

Venous Disorders

Diagnosis and Treatment

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Foreword

Acute and chronic venous disorders are among the most common ailments affecting the population. Due to the interdisciplinary nature of these conditions, patients are treated by numerous specialist disciplines. These primarily include phlebology, angiology, dermatology, surgery, internal medicine and general medicine. This brochure mainly focuses on the latter discipline and is intended to provide interested parties with succinct, practical information on current developments in phlebology. Since the 1st edition of this brochure in 1981, phlebology has undergone numerous changes, particularly with regards to the treatment of varicose veins. The efficacy of sclerotherapy has substantially improved thanks to the introduction of foaming sclerosing agents. Endovenous techniques such as endovenous laser therapy have also come to the fore in the treatment of saphenous varicose veins. With regard to Deep Vein Thrombosis, low molecular weight heparin is administered as outpatient therapy. Additionally, innovation in design and yarns used in compression therapy garments have increased patient compliance and wearing comfort. People without serious vascular symptoms are comfortable wearing these more fashionable garments daily to keep their legs healthy. The substantial medical efficacy of these stockings has also been confirmed in various studies resulting in more physicians prescribing graduated compression stockings.

Dr. Helmut Schepers, MSc Head of Corporate Medical Relations SIGVARIS Management AG

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Epidemiology

Classification

Venous disorders are common. Every third pharmacy customer in France is looking for help regarding leg-related disorders.

The Bonn Vein Study shows that approximately half of the Bonn population experienced some form of leg discomfort in the 4 weeks preceding the survey and 15 % admitted to wearing or having previously worn compression stockings.

Deep vein thrombosis (DVT), the most severe acute venous disorder, affects 1–2% of the population each year. The risk of developing a leg ulcer in your life – the most serious form of chronic venous disorder – is also 1–2%. Thanks to early diagnosis and evidencebased medicine treatment, the occurrence of this serious complication has greatly declined in recent years. However, the risk factor spectrum for venous disorders has increased alongside demographical changes and improved diagnostic techniques. It is important to note that an isolated case of vein thrombosis and untreated varicose veins are associated with a disproportional increase of vein-related problems as age advances.

The CEAP Classification was introduced in 1996 in an attempt to maintain a system that would allow the differentiated classification of venous disorders. Since then, this classification system has consolidated its position in the relevant literature and has been used extensively in the interim. It is used in particular within the scope of scientific publications.

Every letter in the CEAP classification system stands for a venous disorder component:

- **C** = Clinic: clinical signs (score of 0–6), a = asymptomatic, s = symptomatic
- E = Etiology: etiological classification according to congenital, primary and secondary
- A = Anatomy: affected segments of veins, superficial, deep, perforating veins
- **P** = Pathophysiology: pathophysiological dysfunction, return, obstruction, return and obstruction

Clinic CO–C6	Definition	Comments
C0	No sign of venous disorders	
C1	Spider veins and reticular varices	Spider veins: intradermal venulae < 1 mm. Reticular varices: subdermal, < 3 mm
C2	Varicose veins	Subcutaneous, >3 mm
C3	Oedema	Fluid retention
C4	Skin changes	C4a: pigmentation, purpura, eczema C4b: hypodermitis, lipodermosclerosis, White atrophy
C5	Healed ulcer	
C6	Open ulcer	

Diagnosis

Leg pain can be indicative of venous disorder without objective signs of this condition. Vein-induced leg symptoms are typically associated with more or less marked swelling of the legs. Characteristic symptoms include a diffuse, bilateral sensation of swelling, constriction and unrest, etc. These symptoms are hardly discernible in the morning but are marked in the evening, especially after sitting or standing for prolonged periods at work, or following exposure to intense heat. They can be prevented or alleviated by elevating the legs, walking around and wearing compression stockings. Studies have shown that leg pain can have emotional origins with mental syndromes linked to the patient's personality.

The symptoms of acute thrombosis can be interpreted in terms of a compartment syndrome. Pain is localised in the calf and is particularly intense while standing and walking.

In proven chronic venous insufficiency, additional symptoms are found such as local pain due to inflammation, pruritus in presence of stasis eczema, muscle pain during effort in case of venous stasis.

Symptoms

Chronic venous disorders reduce the patient's quality of life. Even without important venous or skin changes, the mental and social discomfort caused by venous disorders is already significant. With a leg ulcer, the patient's integrity is affected. Compression therapy provides rapid pain relief, but the return to normal life implies complete healing of the ulcer.

Clinical findings relating to chronic venous disorders

Superficial veins – varicose veins

Varicose veins are the most common indication of superficial venous disorder. It is important to have a thorough knowledge of the anatomy of the veins in order to understand and describe the clinical symptoms of varicose veins. Morphologically, a distinction is made between the following types of varicose veins:

Saphenous varicosis

Vena saphena magna (greater saphenous vein), Vena saphena parva (small saphenous vein).

- Complete saphenous varicosis: the venous return begins at the 1st valve located in front of the aperture where the saphenous vein enters the deep venous system (cross).
- Incomplete saphenous varicosis: saphenous vein insufficiency with sufficient cross and return venous flow from another vessel.
- *Branch varicosis* (flow over an incompetent lateral branch).
- Perforans varicosis (flow over incompetent perforating veins).

Reticular varicosis

Winding subcutaneous veins that do not belong to the main stem neither to the branches, < 3 mm in diameter

Spider veins

Intradermal vein ectasia



Branch varicosis Vena saphena magna (greater saphenous vein) insufficiency with resulting branch varicosis in the median section of the upper leg.

Anatomy of the principal superficial veins and perforating veins frequently affected by varicosis



Saphenous varicosis

The Vena saphena magna (greater saphenous vein) and the resulting branch varicose veins in the median section of the lower leg.





Reticular varicosis

Spider veins Intradermal vein ectasia.



Venous oedema

It is not unusual for legs to be swollen in the evening. The volume of the lower leg can increase by up to 100 ml after a long working day or up to 200 ml after a longhaul flight without moving. Oedema that does not disappear spontaneously within a few hours or after a walk is described as pathological. Bilateral and marked oedema with few symptoms is mostly caused by the systemic circulation (heart, kidneys, liver). Venous oedema is virtually always associated with symptoms and/or clinical signs such as dilated superficial veins, varicose veins and skin changes. Chronic venous oedema is only partially reversible and soon becomes hard, which is mainly confirmed on palpation. All skin structures are affected and this is characterised by the term lipodermatosclerosis (LDS). LDS can develop into atrophy. The lower leg then takes on the appearance of an upside down champagne bottle. (Secondary) lymph oedema may develop, in many cases accompanied by acral thickening of the skin folds, hyperkeratosis and papillomatosis.

Skin changes

Skin changes mainly develop due to damage caused by chronic venous hypertension, i.e. due to the lack of pressure relief in the veins on walking. Skin changes are apparent in the region of the primary varicose veins and especially in areas where there are incompetent connections to the deep venous system as well as on the distal lower leg and foot. However, the clinical picture is soon dominated by secondary changes: allergic and pathogenic inflammation in chronic oedema and loss of the barrier function of the skin, microvascular thromboses, local ischaemia, reperfusion and toxic damage caused by iron overload, etc. The pathophysiology can be deduced from the clinical picture: dermo-epidermatitis, hypodermatitis, hyperpigmentation and ulceration. The skin vessels can sometimes be reorganised as a result of repair processes: spider veins on the upper leg, flask-shaped varices in the retromalleolar and paraplantar regions, loss of capillaries in atrophic areas with giant capillaries. White atrophy is due to Capillaritis alba and finally a microvascular, thrombotic or inflammation-induced circumscribed ischaemia accompanied by severe, acute pain. The leg ulcer develops spontaneously or as a result of minor, often unnoticed traumas. Many ulcers can be healed by compression therapy whilst others manifest their own biological profile and persist for years. Genetic predisposition appears to be involved.







Venous oedema is one of the most common clinical findings. In this case, it may be due to either the deep or superficial venous system.

Joint changes

Joint changes are an inevitable result of venous insufficiency. The initially paininduced, functional, restricted mobility of the ankle joint, which is subsequently fixed by capsular shrinkage, is of particular significance. The clinical sequelae manifest in the form of "phlebological Talipes equinus" with the corresponding adverse effect on walking. Patients tend to compensate for this restriction by wearing high-heeled shoes. The lesion leads to a vicious circle whereby the pumping function of the calf muscle is considerably affected.



Advanced bilateral, chronic venous insufficiency with marked, bilateral muscle atrophy and Talipes equinus.

Clinical findings relating to acute venous disorders

Bleeding varicose veins

Ruptured varicose veins are the impressive, albeit harmless complication of a specific form of varicosis: intracutaneous venous aneurysms with a thin wall may rupture without causing pain as a result of minor traumas, e.g. by rubbing the skin after a long bath. The blood often squirts out as a result of the high pressure, lack of muscle in the vessel wall and the small aperture. Elevation of the legs and a compression dressing will solve the acute problem. This type of pearl varices is best cleaned by sclerotherapy with eccentric compression.

Phlebitis (superficial venous thrombosis)

Vein inflammation (phlebitis) refers to nosological and clinically different symptoms that can be easily differentiated. In the case of superficial venous thrombosis, a red thrombus is present in a varicose vein with little inflammation in the vein wall but a considerable amount around it. The inflammation of non-varicose, superficial veins affects the entire vascular wall and, to much less of an extent, the surrounding area. Furthermore, the thrombus in the lumen is small or missing. Vein thrombosis has a tendency for appositional growth, i.e. it grows into the deep venous system, whilst the phlebitis of a non-varicose vein tends to migrate, occasionally jumping over onto other sections of veins (migratory phlebitis). In both forms of venous inflammation, deep vein thrombosis and oligosymptomatic pulmonary embolisms are not uncommon. Follow-up ultrasound scans are therefore carried out in both cases. As for venous thrombosis, a rapid improvement in the patient's condition is generally obtained by removing the thrombi via stab incision(s) or heat-mediated varicose surgery.



Bleeding from a pearl varicose vein in the region of the Malleolus latendis.



Deep vein thrombosis (DVT)

Clinical findings in deep vein thrombosis depend on the patient's condition and the extent of the thrombosis. In patients who are confined to bed, the findings are so subtle that diagnosis is often made late.

Cyanosis, dilated superficial veins and overheating are typical warning signs. Outpatients quickly present with findings indicative of a compartment syndrome: hardening of the affected area (soles of the feet, calf), tender muscles, reduced ballottement, pain on standing and walking as well as on active or passive dorsal extension of the foot. Essential oedema, i.e. a difference of > 3 cm in calf circumference compared to the opposite leg, is only to be anticipated in ascending thrombosis when the thrombosis has reached the inguinal vein. On the other hand, descending thrombosis quickly and typically leads to severe swelling and not primarily to calf compartment syndrome.





Ultrasound scan of a longitudinal section through a thrombosed vein.



Examinations using technical equipment

CW (Continuous Wave) Doppler

This examination is suitable for providing a cursory estimate of vein valve function. The following questions can be answered:

Breathing

MW

Doppler

MM

1. Are deep veins permeable? (examination carried out in the supine position)

Normal electrical current, breathing-dependent.

MW

Out

proxima

0

distal



Pathological current, not breathing-dependent (e.g. in vein thrombosis).

2. Are the valves in the deep or superficial veins sufficient? (examination carried out standing or seated)



Normal: Valsalva test: Doppler signal silenced by pressing – no return.



Pathological: Valsalva test: Doppler signal persists on pressing – return.

Duplex sonography

Principle

Duplex sonography combines the B mode, duplex (colour) and the Doppler, thus permitting a thorough and, in most cases, complete examination of the deep and superficial venous systems.

B image:

Highlighting vessels and surrounding structures.

Duplex and Doppler:

Quantifying the flow; in the colour duplex, haemodynamic information is directly transmitted to the morphological image.

Advantages of duplex sonography: Greater information content, noninvasive.

Disadvantages of duplex sonography: Operator dependency, no overview image.

When should duplex sonography be used for further clarification?

Every symptomatic venous disorder requiring active treatment should be clarified using duplex sonography. In most cases, this allows the aetiology, extent and morphology of the venous disorder to be determined and a firm treatment concept to be developed.



Cross (Saphena magna – greater saphenous vein – aperture)



Orthograde flow (blue).



Return with valve aperture insufficiency during Valsalva press test (red).

Distal section of the upper leg (Saphena magna, longitudinal section)



Normal orthograde flow (blue).



Return under Valsalva press test (red).

Evaluation of the venous pump function

Principle

Recording changes in volume and pressure on the distal extremities below when in motion (standing on tiptoe, bending knees, walking).

Method

Light reflection rheography, photoplethysmography, elastic strip plethysmography, foot volumetry, air plethysmography or measurement of venous pressure in a vein at the back of the foot.

Pump

With each movement, blood drains from the legs and venous pressure is reduced. This mechanism is impaired in cases of superficial or deep venous value insufficiency, or when the deep veins are obstructed. Venous pressure remains high and there is inadequate draining of the venous blood. By compressing the defective veins (e.g. the truncal veins), the venous pumping function can be returned to normal again. Functional examinations are carried out with and without a tourniquet to determine the scope for improving venous function, making it possible to predict the anticipated success of a course of therapy.



No disruption to the venous pump.



Venous (pump) insufficiency.



Probe application in light reflection rheography.

Alternative imaging techniques

- Phlebography
- Phlebo-CT, MRI

These techniques are seldom used by vein specialists in their current clinical routine but are mainly employed within the scope of scientific examinations. Phlebography was replaced by the introduction of duplex sonography. It nevertheless remains an important diagnostic tool in special investigations and, as a gold standard, can provide a complete and accurate anatomical overview of the deep and superficial venous systems in the leg. Modern imaging techniques such as CT or MRI scans can also be used. This type of special investigation would be required in pelvic vein obstructions or in the event of complex venous or combined arterio-venous malformation.

Image portraying incompetent perforating veins in the median section of the lower leg.



Image of inguinal varicose vein checks after incomplete crossectomy.



Treatment of venous disorders

Compression therapy

Leg bandaging has been carried out for thousands of years, possibly as part of a ritual, and was confirmed as a medicinal strategy in Ancient Greece. Compressing leather boots have been used for therapeutic purposes since the Middle Ages, and elastic fabric and rubber stockings since the 19th century. Indications were based on clinical experience of efficacy and were much the same as they are today: oedema, varicose veins and skin lesions. A wide range of mechanisms of action was offered, based on the pathophysiological conditions of the time: constriction of the veins, improved valve function. reduced volume of blood in the veins and improved pumping action, amongst others. The reduction of oedema, an improvement in inflammatory skin changes and the healing of ulcers are clinically feasible on a regular basis. The successful treatment of such pathological states, which can be determined objectively, coupled with the beneficial effect on symptoms, guality of life and even on the prognosis of certain disorders, has been confirmed in clinical studies.

Bandaging has always been an art. Many methods for applying bandages were thus developed and enthusiastically

encouraged, but their effects in certain indications were not compared until recently. Medical compression stockings (MCS) are becoming increasingly popular due to improved compression levels, reproducible efficacy, ease of use, longlasting effect and excellent tolerance. Sophisticated textile technology enables the industrial production of medical compression stockings with graduated compression - strong at the ankle and decreasing going up the leg – in many different models and fashion styles. MCS with 20-30 mmHg ankle pressure level are the most widely sold compression products, especially in Germany. This compression level represents the optimal treatment for many indications, because of the proven efficacy of MCS ease of use and compliance.

A different range of indications has been defined over the past years: MCS with 15–20 mmHg pressure are best for the prevention and treatment of occasional leg symptoms and oedema. Support stockings of less than 10 mmHg pressure are just ineffective. On the other hand, MCS with high pressure maybe too firm for occasional symptoms, and therefore less accepted by patients. MCS are also effective for the treatment of leg ulcers. In randomised studies carried out to date, MCS have proven their efficacy over bandages in terms of healing rate, speed, pain management, ease of use, and many other subjective points. However, some prerequisites are necessary in order to treat a leg ulcer with MCS, such as a certain degree of ankle mobility.

Systems using two stockings, one over the other, have proved to be especially effective, not only for leg ulcer management, but also to treat other severe forms of chronic venous disorders. The under-stocking with 15 mmHg is easy to don and holds the wound dressings in place. It's only removed to change the dressing and to wash the leg. Each morning the second stocking with high compression is easily put over the under-stocking and removed in the evening. In an initial comparative study, the SIGVARIS Ulcer X double stocking system proved to be the most effective product in terms of desired compression level and ease of use.

Phlebectomy of branch varicose veins.









Treatment of spider veins with a foaming sclerosing agent.

Specific treatment of venous disorders

Varicose veins

The indication for the treatment of varicose veins depends on the etiology and cause of the disorder. Non-symptomatic varicose veins that do not present any essential skin changes in terms of chronic venous insufficiency do not require any special medical treatment. This applies to spider veins, for instance.

Therapeutic measures are indicated if symptomatic varicosis is present and/or if skin changes indicative of chronic venous insufficiency develop. In this case, a distinction is made between conservative and invasive-ablative techniques.

Conservative

- Prophylaxis: good mobility, elevate the legs
- Compression therapy: use of medical compression stockings

Invasive ablative techniques

- Standard varicose vein surgery (crossectomy, stripping and phlebectomy)
- Thermo-ablative techniques (percutaneous endovenous laser, application of radiowaves or hot steam)
- Sclerotherapy: injection of a liquid or foaming sclerosing agent into the varicose veins. Indication ranging from spider veins to saphenous varicose veins (in this case, ultrasound-guided sclerotherapy).

Thrombosis

The treatment of acute vein thrombosis of the legs always involves anticoagulation therapy. The latter prevents the thrombosis from advancing and precludes the formation of pulmonary embolisms. A surgical procedure to restore vein function is recommended when treating ilio-femoral thromboses. With a few exceptions to the rule, patients are immediately given compression therapy and are actively encouraged to walk. Symptoms will quickly regress as a result and the development of chronic venous insufficiency will be prevented in 50% of cases. Calf stockings with 20-30 mmHg ankle pressure appear to be sufficient. They can be worn day and night. A 2-year compression therapy programme is planned. Treatment can be stopped if a phlebological follow-up examination confirms the absence of any obstructions or return in the deep veins. The wearing of compression stockings is recommended to prevent recurrence of the condition in risk situations.

Ultrasound-guided sclerotherapy.





Ligating of the Vena saphena magna (greater saphenous vein) following inguinal crossectomy.



Thermo-ablation of saphenous varicose veins using a laser. The vein is destroyed by the heat released on pulling back the activated laser probe.





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