# SCLEROTHERAPY of VARICOSE VEINS* GUIDELINE of THE GERMAN SOCIETY of PHLEBOLOGY

## SCLÉROTHÉRAPIE des VEINES VARIQUEUSES : RECOMMANDATIONS de la SOCIÉTÉ ALLEMANDE de PHLÉBOLOGIE

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## PREAMBLE

Guidelines are systematically elaborated recommendations designed to support the clinician and practitioner in his or her decisions about the appropriate care of patients in specific clinical situations.

Guidelines apply to "standard situations" and take into account the currently available scientific knowledge relating to the subject under consideration. Guidelines require ongoing review and possibly modification, in order to adapt to the most recent scientific findings and to practicability in daily routine. Guidelines are not intended to restrict the doctor's freedom to choose the most appropriate method of treatment. Compliance with the recommendations does not always guarantee diagnostic and therapeutic success. Guidelines make no claim to completeness. The decision about the appropriateness of any action to be taken is still the responsibility of the doctor in the light of the individual situation.

## DEFINITION

Sclerotherapy involves the injection of a sclerosant for the targeted elimination of intracutaneous, subcutaneous, and/or transfascial varicose veins (perforating veins) as well as the sclerosation of subfascial varicose vessels in the case of venous malformation. The various sclerosants induce marked damage of the vascular endothelium and possibly of the entire vascular wall. After successful sclerotherapy and in the long term, the veins are transformed into a fibrous cord, a process known as sclerosis [21, 39, 73]. The purpose of sclerotherapy is not merely to achieve thrombosis of the vessel, which *per se* may be amenable to recanalisation, but definitive transformation into a fibrous cord. This cannot recanalise and the functional result is equivalent to the surgical removal of a varicose vein.

## INDICATIONS

The objectives of sclerotherapy are:

- treatment of varicosis and prevention of possible complications;
- reduction or elimination of existing symptoms;
- improvement of pathologically altered haemodynamics;
- achievement of a good result that satisfies aesthetic and functional criteria [2].

In principle all types of varicose veins are amenable to sclerotherapy, in particular:

- truncal veins (long saphenous vein (LSV) and short saphenous vein (SSV));
- collateral veins;
- varicose veins associated with perforator incompetence;
- reticular varicose veins;
- spider veins;

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• residual and recurrent varicose veins after interventions to eliminate varicosities;

• genital and perigenital varicose veins;

• peri-ulcerous veins [19, 48, 89];

• venous malformations [103].

Sclerotherapy is considered to be the method of choice for the treatment of small-calibre varicose veins (reticular varicose veins, spider veins) [2].

For the obliteration of varicose collateral veins and incompetent perforating veins, sclerotherapy competes with percutaneous phlebextraction and with ligation of perforating veins or endoscopic dissection of perforating veins [24, 59].

In the treatment of varicose truncal veins involving elimination of the proximal leakage point and of the incompetent venous portion, surgery is considered to be the method of choice. Nevertheless, treatment of truncal veins by sclerotherapy is also possible [13, 84, 94]. This applies in particular to foam sclerotherapy, as has been demonstrated by studies conducted in recent years [16, 44, 45, 74, 102].

## CONTRAINDICATIONS

*Absolute contraindications are [2, 73, 94]:*

• known allergy to the sclerosant;

• severe systemic disease;

• acute deep vein thrombosis;

• local infection in the area of sclerotherapy or severe generalised infection;

• lasting immobility and confinement to bed;

• advanced peripheral arterial occlusive disease (Stage III or IV);

• hyperthyroidism (in the case of sclerosants containing iodine);

• pregnancy (unless a compelling medical reason exists).

For foam sclerotherapy:

• known symptomatic patent foramen ovale.

*Relative contraindications are [2, 73, 93]:*

• leg oedema, uncompensated;

• late complications of diabetes (e.g. polyneuropathy);

• arterial occlusive disease, Stage II;

• poor general health;

• bronchial asthma;

• marked allergic diathesis;

• known thrombophilia or hypercoagulable state with or without a history of deep vein thrombosis [9, 26, 46].

For foam sclerotherapy:

• known asymptomatic patent foramen ovale [9];

• high risk of thromboembolic events;

• visual disturbances or neurological disturbances following previous foam sclerotherapy.

In addition, it is urgently recommended that due account be taken of the current prescribing information for the sclerosants used [57].

## COMPLICATIONS AND RISKS

If performed properly, sclerotherapy is an efficient treatment method with a low incidence of complications. In the context of therapy a number of adverse events may be encountered in principle [39, 43, 49, 67, 97]. In particular, these are:

• allergic reaction [27, 28, 72];

• skin necroses [6, 23, 30, 40];

• excessive sclerosing reaction (and thrombophlebitis);

• pigmentation [18, 40, 96];

• matting [40];

• nerve damage [85, 92, 104];

• scintillating scotomas [43];

• migraine-like symptoms [5, 58, 77];

• orthostatic collapse;

• thromboembolism [11, 32, 49].

In addition, it is urgently recommended that due account be taken of the current prescribing information for the sclerosants used [57].

Allergic skin reactions occur occasionally in the form of allergic dermatitis, contact urticaria or erythema. Anaphylactic shock as well as inadvertent intra-arterial injection are extremely rare complications constituting an emergency situation [27, 28, 70, 72].

Transient migraine-like symptoms occur more commonly after foam sclerotherapy than after liquid sclerotherapy [43]. In this context it has been speculated whether a patent foramen ovale (PFO), which is present in 15-25% of the population, might be a factor here, allowing foam bubbles to pass into the arterial circulation [29, 66, 71, 95].

Thromboembolic events (deep vein thrombosis, pulmonary embolism or stroke) occur in rare exceptional circumstances after sclerotherapy. A higher risk is present when larger volumes of sclerosant are used, particularly in the form of foam [10, 32, 101], and in patients with a previous history of thromboembolism or known thrombophilia [46]. In patients with these risk factors the indication for sclerotherapy must be established absolutely and additional precautionary measures must be observed [9].

Skin necroses have been described both after paravascular injection of sclerosants in higher concentrations and – rarely – after properly performed intravascular injection with sclerosants in various concentrations, for example, 0.5% polidocanol in the treatment of spider veins [30, 40]. In the latter case, a mechanism involving passage of the sclerosant into the arterial circulation via arteriovenous anastomoses has been suggested [6].

In individual cases, this has been described as embolia cutis medicamentosa [37, 56, 79].

Extensive necroses occur after inadvertent intra-arterial injection [30, 40, 70].

Instances of hyperpigmentation have been reported with frequencies ranging from 0.3% to 10% [36, 96]. In general, this phenomenon regresses slowly. The incidence of pigmentation is likely to be higher after foam sclerotherapy [43].

Matting, fine telangiectasias in the area of a sclerosed vein, is an unpredictable individual reaction of the patient and can also occur after surgical removal of a varicose vein [40].

Nerve damage has been reported experimentally after paravascular injection [85, 92, 104]. Local paraesthesia after sclerotherapy is very rare.

Other transitory phenomena after sclerotherapy include intravascular clots, phlebitis, haematomas, disturbed sense of taste, feeling of tightness in the chest, pain at the injection site, swelling, induration, mild cardiovascular reactions, and nausea. Additionally, complications may arise due to the compressive bandage, such as blister formation (e.g. blisters in the vicinity of an adhesive plaster) [39, 73]. Intravascular clots can be squeezed out after a stab incision to reduce the development of hyperpigmentation.

Sclerotherapy is an intervention that requires patients to be appropriately informed.

## Diagnosis before sclerotherapy

Successful sclerotherapy requires thorough planning. Sclerotherapy is generally performed in the order of leakage points, proceeding from the larger to the smaller varicose veins. Therefore, a proper diagnostic evaluation should be performed prior to treatment [2, 39, 73, 93].

Diagnostic evaluation includes history-taking, clinical examination and Doppler ultrasound investigation.

Additionally, functional examinations (e.g., photoplethysmography, phlebo-dynamometry, venous occlusion plethysmography) and imaging modalities (e.g., duplex ultrasound, phlebography) may be considered.

Functional examinations make it possible to assess the improvement in venous function, which is to be expected for the elimination of varicosis.

Diagnostic imaging is especially suitable for identifying incompetent junctions with the deep venous system and for locating pathological reflux, as well as for clarifying post-thrombotic changes [34, 86] and for selecting the most appropriate treatment option.

## Implementation of sclerotherapy of varicose veins

Aethoxysklerol®, which contains the active ingredient polidocanol in concentrations of 0.25/0.5/1/2/3 and 4%, is licensed in Germany for sclerotherapy of varicose veins:

The maximum daily dose of polidocanol is 2 mg/kg body weight [57].

### *Sclerotherapy with sclerosant solutions (liquid sclerotherapy)*

Table 1 provides guide values for concentration and volume per injection for liquid sclerotherapy [57].

| **Sclerosants containing polidocanol** | | |
|---|---|---|
| **Indications** | **Volume/injection** | **Concentration** |
| Spider veins | 0.1-0.2 ml | 0.25-0.5% |
| Central veins of spider veins | 0.1-0.2 ml | 0.25-1% |
| Reticular varicose veins | 0.1-0.3 ml | 1% |
| Small varicose veins | 0.1-0.3 ml | 1% |
| Medium-size varicose veins | 0.5-2.0 ml | 2-3% |
| Large varicose veins | 1.0-2.0 ml | 3-4% |

*Table I. – Guide values for concentration and volume per injection for sclerosants containing polidocanol used for liquid sclerotherapy*

A smoothly functioning disposable or glass syringe is required for sclerotherapy as well as a cannula with a small diameter. Cotton-wool rolls or pads and adhesive paper tapes are used for local compression. The different techniques vary considerably [3]. The following principles apply to liquid sclerotherapy proper:

- Puncture of the veins to be sclerosed can be performed with the patient standing or lying down.
- The injection is usually given with the patient lying down. After the vein has been punctured with the free cannula or with the syringe attached, the intravascular position is checked.
- Intravascular injection of the sclerosant is performed slowly, possibly in fractions and checking that the cannula is positioned inside the vein. Severe pain during injection may be indicative of paravascular injection.
- Immediately after injection of the sclerosant and removal of the cannula, local compression is performed along the course of the sclerosed vein [21, 73, 88, 90].
- After sclerotherapy, compression is applied to the treated extremity. When sclerosing spider veins, compression is achieved in a variety of ways. Compression can be performed using both a compression stocking and a compression bandage [21, 25, 38].
- Local compression can be removed the same evening or on the next day. Depending on the diameter and location of the varicose veins, compression is performed for hours up to several days and weeks after completion of sclerotherapy [2, 78, 93].
- After a sclerotherapy session using the traditional technique, the patient should walk around for a while (physical thromboprophylaxis) A careful watch must be kept for any signs of allergic reactions.
- Intensive sports activity, hot baths, saunas, and strong UV irradiation (solarium use) should be avoided in the initial days after sclerotherapy.

### *Sclerotherapy guided by duplex ultrasound*

Duplex ultrasound-guided sclerotherapy has proved to be a useful addition to the range of methods for sclerosing saphenous junctions, truncal veins close to saphenous junctions, and perforating veins [30, 33, 41, 42, 80, 81, 82]. In this procedure, the vein to be sclerosed is visualised by duplex ultrasound with the patient lying down and puncture is performed under visual control. The needle is visible on the ultrasound image, and intravascular injection can be monitored. Some authors recommend intermittent compression using the ultrasound transducer after injection [81, 82]. This enables the contraction of the injected venous segment and the length of the sclerosed portion to be assessed. The purpose of this method is to achieve a more controlled procedure with fewer complications and increased efficacy.

### *Sclerotherapy with foam sclerosants (foam sclerotherapy)*

The literature has long contained reports of sclerotherapy with foamed sclerosants [14, 31, 34, 61, 86, 99]. In recent years, as the technology has improved, foam sclerotherapy has become established particularly for the treatment of larger varicose veins [47, 65, 80]. Detergent-type sclerosants such as polidocanol can be transformed into a fine-bubbled foam by special techniques.

In the Monfreux technique [65] negative pressure is generated by drawing back the plunger of a glass syringe, the tip of which is tightly closed. The resulting influx of air produces a large-bubbled, fairly fluid foam [99]. In the Tessari technique the foam generated is fine-bubbled and fluid at low concentrations and rather viscous at high concentrations and it is produced by the turbulent mixture of liquid and air in two syringes connected via a three-way stopcock. The mixing ratio for sclerosant + air is 1 + 3 to 1 + 4 [91]. The DSS (double syringe system) technique involves the turbulent mixing of polidocanol with air in a sclerosant + air ratio of 1 + 4 in two syringes linked via a connector. The resulting product is a fine-bubbled, viscous foam [8, 99].

The standardised transformation of a licensed liquid sclerosant into a foam sclerosant and treatment with it is permissible provided that the patient has been adequately informed about the procedure and about the benefits and risks of the method and consents to its use. Even if foam is used off-lable, the published evidence and data documents the use as a standard procedure.

The Second European Consensus Conference on Foam Sclerotherapy took place at Tegernsee in April 2006. On the basis of the expert's own experience and the available literature, the following recommendations on foam sclerotherapy were given [9], partially modified for this guideline.

Puncture and injection:

• When treating the long saphenous vein (LSV) by direct puncture, it is recommended that venous puncture be performed in the proximal thigh area. If long catheters are used it is recommended to make the access to the LSV below the knee.

• When treating the short saphenous vein (SSV) by direct puncture, it is recommended that venous puncture be performed in the proximal or middle part of the lower leg.

• When treating the perforating veins it is recommended that the injection should not be made directly into the affected vein.

Foam generation, concentrations and volumes:

• The Tessari and Tessari/DSS methods are recommended for the generation of foam sclerosant for all indications.

• Air is accepted and/or proposed as the gas component for the generation of foam sclerosant for all indications. A mixture of carbon dioxide and oxygen may also be used.

• The preferred ratio of liquid sclerosant and gas for the generation of a foam sclerosant is 1 + 4 (1 part liquid + 4 parts gas). Ratios between 1 + 1 and 1 + 5 are used for reticular varicose veins and spider veins, but the 1 + 4 ratio is also used by the majority.

• The preferred foam volumes per venous puncture are shown in Table 2 and the preferred concentrations are outlined in Table 3.

| | Mean foam volume per puncture | Maximum foam volume per puncture |
|---|---|---|
| **LSV** | 2 to 4 ml | Up to 6 ml |
| **SSV** | 2 to 4 ml | Up to 4 ml |
| **Collateral veins** | Up to 4 ml | Up to 6 ml |
| **Recurrent varicose veins** | Up to 4 ml | Up to 8 ml |
| **Perforating veins** | Up to 2 ml | Up to 4 ml |
| **Reticular varicose veins** | < 0.5 ml | < 1 ml |
| **Spider veins** | < 0.5 ml | < 0.5 ml |
| **Venous malformations** | 2 to 6 ml | < 8 ml |

*Table II. – Foam volume per venous puncture*

• The recommended maximum foam volume per leg and session (given in a single injection or in several injections) is 10 ml.

• When treating large-calibre varicose veins, the foam sclerosant should be as viscous as possible.

Safety measures:

• Safety during foam sclerotherapy of the GSV and SSV can be improved by:

– avoiding immediate compression of the injected areas;

– using ultrasound to monitor foam distribution;

– injecting a highly viscous foam;

– ensuring there is no patient or leg movement for 2 to 5 minutes, no Valsalva manoeuvre or other muscle movement;

– encouraging active muscle movement, e.g. repeated foot flexion, if a larger volume of foam is detected in the deep venous system.

| | Liquid | 0.25% | 0.5% | 1% | 2% | 3% | 4% |
|---|---|---|---|---|---|---|---|
| **LSV** | | | | + | ++ | ++ | |
| **SSV** | | | | + | ++ | + | |
| **Collateral veins** | | | | ++ | | | |
| **Recurrent varicose veins** | | | (+) | ++ | ++ | + | |
| **Perforating veins** | | | (+) | ++ | + | (+) | |
| **Reticular varicose veins** | (+) | (+) | ++ | + | | | |
| **Spider veins*** | ++ | (+) | (+) | | | | |
| **Venous malformations** | | | + | ++ | + | | |

The stated concentrations refer to the liquid polidocanol solution from which foam is generated.

* Foam sclerotherapy is not the treatment of choice for vessels less than 1 mm in diameter. For sclerotherapy of spider veins the recommendation is first to use polidocanol in liquid form. Where foam is used, small volumes of a 0.25% foam (possibly even of a 0.5% foam) should be given.

*Table III. – Guide values for concentration and volume per injection for sclerosants containing polidocanol used for liquid sclerotherapy*

• The known presence of a patent foramen ovale (PFO) is a relative contraindication for foam sclerotherapy. In such patients the following is recommended:

– the patient should remain lying down for longer (8 to 30 minutes);

– use only small volumes of foam (2 ml) or liquid sclerotherapy;

– avoid Valsalva manoeuvres;

– elevate the patient's leg by ca. 30 cm.

• Prior to foam sclerotherapy it is not necessary to perform specific investigations for PFO.

• A high risk of thromboembolism in the patient's history and known thrombophilia (especially in combination with a high risk of thromboembolism) is a relative contraindication for foam sclerotherapy. In such patients the following is recommended:

– institute adequate LMW heparin prophylaxis (in line with relevant guidelines/recommendations);

– implement physical prophylaxis;

– use low sclerosant concentrations for foam generation;

– use small volumes of foam;

– decide on a case-by-case basis (perform a benefit-risk assessment based on the particular indication).

• Prior to foam sclerotherapy it is not necessary to perform specific investigations for thrombophilia.

Patient information:

• Before foam sclerotherapy patients should be informed about risks and possible adverse effects in the same way as before liquid sclerotherapy. In addition, they should be told that:

– there is a slightly higher risk of hyperpigmentation and inflammation;

– there is a risk of developing (transient) neurological symptoms;

– there is a risk of developing (transient) visual disturbances;

– there is a risk of triggering migraine.

• As before liquid sclerotherapy, patients should be informed about the expected treatment outcome. In addition, they should be told that:

– short-term outcomes are highly satisfactory;

– further therapy is possible and may be necessary in some cases, especially in treatment for large varicose veins;

– foam sclerotherapy is more effective than liquid sclerotherapy.

Duplex ultrasound in foam sclerotherapy:

• The therapeutic effect of foam sclerotherapy on the patient and on the patient's leg should be assessed clinically and on the basis of symptoms.

• The therapeutic effect of foam sclerotherapy on the LSV, SSV, collateral branches, recurrent varicose veins, perforating veins and on venous malformations can be assessed additionally using duplex ultrasound.

• In terms of puncturing non-visible varicose veins, duplex-guided ultrasound is an important instrument that enables puncture errors to be avoided. Ultrasound visualisation (preferably duplex-guided) is necessary for the direct puncture of non-visible LSV, SSV and perforating veins as well as of non-visible varicose veins in the groin and popliteal fossa.

• Duplex guidance is recommended for other non-visible varicose veins.

Criteria for assessing the therapeutic effect of foam sclerotherapy are presented in Table 4.

| Grade/Name | Duplex criteria | | Clinical criteria | Symptoms |
|---|---|---|---|---|
| **2** Successful | No REFLUX | a) – Complete disappearance of treated vein or – "Fibrous cord" (non-compressible, echogenic cord at the site of the treated vein) b) Complete occlusion (non-compressibility) of the treated venous segment c) Patency of the treated venous segment with reduced diameter and antegrade blood flow | Normalised (i.e. no visible varicose veins) | Absent or improved |
| **1** Partially successful | REFLUX < 1 sec | – Partial non-compressibility and – Partial occlusion of the treated venous segment and – Diameter reduction | Normalised or improved (i.e. varicose veins less visible) | Absent or improved |
| **0** Unsuccessful | REFLUX > 1 sec or unchanged | – Complete (or incomplete) patency and/or – Diameter unchanged | No change or worse (i.e. larger varicose veins or deterioration in terms of CEAP) | No change or worse |

Further information:
- Duplex ultrasound is performed with the patient standing.
- The length of the occluded venous segment must be compared with the length of the incompetent venous segment that was to be occluded by sclerotherapy injection. (The segment to be treated must therefore be defined before injection.) This is important for establishing after sclerotherapy whether the "whole vein" is occluded.
- Reflux is assessed during a Valsalva manoeuvre or during distal compression/decompression.
- In terms of symptom assessment – where appropriate – more sophisticated and standardised symptom scores such as the VCSS may be used; otherwise visual analogue scales (VAS) from 1-10 are helpful and simple to use.
- In terms of clinical assessment – where appropriate – more sophisticated and standardised classifications such as in the CEAP classification may be used.
- When treatment is being given simultaneously for medical and aesthetic reasons, two separate assessment forms should be used.
- This classification is applicable for all endovenous treatment methods (laser, radiofrequency and sclerotherapy techniques) and should facilitate comparability.
- Details of the number of treatments (injections and sessions) and the type of treatment should be recorded.

*Table IV. – Assessment of treatment outcome following foam sclerotherapy*

## EFFICACY

A wealth of published clinical series [e.g. 4, 7, 10, 12, 15, 17, 18, 20, 50, 53, 64, 68, 83, 89, 98] and controlled clinical trials [1, 16, 44, 45, 52, 74, 76, 102] provide undoubted evidence to corroborate the elimination of intracutaneous and subcutaneous varicose veins by sclerotherapy. The success rates of sclerotherapy vary depending on technique, sclerosant (liquid or foam) and venous calibre.

Sclerotherapy is considered to be the standard treatment for intracutaneous varicose veins (spider veins and reticular veins), allowing improvement of up to 90% to be achieved [6, 22, 51, 54, 62, 69].

Compression treatment with medical compression stockings may improve the result of sclerotherapy for spider veins [55, 60, 63, 96]. The incidence of pigmentation decreases significantly [38, 96].

Local eccentric compression significantly increases local pressure in the sclerosed area and improves the efficacy of sclerotherapy [88].

In older studies with liquid sclerotherapy, surgery was significantly more effective in the treatment of truncal varices [24]. In the sclerosis of truncal varicose veins foam sclerotherapy is significantly more effective than liquid sclerotherapy [44, 74, 102].

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