therapy in lymphedema.

Dietetic treatment

If diets are appropriate in lymphedema or not, is frequently discussed. In uncomplicated lymphedema without intestinal involvement there are no specific dietetic recommendations. In case of overweight, weight normalization is recommended in any case since there is an additional impairment of

lymphatic transport due to the increased intraabdominal pressure, which has a negative effect on the development of the edema. In addition to that, normal nutrition has a positive influence on a possible obstipation and, thus, indirectly on the lymphedema. From a the point of view of treatment by natural remedies, too, normal nutrition should be preferred to nutrition exclusively reduced in calories, since this kind of diet stimulates the intestinal immunological system. This might react upon the locally lowered resistance in the lymphatic region. But this thesis has to be proved, yet.

The above discourse shows that, despite the established and time-tested conservative therapy in lymphedema – complex physical drainage therapy –, attempts for further optimization in therapy are promising.

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