Liquid and Foam Sclerotherapy for Spider and Varicose Veins

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KEYWORDS

• Sclerotherapy • Telangiectasia • Spider veins • Varicose veins
• Foam sclerotherapy

KEY POINTS

- Sclerotherapy has diverse application in the treatment of cutaneous telangiectasia, superficial venous insufficiency, pelvic venous reflux, and venous malformations.
- It has an important role in the treatment of venous disease in all stages.
- It is an important tool for physicians treating venous disease, and familiarity with sclerotherapy indications, contraindications, and techniques is an important part of any vein practice.
- Management of patient expectations regarding symptom relief, improvement in appearance, and expectation of recurrent disease is of critical importance.

INTRODUCTION

Patients with venous insufficiency may present with symptomatic varicosities or advanced disease (skin changes, ulceration) or may just have cosmetically bothersome varicose or spider veins.[1,2] Techniques for treating superficial venous insufficiency include surgical stripping, microphlebectomy, and endothermal (laser and radiofrequency) and nonendothermal ablation. These techniques all have important places in the treatment of venous disease; however, sclerotherapy has the broadest role because it can be used in the treatment of venous disease at every stage of severity. Sclerotherapy is an effective and widely used modality to diminish the appearance of cosmetically bothersome lower-extremity telangiectasias.[3] Truncal saphenous incompetence can be treated with sclerotherapy, which offers an advantage over other saphenous ablation techniques in that incompetent tributary veins can be treated simultaneously with the same modality.[4] With advanced venous disease, nests of

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abnormal veins are often present in the dermal and subdermal beds of active and healed ulcers. Because of the thickening associated with the diseased overlying skin, microphlebectomy of these veins may not be possible, and foam sclerotherapy offers a straightforward treatment approach.[5] Foam sclerotherapy has also been used in the treatment of pathologic perforator veins.[6] Sclerotherapy has an important role in the treatment of vascular malformations throughout the body,[7] and in the treatment of pelvic venous reflux.[8] Given the diverse applications of liquid and foam sclerotherapy in the treatment of venous disease, it is important for physicians caring for venous patients to have familiarity with its potential benefits, limitations, contraindications, and side effects.

THE DEVELOPMENT OF SCLEROTHERAPY

Sclerotherapy induces injury to the venous intima, which is followed by eventual fibrosis of the vessel. A variety of sclerosants have been used in the past, but in the United States, the most commonly sclerosing agents used today are hypertonic saline, sodium tetradecyl sulfate (STS), and polidocanol (POL). Both liquid and foam sclerotherapy are widely used throughout the world.[9]

POL and STS are detergent sclerosants and can be turned into a foam by mixing them with a gas, usually room air, CO_2, O_2, or a CO_2/O_2 mixture. In 1944, Orbach described mixing room air with a sclerosant[10]; however, this technique did not gain popularity until its "rediscovery" some 50 years later. Both Cabrera Garrido and colleagues[11] of Spain and Monfreux[12] of France published papers in 1997 describing their techniques in the use of foam sclerosants.[11,12] Today, the most widely used technique is the "double-syringe" method described by Lorenzo Tessari of Italy in 2000.[13]

The techniques described by Cabrera Garrido, Monfreux, and Tessari were applied by clinicians to compound foam in their own clinical settings (physician compounded foam, PCF). A standardized proprietary foam sclerosant (Varithena; BTG, West Conshohocken, PA, USA) was approved by the US Food and Drug Administration (FDA) for the treatment of great and accessory saphenous vein and tributary vein incompetence in 2013.[14] Potential advantages of this commercially available proprietary foam is more consistent foam characteristics (bubble size, sclerosant strength) and assured sterility.[15]

SCLEROTHERAPY BASICS

Agents

The most frequently used sclerosants are outlined in **Table 1**. In the United States, the most commonly used agents are STS, POL, and hypertonic saline. Both STS and POL are FDA-approved sclerosants, whereas the use of hypertonic saline is considered to be an off-label use. The mechanism of action of endothelial injury varies depending on the sclerosing agent used. Hyperosmolar agents, such as hypertonic saline, cause diffusion of water from the intracellular space to the extracellular space, causing nonspecific cell destruction as well as hemolysis. The 2 commonly used detergent sclerosants, STS and POL, cause protein theft denaturation, which lyses of the cell wall, without hemolysis. Corrosive sclerosants are less commonly used and have a direct cytotoxic effect on the endothelium. Platelet aggregation is stimulated by all sclerosants, which then produces a dense network of platelets and fibrin, then eventually, vessel fibrosis.[16] If the process of fibrosis fails to occur, the sclerotherapy will not be successful. Selection of the appropriate concentration of sclerosant for the size of the treated vessel increases the chance for successful treatment.

Each sclerosant has different dosing, different advantages and disadvantages, as shown in **Table 2**. STS is a synthetic surfactant (soap); POL is a nonester local

Table 1
Sclerosing agents

Agent	Hypertonic Saline	Saline/Propylene Glycol	STS	POL	Sodium Morrhuate	Chromated Glycerine	Polyiodinated Iodine
Class	Hyperosmolar	Hyperosmolar	Detergent	Detergent	Detergent	Corrosive	Corrosive
Trade name	Not available	Sclerodex	Sotradecol	Asclera	Scleromate	Sclermo	Sclerodine
Distributer	Multiple	Omega Laboratories (Canada)	Mylan	Merz	Glenwood, LLC	Omega Laboratories (Canada)	Omega Laboratories (Canada)
FDA/US status	Off-label	Not applicable	Approved	Approved	Approved	Not applicable	Not applicable

Table 2
Advantages and disadvantages of sclerosing agents

Agent	Hypertonic saline	STS	POL
Advantages	Inexpensive Minimal allergy potential	Minimal pain Able to treat larger veins	Nearly painless Ulceration rare Allergy very rare
Disadvantages	Painful Ulceration with extravasation Can cause hyperpigmentation	Allergy less rare Contraindicated with severe asthma Can cause hyperpigmentation	Limited in size of veins to treat Can cause hyperpigmentation

anesthetic,[17] and hypertonic saline has only a local effect and then is rapidly diluted. Both STS and POL are deactivated quickly after injection because they are bound to circulating blood proteins.

With injection of judicious volumes of these 2 agents, the rapid binding/deactivation provides protection against systemic action on the deep veins, and the incidence of thrombotic complications with sclerotherapy is low.[18] Although they are more expensive, STS and POL are less painful upon injection than hypertonic saline, which increases patient acceptability.[19]

Concentration

Sclerosant concentration should be guided by the size of the vein to be treated. **Table 3** outlines suggested concentrations by vein diameter. In the United States, POL is available only in 0.5% and 1.0% concentrations; however, higher concentrations of POL are available in other parts of the world. STS is available in concentrations of up to 3% in the United States. More complex venous disease patterns, such as pelvic venous reflux and venous malformations, may warrant a stronger concentration of sclerosant; therefore, in these situations, STS may be the agent of choice.[7,8]

FOAM SCLEROSANTS

Physician Compounded Foam

The preponderance of foam sclerosants used throughout the world today is PCFs. PCFs are considered an "off-label" use of FDA-approved liquid sclerosants because the drug is fundamentally changed by mixing it with a gas. Because of the presence of gas, foams are echogenic with ultrasound, which allows them to be used in a controlled and directed fashion. PCFs are inexpensive and easy to produce, but they are not standardized and their composition can vary widely depending on which sclerosant and gas are selected and which technique is used to produce them. Injected foam pushes blood out of the vessel for a short distance and forms a "vapor lock" that arrests the flow of blood and keeps the active drug in contact with the venous endothelial for a longer period than would occur with the injection of a liquid.

Table 3
Sclerotherapy concentration by vein diameter

Vein diameter	<1 mm	1–3 mm	>3 mm
Detergent, %	STS 0.1–0.3 POL 0.3–0.5	STS 0.5–1.0 POL 1.0	STS 1.0–3.0 POL 1.0 (or foam)
Hypertonic saline, %	11.7	23.4	—

This “trapped drug” is not deactivated as quickly as a liquid drug would be because it has delayed contact with circulating plasma proteins. This prolonged contact with the vessel wall allows the use of lower concentrations and volumes of sclerosant when compared with liquid sclerosants.[4]

The Tessari technique of foam production is shown in **Fig. 1**. A sclerosant of the detergent case is forcibly mixed with air or physiologic gases (CO_2, O_2, or a mixture of both) through either a 3-way stopcock or a “female-to-female” stopcock (double syringe technique). The small aperture produces small sclerosant encapsulated gas bubbles. The ratio of gas to liquid is 1:4 or 1:3 depending on whether “wet” versus “dry” foam is preferred. The size of the circulating gas bubbles and the stability of the foam are dependent on the method of foam production, the gas chosen for use, and other factors, including atmospheric pressure and temperature.[20] Nitrogen gas is less soluble than O_2 or CO_2 because the amount of nitrogen in the gas used to create foam increases, the foam is more stable, but the bubbles are also less soluble in blood.[21]

Although liquid sclerosants are usually preferred for treating spider telangiectasias, foam sclerotherapy has been shown to be superior in terms of closure rates of varicose veins and truncal veins, such as the great saphenous vein (GSV). Closure rates of GSVs treated liquid POL were as low as 40% and 26% at 3 weeks and 6 months in a prospective randomized trial comparing liquid to foam sclerotherapy published in 2003. The foam sclerotherapy group had elimination GSV reflux in 84% and 80% of limbs at 3 weeks and 6 months.[22] Duplex closure rates of the GSV using foam sclerotherapy are highly variable in the literature, and differing patient populations and disease severities make comparisons between studies difficult. GSV closure rates after treatment with foam sclerotherapy range from 69% to 91%, depending on the agent

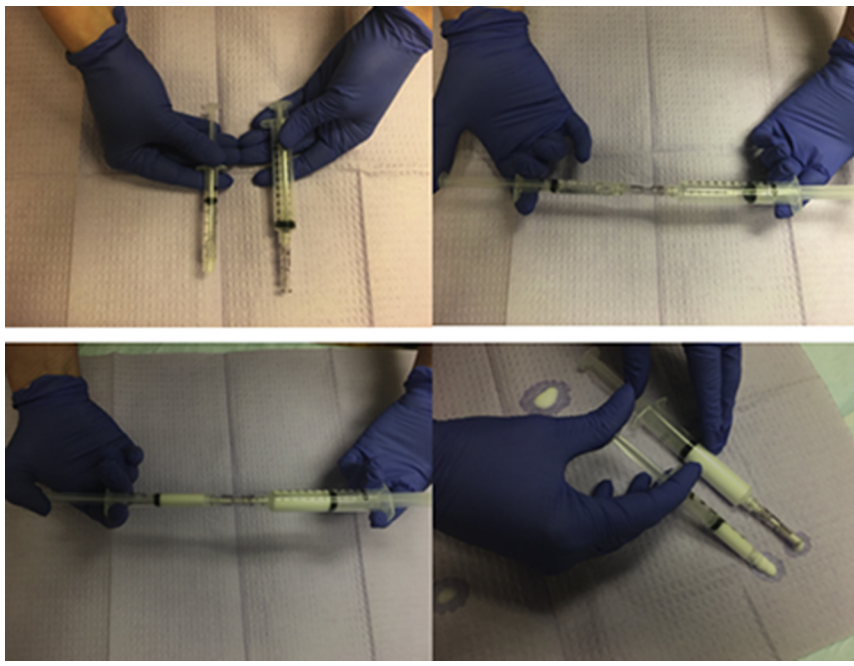

Fig. 1. Tessari technique for the production of PCF.

used, the concentration, the number of treatment sessions administered before assessing closure, and the time at which closure was assessed.[23–27] Until recently, most studies did not provide outcome assessments, such as venous clinical severity scores (VCSS) and quality-of-life (QOL) instruments. Rasmussen and colleagues'[28] often referenced trial randomized patients to surgical stripping, endothermal laser ablation (EVLT), radiofrequency ablation (RFA), or ultrasound-guided foam sclerotherapy (UGFS). All groups had similar improvements in QOL scores, but recanalization and the need for additional treatments were most common in the group treated with UGFS.[28] van der Velden and colleagues[29] performed a randomized trial comparing EVLT and conventional surgery with UGFS. The GSV was obliterated in 85%, 77%, and 23% in the surgical, EVLT, and UGFS groups, respectively. At 5 years, QOL scores in the UGFS groups were inferior compared with the other groups.

One concern for the use of PCF is a rare but serious adverse event or events, particularly neurologic injuries (strokes and transient ischemic attacks [TIAs]), that have been reported. As previously noted, when air is used to produce PCF, the compound is high in nitrogen, an insoluble gas. Most cases of reported neurologic injury occurred with the use of air-based foam. With further investigation, some patients were found to have structural cardiac defects such as a patent foramen ovale or atrial septal aneurysm.[30–33] There are some data demonstrating fewer visual disturbances and other side effects when physiologic gases are used.[34] These data, as well as the reported cases of neurologic injury with air-based foams, have led some to recommend the use of physiologic gases (CO_2 or CO_2/O_2) to produce PCF.[35] O_2 and CO_2, the "physiologic gases," have minimal nitrogen content and are rapidly absorbed in the circulation. There is little downside to using physiologic gases other than the cost of the gas itself.

Right-to-left shunts are quite common in the general population and theoretically place patients at higher risk of cerebral embolization with foam sclerotherapy. It is estimated that roughly 25% individuals have a right-to-left shunt; however, they are more common in patients with varicose veins. A study of 221 patients with varicose vein showed that 58.5% of the individuals had a right-to-left shunt with bubble testing.[36] The overall rarity of neurologic events with foam sclerotherapy, and the high prevalence of such shunts in patients with varicose veins, makes screening for shunts before foam sclerotherapy impractical and unnecessary. Caution should be used, however, in performing foam sclerotherapy in patients with a known right-to-left defect and is contraindicated if the patient has a history of previous events that led to the detection of the defect. Good standard practice in the performance of foam sclerotherapy is to use foam with no grossly visible bubbles and to limit injection volumes.

Proprietary Endovenous Microfoam

A desire to standardize and market a consistent endovenous microfoam for clinical use led to the development of Varithena. This product gained FDA approval for treatment of incompetence of the GSV, accessory saphenous veins (ASV), and their tributaries after several clinical trials proving safety and efficacy. Although it tempting to extrapolate the results of PEM trials to PCF, caution should be used in doing so because the techniques for producing PCF are not standardized. In vitro testing in a bench-top vein model has been performed, and proprietary endovenous microfoam (PEM) gas bubbles are smaller overall, with a narrower distribution of sizes when compared with PCF bubbles, and the stability of PEM foam is superior to PCF. Stable foam is easier to work with, and decreased circulating bubble size may decrease the chance of neurologic complications.[21]

To date, there have been no published reports of stroke or TIA in patients treated with PEM. During the development of PEM, the FDA expressed concern for the possibility of neurologic injury with treatment because of demonstration of bubbles in the left heart on echocardiography in some patients treated with PEM. This concern led to a phase 2 clinical trial to assess the neurologic safety of the use of PEM for the treatment of GSV incompetence. To qualify for the trial, patients with symptomatic GSV incompetence had to have a right-to-left shunt as demonstrated with a transcranial Doppler bubble test. Sixty-one patients had a demonstrated shunt and underwent diffusion-weighted MRI testing (very sensitive to the presence of edema formation) at baseline, and at 24 hours and 1-month after treatment. There were no changes in MRI findings, visual fields, or neurologic examinations after PEM treatment in any of the study patients.[37] Following the encouraging safety results from this trial, phase 3 testing of PEM with 2 pivotal trails was completed. After presentation of the pivotal trials, the FDA approved Varithena for use in November of 2013.[38]

The 2 pivotal single-blind randomized trials, VANISH-1 (275 patients)[39] and VANISH-2 (230 patients),[39] used patient-reported outcomes (PRO) as the primary study endpoint, along with change in appearance of the leg as assessed by both an independent physician reviewer and the patients themselves. The primary and secondary outcome measures were assessed at 8 weeks. GSV or ASV duplex closure was assessed, and studies compared PEM to placebo. The VANISH-1 study randomized patients to 3 differing doses of POL (0.5%, 1.0%, and 2.0), whereas VANISH-2 randomized patients to 0.5% or 1.0% POL. VANISH-2 patients could have 2 treatment sessions, separated by 1 week. Highly statistically significant improvements ($P<.0001$ for both endpoints) in PRO scores and appearance compared with placebo were achieved in both trials. At 8 weeks, the duplex closure rate was 80.4% in the VANISH-1 trial (with 1% POL)[39] and 86.2% for the VANISH-2 trial.[40] The VANISH-2 group was followed out to 1 year, and symptom improvement was sustained.[41] Adverse events were monitored in these trials, and other than headache, there were no neurologic events. The most common adverse events were superficial thrombophlebitis in 5.4% of patients and deep vein thrombosis (DVT) in 4.7% of patients. Most DVTs were asymptomatic and discovered as part of the study follow-up protocol with mandated detailed duplex examinations. None of the patients developed postthrombotic changes, and there were no pulmonary emboli.

PEM has several advantages over traditional heat ablation techniques in that it allows treatment of truncal incompetence and side tributaries with a single-treatment modality. It does not require a tumescent anesthesia and can treat tortuous veins through which an ablation device could not travel. In addition, because there is no risk of thermal injury, it can be used to treat veins near the dermis. In the authors' practice, PEM is often their "go-to" treatment for recurrent varicose veins and neovascularization. Disadvantages include dosing limitations, a somewhat lower duplex closure rate (although there are no head-to-head studies published comparing this modality to endothermal ablation), and a higher rate of thrombotic events (DVT and superficial thrombophlebitis), when compared with historic endothermal ablation data. A final disadvantage to PEM is cost, especially when compared with PCF.

Barriers still exist in terms of widespread adoption to PEM in that some insurers consider it to be "investigational." A dedicated current procedural technology code for billing for PEM is anticipated to be available soon, and such a code should help make carrier coverage and reimbursement more predictable.

PATIENT WORKUP AND TREATMENT

Diagnostic Workup

As with any patient evaluation, a good history and physical examination are the first step to successful treatment. A history should begin with addressing why the patient is seeking treatment, and what their goals for treatment are—whether for symptom relief or to improve the appearance of their legs. Patients without advanced venous disease and without symptoms do not require treatment (except for cosmesis) and may just be seeking reassurance that their spider and/or varicose veins are not a life- or limb-threatening health concern.

Patients should be asked about previous treatments and response to those treatments, including any adverse events they may have encountered. The risks and benefits of the procedure should be outlined and balanced next to the patient's treatment goals. Expected results should be realistically addressed as should potential recurrence of spider and varicose veins. The pretreatment consultation is a key factor to avoiding unrealistic expectations on the part of the patient, and the patient should understand that multiple sclerotherapy sessions may be required for them to achieve their goals.

A review of medical history and medications should be done to alert the provider to any contraindications the patient may have for treatment. Sclerotherapy should not be performed in a patient with active infection or acute deep or superficial thrombosis. Minocycline, often prescribed for adult acne, can cause permanent hyperpigmentation in the areas of treated veins and should be stopped several weeks before a sclerotherapy session and not resumed for about a month afterward.[42] Sclerotherapy should not be performed in pregnant women or women who are breast-feeding unless the benefit clearly outweighs the risk, which is seldom if ever the case for venous treatment. Allergic reactions are not common, but may occur.[43,44] STS is contraindicated in patients with asthma. All clinical sites where sclerotherapy is performed should have a readily available and up-to-date emergency kit in the event of an anaphylactic reaction to a sclerosant. Sclerotherapy has been reported to cause visual disturbances or migraine headache,[45] and patients with a history of migraine (especially migraine with aura) are cautioned that therapy could possibly trigger symptoms. In the authors' practice, they advise patients with a history of migraine with aura to bring any medications that they would usually take in the event of a migraine with them to their sclerotherapy session.

Sclerosant Volumes/Concentration

Both STS and POL have a maximum volume per session of 10 cc, regardless of concentration (STS in the United States is available as 1% and 3% concentrations, and POL is available as 0.5% and 1% concentrations). Multiple injections of small volumes of sclerosant are preferred to fewer injections of large volume. The lowest concentration (effective dose) of sclerosant to achieve the desired effect should be used. **Table 3** lists suggested sclerosant concentration by vein diameter. Side effects, such as matting, ulceration, and venous thrombosis, can occur when high volumes, high concentrations, or forceful injections are used.

Telangiectasias

Although spider telangiectasias rarely cause significant health issues, treatment of this most minor of venous disorders often has the steepest learning curve. With proper technique and patient preparation, sclerotherapy of spider veins is safe and effective. Target veins can be quite small, sometimes a millimeter or less, so stability of the injecting hand

is very important because any extraneous movement may dislodge the needle from the vein. The sclerotherapist should position himself or herself in a favorable ergonomic position in relation to the target vein. It is a 2-handed technique, with the nondominant hand stabilizing and stretching the skin, and the dominant hand bracing the elbow, wrist, and hypothenar eminence of the dominant hand against a solid surface to ensure stability. This positioning is shown in **Fig. 2**. In the authors' practice, spider veins are treated using small needles (30 or 32 gauge) and a small-volume (3-cc) syringe. The angle of injection is shallow, with the bevel up. Bending the needle to allow a more acute angle of entry can be helpful. The liquid should be injected with very low pressure to prevent extravasation into the surrounding tissues. Typically, patients will have pain with extravasation, and a wheal will appear. Commercially available tools to aid in visualization of telangiectasias include the Syris system, Veinlite, and Venoscope (transillumination aids) and the Veinviewer (near infrared light).

Instructions for after-sclerotherapy care are not standardized evidence based. There is a paucity of data regarding exercise, bathing, and sun exposure following sclerotherapy. Most practitioners recommend compression after sclerotherapy, but the type, strength, and duration of compression use is highly variable. A randomized trial of 100 patients compared results in women treated with 3 weeks of 23 to 32 mm Hg compression stockings versus no stockings following sclerotherapy of telangiectasias and reticular veins. The study found no difference in adverse events between the 2 groups, but did find a significant difference ($P = .026$) in favor of compression in terms of improvement in appearance as rated by blinded observers.[46]

Varicose Veins

PCF treatment of varicose veins is facilitated by UGFS; however, it can be performed with confirmation of needle placement with blood return. Advantages to the use of ultrasound are confirmation of intravenous needle placement, demonstration of spasm in the treated vein, and the ability to follow the PCF as it travels through the vein. The authors typically mark the veins with an indelible pen with the patient in the standing position and use a 23- or 25-gauge butterfly needle when treating varicose veins. Multiple injections with small volumes are recommended, to avoid inadvertent boluses of foam into the deep system. Ultrasound images of a varicose vein treated with PCF showing needle placement and vasospasm are shown in **Fig. 3**. The authors' practice places patients in a 20- to 30-mm Hg stocking with or without underlying pressure

Fig. 2. Positioning for injection of telangiectasias.

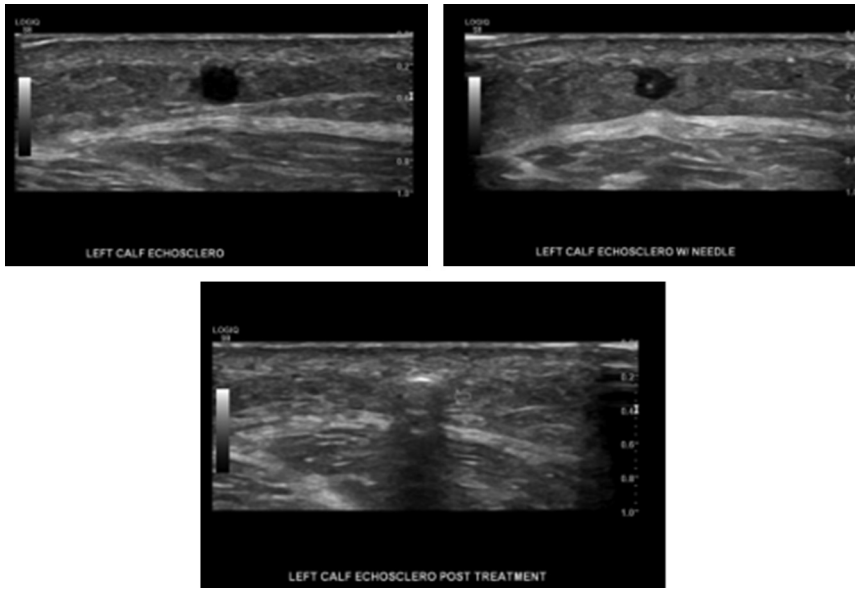

Fig. 3. Ultrasound-guided foam sclerotherapy.

pads for 2 weeks after treatment. Patients walk for 10 minutes after the procedure and are encouraged to walk/be physically active hourly during the first 2 weeks after treatment.

UGFS can be a helpful treatment in advanced venous disease in patients with lipodermatosclerosis or ulceration as an adjunct to truncal ablation and compression therapy.[47] Society for Vascular Surgery/American Venous Forum (SVS/AVF) guidelines recommend treatment of pathologic perforator veins (those >3.5 mm in diameter with >500 ms of reflux near an open or healed ulceration) to aid in ulcer healing and prevent recurrence in patients with CEAP clinical class 5 or 6 disease.[48] UGFS can be used to treat nests of subdermal varices as well as pathologic perforator veins. One study showed a 75% improvement in patients' VCSS and venous disability scores with treatment of pathologic perforator veins with UGFS.[6]

Nonsaphenous source varicose veins in the leg often have a pelvic source.[49] UGFS can be used to treat pelvic source varicose veins in the perineum and leg. PCF has been used extensively for both treatment of pelvic venous insufficiency on its own and as an adjunct to coil embolization of the gonadal veins.[50] A final essential use of sclerosants is the treatment of vascular malformations.[51] Vascular malformations may require multiple sclerotherapy sessions, and recurrence is not uncommon.

Saphenous Incompetence

As described previously in this article, PCF can be used to treat saphenous incompetence, but no standardization of technique exists. In contrast, the technique for GSV or ASV ablation with PEM is standardized and outlined in its instructions for use.[52] Access into the truncal vein is performed in a standard fashion with ultrasound guidance using either a micropuncture set or an angiocatheter. For the GSV, the tip of the catheter is usually in the mid thigh. After blood return is confirmed and the catheter is flushed, the limb is elevated to 45°. After preparation of the PEM, compression is held caudal to the access site and the injection is performed with a silicone-free

syringe. During injection, a second individual visualizes the saphenofemoral junction (SFJ) in longitudinal view. The PEM will arrive as a bright white column, and when visualized 2 to 3 cm from the SFJ, the junction will be compressed with the ultrasound probe to hold the PEM in place and prevent premature entry into the deep veins. The distal compression is then released. The SFJ is compressed until the GSV or ASV is visualized with ultrasound and found to be in complete spasm along the treatment length, with no areas of patency. Pressure is continued for about 3 to 5 minutes, and a typical GSV can be treated with 4 to 7 cc of PEM. Up to 15 cc of PEM can be used in one session and can include injections into tributaries.

Following treatment of the truncal vein in the thigh, it can be treated more caudally by either pulling the access catheter back slightly, compressing above the tip of the catheter and injecting retrograde through the catheter, or accessing the vein in another location. Side branches are then accessed using a butterfly or other needle, and injecting small volumes of PEM (1–2 cc per injection) while compressing any large perforator veins associated with the side branches being treated. Following completion of treatment, the leg is wrapped with a short-stretch bandage, a compression pad, and a compression stocking. Patients are instructed to walk or be active for 5 to 10 minutes out of every waking hour for the first 2 weeks after the procedure. More than one treatment session may be required for optimal results in patients with extensive branch varicosities.

ADVERSE REACTIONS

Strokes, the most dreaded sclerotherapy complication, are fortunately rare. Migraines and visual disturbances, however, are more commonly reported and can occur with the use of either liquid or foam sclerotherapy. It is estimated that the prevalence of transient visual disturbance with sclerotherapy ranges from 0.09% to 2% in a recent review of the literature.[53] There are several proposed mechanisms for visual disturbance and migraine with sclerotherapy, including gas and particle microemboli, or the release of endothelin from the treated veins. Rat models show that circulating endothelin, a potent vasoconstrictor and bronchoconstrictor, is increased with foam sclerotherapy.[54] The endothelin hypothesis is especially intriguing because it helps explain why visual disturbances may occur with liquid sclerotherapy.

DVT can occur following sclerotherapy, with either liquids, PCF, or PEM. The prevalence of reported DVT and pulmonary embolism after sclerotherapy was 0.8% and 0.2%, respectively, in a review of nearly one million subjects undergoing venous procedures. These rates were lower than reported rates for endothermal ablation (RFA and EVLT) and surgery.[55] A common adverse event after sclerotherapy is superficial phlebitis. Superficial phlebitis can be uncomfortable for the patient but is rarely dangerous. Early drainage of trapped coagula using an 18-gauge needle or a number 11 blade may provide quick relief of discomfort and decrease the extent of hyperpigmentation following sclerotherapy.

Cutaneous necrosis can cause disfiguring scars. It can occur with any sclerosant, but is more common with hypertonic saline when compared with STS or POL.[56] Mechanisms of cutaneous necrosis include extravasation of contrast, and inadvertent injection into a small arteriole or arteriovenous fistula. Most ulcerations, fortunately, are small and will heal with appropriate wound care; however, large areas of necrosis may require advanced wound techniques to achieve healing.

Both hyperpigmentation and telangiectatic matting are cosmetically adverse events that can decrease patient satisfaction. Matting has the appearance of fine red or purple veins that occur over areas of treatment and can occur after sclerotherapy in 10%

to 30% of patients. Hyperpigmentation is common following sclerotherapy and will generally gradually lighten and improve over time. Spontaneous resolution will typically occur in 70% of patients by 6 months and 99% of patients by 1 year.[57] Conservative therapy with observation should be the first approach to the patient with hyperpigmentation after sclerotherapy. As with hyperpigmentation, patients should be reassured that resolution with time is typical.

In general, sclerotherapy is safe and well tolerated, and it is likely that the most common "adverse event" following treatment is failure to meet the patient's expectations in terms of cosmesis. One of the most important considerations in terms of patient satisfaction is educating patients in regards to realistic outcomes. Patients should be counseled that immediate improvement in appearance is not likely, and that improvement is usually gradual and incremental. Multiple treatment sessions, especially for telangiectasias, may be necessary for the patient to achieve their desired results. Preprocedural counseling should be thorough and include showing patients photographic examples of both ideal and nonideal outcomes.

Fortunately, serious complications from sclerotherapy are rare, and the more common adverse events will almost always improve over time. The most common "adverse event" with sclerotherapy is a failure of the treatment to live up to the patient's expectations. It is important that patients have a thorough understanding of the gradual and incremental improvements that are the norm with sclerotherapy. Multiple sclerotherapy sessions may be required to achieve a good result. Photographic examples of ideal as well as nonideal sclerotherapy outcomes can be helpful in educating patients in regards to realistic expectations.

SUMMARY

Sclerotherapy has diverse application in the treatment of cutaneous telangiectasias, superficial venous insufficiency, pelvic venous reflux, and venous malformations. It has an important role in the treatment of venous disease in all stages. It is an important tool for physicians treating venous disease, and familiarity with sclerotherapy indications, contraindications, and techniques is an important part of any vein practice.

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