Compression therapy in obese patients

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Summary
Triggered by obesity, venous (obesity-associated dependency syndrome) and lymphatic drainage disorders (obesity-associated lymphoedema) can develop, which in themselves require compression therapy, or other comorbidities with indication for compression therapy may exist. In obese patients, some specific features have to be observed in compression therapy:
- An adequate initial decongestive phase with padding and bandage materials,
- Compression hosiery with a high degree of stiffness (high-strength materials, where appropriate, flat-knitted) and optimal fit (meticulous fitting),
- Garment types that are suitable for daily use, if necessary, multi-part garment,
- Need for aids or auxiliary persons to ensure correct use,
- Concomitant consistent, intensive, lipid-replenishing skin care and optimised hygiene to reduce complications and side effects.

Regular medical check-ups to ensure correct fit of the leg compression garment.

Sometimes, particularly at the initial provision and in patients with a complicated physical shape, the stockings have to be modified several times before an optimal fit is achieved.

Schlüsselwörter
Kompressionstherapie, Adipositas, komplexe Entstauungstherapie, Dependency-Syndrom, Ödem

Zusammenfassung
Getriggert durch eine Adipositas können venöse (Adipositas-assoziiertes Dependency-Syndrom) und lymphatische Abflussstörungen (Adipositas-assoziiertes Lymphödem) entstehen, die per se eine Kompressionstherapie erforderlich machen, oder weitere Komorbiditäten mit Indikation zur Kompressionstherapie bestehen. Bei adipösen Patienten sind für die Kompression einige Besonderheiten zu beachten:
- Eine initiale suffiziente Entstauungsphase mit Polster- und Bandagiermaterialien,
- eine Strumpfversorgung mit hoher Stiffness (Materialien mit hoher Festigkeit, ggf. Flachstrick) und optimale Passform (sorgfältige Anpassung),
- alltagstaugliche Versorgungsformen, ggf. geteilte Versorgungen,
- Notwendigkeit von Hilfsmitteln oder Hilfspersonen zur Sicherung der Anwendung,
- begleitende konsequente, intensiv rückfettende Hautpflege und optimierte Hygiene zur Reduktion von Komplikationen und Nebenwirkungen und
- eine regelmäßig ärztliche Kontrolle der Kompression am Bein.

Manchmal sind – insbesondere bei der Erstversorgung und bei komplizierten Körperformen – mehrfache Nachbesserungen der Strumpfversorgung erforderlich, bis ein optimaler Sitz erreicht wird.

According to World Health Organization (WHO) estimates, obesity is developing into a worldwide epidemic (13). At present, approximately 2/3 of the population of the USA are overweight and, surprisingly, approximately 70% of the population of Micronesia, Tonga and the Cook Islands are also obese. According to figures from the Federal German Institute for Population Research, 60% of women and 40% of men are overweight and the numbers are increasing (3, 13).

According to current projections and estimates, this development has considerable socio-economic significance for the health care system (36). Furthermore, it also presents a particular challenge in routine clinical practice: ambulance transport, hospital beds and examination tables are often not approved for overweight patients and the capacities of medical equipment, such as that used for ultrasound and magnetic resonance imaging, are being stretched to their limits. Moreover, even when using inherently established and proven therapeutic measures, such as compression therapy, particular aspects have to be considered.

It is undisputed that compression therapy represents basic treatment in phlebology and lymphology. Depending on the indication, it can be used either alone or in combination with interventional or surgical procedures as short-term or long-term therapy (23). In obese patients, it also plays a particular role in respect of the venous and lymphatic drainage disorders associated with the primary disease.

Several factors coalesce ...
duced hosiery and even present problems when individually made-to-measure garments are used. Usually, the correct choice of material and wearing the garments on a daily basis pose a greater problem than the manufacture (27).

Many of the obese patients are poly-pathic – often independently of their age. In addition to the diseases associated with the obesity itself, such as diabetes mellitus with a susceptibility to infection and wound-healing disorders, patients are also suffering from arterial hypertension and cardiac disease, lipopathy and atherosclerosis, an increased risk of thromboembolism and post-thrombotic syndrome, chronic venous insufficiency (CVI) with and without varicosis, immobility or reduced mobility, progressive arthritic changes, sometimes with consecutive arthrogenic congestion, secondary obesity-associated lymphoedema, recurrent erysipelas and, last but not least, from skin complications, such as intertrigo, folliculitis and abscesses (1, 2, 6, 12, 30, 33).

All these co-morbidities and complicating factors must be taken into account when selecting the appropriate compression therapy. Simply withholding compression therapy from this growing patient group (“It won’t fit anyway”) is not an alternative, as it is precisely obese patients, who are reliant on adequate compression therapy, purely as a result of the weight-associated changes in the venous and lymphatic systems, if they are to avoid complications and sequelae.

**Obesity-associated dependency syndrome**

There is a significant association between the Body Mass Index (BMI) and the severity of chronic venous insufficiency (CVI), which is more pronounced in women than in men (4, 20, 34). However, studies to date have established no correlation between the clinical severity of the disease and evidence of reflux, so that it can be assumed that, in addition to varicosis, other factors are present in obese patients, which predispose towards or allow the development of advanced CVI (4, 20).

In phlebology, the underlying phenomenon is called “obesity-associated dependency syndrome” (9). Originally, the term dependency syndrome indicated the development of oedema in the feet and lower legs as a result of prolonged sitting with inactivity of the calf muscles, such as can occur in wheelchair users. However, Garzon et al. showed that similar phenomena can also occur as a result of obesity. Pressure values in the groin skin fold and in the venous system increase in proportion to the BMI. Thereby, the pressure increase in the peripheral venous system correlates with the inguinal pressure values. Even at a pressure of 20 mmHg in the groin skin fold, which is reached with a BMI as low as 25 kg/m², effects on pressure ratios are already seen in the venous system of the legs. Ultimately, an obstruction develops in the leg veins of the inguinal region due to the overlying abdominal apron, particularly in the sitting (or, in extreme cases, also standing) patient. An additional factor is the relative immobilisation of the calf muscles due to the weight pressing on them (9).

Recent investigations by other working groups have confirmed these results and have also observed an increase in the venous diameter of the femoral vein in relation to the patient’s weight and position and a continuous increase in abdominal pressure, which is transferred to the peripheral venous system (21).

These phenomena lead to the development of clinical signs of advanced CVI, even in the absence of varicose veins. The changes range from oedema, hyperpigmentation and dermatolipofasciosclerosis to hydrostatic chronic leg ulcer, which, without appropriate therapy (compression, exercise, weight reduction), can be extremely resistant to treatment or can even progress (10). Furthermore, the changes in the venous system, if sufficiently severe and prolonged, usually affect the lymphatic system.

**Secondary lymphoedema in class III obesity**

Secondary lymphoedema occurs at a BMI of ≥ 40 kg/m² (15, 19, 31). This usually takes the form of local, chronic oedema of the legs, genital region or the abdominal apron. If the symptoms are sufficiently prolonged and progressive, lymphostatic tissue changes develop, particu-
Fig. 2 Examples of complications and side effects (from above left to below right): erosions, constrictions, papillomatosis cutis, stasis dermatitis, xerotic eczema and cracks in the soles of the feet.

Diagnostics and therapeutic concept

Thorough diagnostic testing should be undertaken before initiating therapy. In addition to taking the medical history (▶box), examination and palpation, this testing also includes a detailed duplex ultrasound examination of the venous and lymphatic system, in order to exclude concomitant varicosis, thrombosis and postthrombotic syndrome. High-resolution ultrasound frequently reveals widened lymphatic spaces, although, taken alone, these do not provide confirmation of lymphoedema (5). Using Doppler screening, peripheral arterial occlusive disease should also be excluded. In addition, depending on the known pre-existing investigations, further medical examinations are advisable with regard to possible concomitant obesity-associated disease. In such cases, cooperation with an interdisciplinary obesity centre can be helpful.

The direction and targeting of therapy is also interdisciplinary. In the short-term, compression therapy combined with intensive skin care, guideline-compliant wound therapy and decongestive therapy is both advisable and helpful. In the long-term, however, only weight loss, increased mobility, treatment of the concomitant diseases and, if appropriate, concurrent psychotherapy will lead to success and prevent recurrence.

Performing compression therapy

a. Decongestive phase

Initially, obese patients often have considerable oedema in the feet and lower legs. There is no sense in wanting to treat such legs directly with a compression stocking, irrespective of its type and length. In the initial phase, consistent (lymphological) decongestion with padding and bandaging materials for 2–4 weeks is indicated (5). Maximum pressure values of 50–60 mmHg in the legs are optimal for oedema reduction in the case of lymphoedema (22). If possible, the decongestive phase should be performed on an outpatient basis (25). Multi-component compression systems, consisting of padded underlayers and adhesive short-stretch bandaging, are of proven efficacy here (7, 16, 17). Analogous to complete decongestive therapy (CPT) in lymphoedema therapy, this compression bandaging should be worn for 24 h at a time and combined with lipid-replenishing skin care, exercise during compression and manual lymphatic drainage (5).

It can be helpful, as well as essential for compliance, to start the treatment with compression bandaging on the lower legs only and, if appropriate, with reduced pressure values (so-called “light bandages”) and to then successively to increase the pressure and extent of compression over time. Reduced pressure values of 20 mmHg with a high degree of stiffness have also proven effective (18).

In the initial phase of compression, particular attention should be paid to any con-
comitant diseases that complicate or pose an obstacle to compression therapy (e.g. advanced heart failure).

### b. Maintenance phase

Once sufficient decongestion has been achieved, the maintenance phase can begin (25, 26). It should ideally be continued for as long as the obesity persists. During the maintenance phase, a switch is made from compression bandages to stockings (5). As fitting is often difficult in light of the physical dimensions involved, this should be performed in an established medical supply outlet.

Compression materials with a high material strength (stiffness) should be given preference, so as to achieve a sufficiently high working pressure and to reduce the risk of strangulation marks. Flat-knitted garments are usually used. In patients with mild symptoms, round-knitted garments with a high degree of stiffness (high material strength, short-stretch properties) are used. In addition, for patients with sturdier legs, a high contact pressure (class II or III) should be selected. Alternatively, two stocking types of a lower compression class can be worn over each other. On the one hand, this simplifies handling and, on the other, it ensures that appropriate pressures are achieved at sites requiring exertion of a particularly high pressure (e.g. class I pantyhose + class I below-knee stocking). In most cases, obese patients require made-to-measure garments.

For many obese patients, a pantyhose presents a real problem in everyday life. Therefore, shorter garments (below-knee stocking, thigh-length stocking) or more than one garment (cycling shorts + thigh-length stocking, Capri trousers + below-knee stocking) are preferable. Wearing separate garments facilitates donning by the patient and enables them to vary their compression garments according to the weather and their planned activities. This increases compliance (29).

#### Problem areas of compression therapy

As with every type of therapy, compression therapy has its side effects. These can occur more frequently in obese patients than in slimmer patients with “easier” leg shapes (Table 1). Compression therapy is often insufficiently effective, because patients cannot even don their compression garments on their own (27). In addition to age, BMI appears to be a major factor in determining whether another person is required to help put on the compression garment (27). Here too, wearing more than one garment can prove beneficial. The use and prescription of donning aids can also be advantageous. However, in some cases, prescribing mobile nursing services remains the only option, if no relatives are available to help.

Skin complications, such as constriction, congestion, blisters, erosions and ulceration due to slippage or poorly fitting compression garments present a considerable problem in routine clinical practice (28). Accordingly, it is important that the physician checks the prescribed leg compression garments while the patient is wearing them, particularly in patients, for whom garments are difficult to fit. It is the prescribing physician who is ultimately responsible for the compression care, irrespective of the experience and expertise of the medical supply outlet.

Chronic and/or recurrent erysipelas in the oedematous region can present a particular challenge. In such cases, the question repeatedly arises as to whether decongestive/maintenance therapy can be performed with consistent compression therapy or whether it is actually contraindicated. Although no studies are available on this topic, experience from clinical practice does exist, showing that patients benefit if only a short break (usually 2–4 days) is taken from the decongestive or maintenance therapy because of acute erysipelas, until the onset of effect of systemic antibiotic therapy. The latter should have good bioavailability and, particularly in chronic recurrent erysipelas, a broad spectrum of efficacy. Once the clinical signs (redness, swelling, hyperthermia, fever) and inflammatory laboratory parameters have subsided, the compression therapy and, if appropriate, the manual lymphatic drainage can be resumed.

#### Informing and motivating the patient

The patient’s co-operation is essential if therapy is to be successful. It is therefore important for the patient to understand what lies behind his/her symptoms and how he/she can play a part in improving

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**Important questions when taking a medical history before initiating compression therapy in obese patients**

- Current symptoms
- Medication
- Height, weight
- Previous weight development, particularly in the last months
- Mobility, exercise possible during compression therapy?
- Known concomitant diseases: heart failure, erysipelas, atherosclerosis, etc., if appropriate, further diagnostics in cooperation with medical colleagues
- Cause/ trigger factors of obesity, if appropriate, further diagnostics with psychiatry, endocrinology
- Motivation for consistent adherence to compression therapy
- Patient’s preferences/wishes with regard to a compression garment (below-knee/thigh-length stocking, pantyhose, wearing more than one garment)
- Foreseeable physical limitations with regard to compression therapy (can the patient reach his/her feet? Is the patient capable of donning a compression garment alone with/without aids?)
- Mobility and logistics with regard to performing ambulatory decongestive and maintenance therapy at the patient’s home?
his/her condition. With regard to compression therapy in obese patients, this specifically means that the patient should understand that the leg symptoms are associated with the obesity, that the compression therapy effectively represents a "life insurance" for the legs and that it must be applied consistently and on a daily basis. At the same time, however, the expected side effects of therapy and their management should also be discussed (28).

a. Skin care

During compression therapy, particularly in association with long-term and regular use, dermatological side effects are unavoidable (28). Daily, consistent skin care with lipid-replenishing and external agents low in allergens (e.g. lipolotions) is thus very important. In principle, every type of skin care that the patient tolerates and finds pleasant is possible. Alcoholic additives must, however, be avoided, as they have a long-term desiccative effect. The skin care products should be low in allergens, particularly in patients with pre-existing venous or lymphatic drainage disorders. Patients with CVI are at increased risk of sensitisation and contact allergy (8). Accordingly, additives such as scents, preservatives and lanolin should be avoided. On the other hand, ingredients such as urea, glycerol and high-quality oils (almond, olive or jojoba oil) are recommended. Polidocanol can be added to treat persistent itching. Menthol has a pleasant cooling effect. Many patients favour "natural products", such as chamomile, propolis, arnica and calendula, because they sound so "healthy". Used over a long period, however, they too have a sensitisation potential and should therefore only be used for a short period of time.

Particularly the skin on the soles of the feet requires intensive, concentrated lipid-replenishing care, in order to avoid cracks and hyperkeratosis. In this case, preference should be given to ointments or possibly even fatty ointments.

b. Hygiene

Furthermore, careful hygiene is recommended, in order to avoid complications, such as tinea, erythrasma or erysipelas (triggered by skin cracks). Particularly in the prevention of bacterial or fungal infections of the groin, below the breasts or in deep skin folds, use of antiseptic wash lotions can be advisable. Deep skin folds should be kept dry and protected from macerations by padding them with gauze compresses. If the patient is unable to reach his/her feet alone, regular professional podiatry is advisable.

c. Irritation caused by compression components

Sensitisation to compression stocking material is extremely rare (35). In particular, dark colours and components of the adhesive edges can actually precipitate contact allergies (35). Usually, alleged "intolerance" is more likely to be the result of irritation, caused by an incorrect fit, poor skin care or chafing and slippage of the compression garment. If there is a genuine suspicion of

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**Summary for clinical practice**

Compression therapy is indicated in obese patients, solely on account of the venous and lymphatic drainage disorders associated with the primary disease, and it should be well planned and consistently implemented. When selecting the correct stocking type, attention should be paid to the following factors:

- An adequate initial decongestive phase with padding and bandaging materials,
- Hosiery with a high degree of stiffness (high-strength materials, flat-knitted if applicable) and optimal fit (meticulous fitting),
- Garment types that are suitable for daily use, where appropriate multi-part garments that are divided into more than one garment.
- Prescription of the required aids or auxiliary persons to ensure that the garments are actually worn (donning aids, mobile nursing service),
- Concomitant consistent, intensive, lipid-replenishing skin care and optimised hygiene to reduce complications and side effects and
- Regular medical check-ups to ensure correct fit of the leg compression.

Ultimately, many options are currently available on the market for customised provision, so that there are scarcely any patients who cannot be fitted with appropriate garments. However, before optimal provision can be found, considerable experience and patience is often necessary on the part of the prescribing doctor, the medical supply outlet performing the fitting and the patient him-/herself. Particularly during initial provision and in patients with complicated leg shapes and severe obesity, several modifications may be necessary before all parties are satisfied.
contact sensitisation, the compression therapy should not simply be withdrawn without substitution, but rather appropriate diagnostic tests (skin prick test, epicutaneous test) should be performed and alternatives considered (35). It may be possible to avoid adhesive topbands (below-knee stockings or pantyhose rather than thigh-length stockings) and dark colours, or understockings can be worn (29).

Patients with pre-existing chronic skin disorders, such as psoriasis or atopic eczema, can also benefit from the incorporation of silver-coated threads into the compression materials (14, 29). In such cases, however, a specific justification should be added to the prescription and a preliminary enquiry should be sent to the health insurance scheme with regard to assumption of the costs.

Conflict of interest

In the course of various studies, the author has co-operated with companies operating in the compression industry (including Bauerfeind AG, medi Germany GmbH). Furthermore, she has received fees for consultancy activities. However, these activities have had no effect on the current publication.

Ethical guidelines

The data for this article were obtained in accordance with national ethic laws and the current Helsinki Declaration. Informed consent by the patients was given.

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