Regence

Medical Policy Manual Surgery, Policy No. 104

Varicose Vein Treatment

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IMPORTANT REMINDER

Medical Policies are developed to provide guidance for members and providers regarding coverage in accordance with contract terms. Benefit determinations are based in all cases on the applicable contract language. To the extent there may be any conflict between the Medical Policy and contract language, the contract language takes precedence.

PLEASE NOTE: Contracts exclude from coverage, among other things, services or procedures that are considered investigational or cosmetic. Providers may bill members for services or procedures that are considered investigational or cosmetic. Providers are encouraged to inform members before rendering such services that the members are likely to be financially responsible for the cost of these services.

DESCRIPTION

Varicose veins are dilated, tortuous veins that may cause pain or skin ulcers; however, the majority of treatment is done for cosmetic reasons. Invasive treatment may include surgical removal and/or destruction using lasers, heat, or injection of sclerosing solution.

MEDICAL POLICY CRITERIA

Notes:

- Member contracts for covered services vary. Member contract language takes precedence over medical policy for determining eligibility for varicose vein treatment benefits. Once eligibility is confirmed, medical policy criteria apply. In addition, when there is a contract denial for treatment of varicose veins, the denial not only includes treatment but also the associated venous imaging studies (i.e. CPT 93970 or 93971) for treatment planning.
- This policy addresses treatment of the superficial system veins of the lower extremity (e.g., great and small saphenous veins, saphenous tributaries, varicose veins and associated lower extremity perforator veins), upper extremity varices, and vulvar varices.
- Embolization, ablation, and sclerotherapy of the ovarian, internal iliac, or gonadal

veins for treatment of pelvic congestion syndrome or varicoceles are addressed separately (see Cross References below).

- This policy uses the nomenclature great saphenous vein and small saphenous vein. Great saphenous veins are also known as long saphenous veins (CPT nomenclature) or greater saphenous veins. Small saphenous veins are also known as short saphenous veins (CPT nomenclature) or lesser saphenous veins.
- Clinical documentation to support criteria is required (See Required Documentation)

Medically Necessary

I. **Both** (A. and B.) of the following **general criteria** must be met for varicose vein treatment to be considered for coverage:

A. The individual meets one or more of the following indications (1. – 5.)

1. Functional impairment caused by varicose veins symptoms (see policy guidelines) when both of the following are met;

a. The functional impairment limits performance of instrumental activities of daily living (ADLs; See policy guidelines) and clinical documentation includes both of the following:

i. The specific instrumental ADL that is impaired; and

ii. A description of how performance of the instrumental ADL is limited with documentation of associated varicose vein symptoms (see policy guidelines); and

b. Compliance with a minimum of three consecutive months of medically supervised conservative therapy immediately prior to the request including all of the following (i – iii):

i. Use of graded compression stockings providing a minimum gradient of 15 -20 mmHg of pressure; and

ii. Include at least 2 visits for medical supervision, during the 3 consecutive months of conservative therapy. One visit must occur at initiation, and another at least 3 months later (90 days); and

iii. Individual compliance throughout the three-month period (e.g., consistent daily ambulatory use of compression stockings) and assessment of treatment response comparing baseline to outcomes at three months (e.g., improved activity, reduced swelling); or

2. Recurrent attacks of superficial thrombophlebitis as documented by venous imaging studies; or

3. Recurrent or persistent hemorrhage from ruptured varix (excluding bleeding caused by shaving); or

4. Meets the Clinical, Etiology, Anatomy and Pathophysiology guidelines (CEAP) of C4 (C4a or C4b) (see Appendix A) with photo and/or clear clinical documentation of skin and subcutaneous tissue changes; or

5. Documentation of ulceration from venous stasis where incompetent varices are a significant contributing factor; and

B. A complete venous imaging study in the superficial system veins (e.g., great and small saphenous veins, perforator veins, and saphenous tributaries) is performed including documentation of the diameter of the vein and the reflux in seconds measured at multiple levels in the thigh and calf (see Required Documentation).

II. Procedures

A. Endovenous radiofrequency, laser ablation, or endovenous glue or adhesive of incompetent great or small saphenous veins may be considered **medically necessary** when ALL of the following Criteria (1.- 4.) are met:

1. Criterion I. is met.
2. Documentation by venous imaging study of minimum vein diameter measurements within the planned treatment segment, as defined in the Required Documentation section:
   a. Great saphenous vein diameter 5.5 mm or greater (not at or closely adjacent to the saphenofemoral junction)
   b. Small saphenous vein diameter is 4 mm or greater (not at or closely adjacent to the saphenopopliteal junction); and
3. Incompetence exceeding 0.5 seconds; and
4. Clinical documentation demonstrates that all incompetent segments of the same vein will be treated (both a and b must be documented);
   a. in the same session; and
   b. with the same modality.

B. Ligation/stripping and phlebectomy (i.e., stab, hook, transilluminated powered) of incompetent superficial system veins (including the great and small saphenous veins and saphenous tributaries including accessory saphenous veins) and varicose veins may be considered **medically necessary** when ALL of the following Criteria (1. - 4.) are met:

1. Criterion I. is met; and
2. The incompetent superficial veins proximal to the vein to be treated either have been treated or are being treated concurrently; and
3. Documentation by venous imaging study of minimum vein diameter ≥ 4 mm within the planned treatment segment, as defined in the Required Documentation section; and
4. Incompetence exceeding 0.5 seconds.

C. Sclerotherapy (liquid, foam, or microfoam) of the following superficial system veins: great saphenous vein below the knee, small saphenous vein, and saphenous tributaries including accessory saphenous veins, and other varicose veins may be considered medically necessary when ALL of the following Criteria (1. - 3.) are met:

1. Criterion I. is met; and
2. Documentation by venous imaging study of minimum vein diameter of 4mm or greater (not at or closely adjacent to the saphenofemoral junction or saphenopopliteal junction) as defined in the Required Documentation section; and
3. The incompetent superficial veins proximal to the vein to be treated either have been treated or are being treated concurrently.

D. Venous imaging study guidance (see Policy Guidelines) may be considered **medically necessary** for liquid, foam, or microfoam sclerotherapy of the great saphenous vein below the knee, small saphenous vein, accessory saphenous veins and saphenous tributaries**.**

III. Treatment sessions (see Required Documentation): When applicable medical necessity criteria detailed above are met, either initial or subsequent treatment may be considered **medically necessary** when performed within either of the following numbers of treatment sessions:

A. One treatment session; or

B. Two treatment sessions of bilateral veins (a separate session for each of the right and left legs).

Not Medically Necessary

IV. Varicose vein treatment is considered **not medically necessary** when Criterion I. is not met.

V. If Criterion II.A. is not met, endovenous radiofrequency, laser ablation, or endovenous glue or adhesive of incompetent great or small saphenous veins is considered **not medically necessary.**

VI. If Criterion II.B. is not met, ligation/stripping or phlebectomy (including perforator veins) is considered **not medically necessary.**

VII. If Criterion II.C. is not met, sclerotherapy is considered **not medically necessary.**

VIII. Venous imaging study guidance is considered **not medically necessary** for sclerotherapy of all other superficial system veins**.**

IX. Separate sessions for ablation of segments of a continuous vein are considered **not medically necessary**.

X. Treatment sessions not meeting Criterion III. above are considered **not medically necessary**.

XI. Follow-up venous imaging studies performed within 6 months following the most recent ipsilateral treatment, in the absence of complications, are considered **not medically necessary**, including but not limited to routine confirmation studies following endovenous ablation. Focused venous imaging studies to confirm ablation or rule out deep vein thrombosis or endovenous heat-induced thrombosis are considered a component of and incidental to the procedure or follow-up evaluation.

Investigational

XII. Endovenous ablation is considered **investigational** for ANY of the following:

A. Cryoablation of any vein; or

B. Radiofrequency, endovenous glue or adhesive, or laser ablation of veins other than the great or small saphenous veins, including but not limited to the following:

1. accessory saphenous veins
2. branch tributaries
3. perforator veins; or

C. Ablation of any other veins (e.g., vulvar varices); or

D. Mechanochemical ablation of any vein; or

E. Microwave ablation of any vein; or

F. Steam injection ablation of any vein.

XIII. Sclerotherapy is considered **investigational** for ANY of the following:

A. Vulvar, including labial and buttock varices; or

B. Upper extremity varices; or

C. Great saphenous vein from the saphenous femoral junction (SFJ) to knee; or

D. Perforator veins.

XIV. High-intensity focused ultrasound (HIFU) ablation of any vein is considered **investigational.**

Cosmetic

XV. Sclerotherapy of small (less than 4 mm in diameter) superficial veins, including but not limited to reticular veins and/or telangiectasias (spider veins) is considered **cosmetic.**

NOTE: A summary of the supporting rationale for the policy criteria is at the end of the policy.

POLICY GUIDELINES

Symptoms caused by varicose veins; heaviness, achiness, swelling, throbbing and itching (HASTI). Additional symptoms include pain, burning, cramping, limb heaviness, restless legs and muscle cramps.[1]

Instrumental activities of daily living (ADL) are defined as feeding, bathing, dressing, grooming, meal preparation, household chores, and occupational tasks that are required as a daily part of job functioning.

REQUIRED DOCUMENTATION

It is critical that the list of information below is submitted for review to determine if the policy criteria are met. If any of these items are not submitted, it could impact our review and decision outcome.

- History of present illness and physical examination.

- Impact on activities of daily living (including the specific ADL) impaired, how it impacts performance, and what is done to alleviate it.
    - Note: Impact on ADLs and conservative therapy plan are not required when there are documented recurrent attacks of superficial phlebitis, recurrent or persistent hemorrhage from ruptured varix, which does not include bleeding caused by scratching or shaving, and/or ulceration from venous stasis where incompetent varices are a significant contributing factor.
- Conservative therapy treatment plan must include:
    - Graded compression stockings with strength clearly documented in mmHg (minimum 15 – 20 mmHg)
    - Medically supervised trial of at least three months of compression garment use documented by provider -including two visits three months apart prior to the request.
    - Documentation of patient compliance throughout trial (e.g., documentation by provider of consistent daily ambulatory use of compression garments)
    - Assessment of treatment response comparing baseline to three-month outcomes (e.g., improved activity, reduced swelling, etc.)
- Complete venous imaging studies including vein names with measurements of seconds of reflux and average vein diameters per the requirements below:
    - All vein diameter measurements must be:
        - Taken within the planned treatment segment
        - Not at or closely adjacent to the saphenofemoral or saphenopopliteal junction (e.g., within 3 cm)
        - Excluding focal dilations (e.g., valve sinuses)
    - Note: The diameter threshold applies to the maximum representative trunk diameter within the planned treatment segment, not the entire vein length.
- Documentation of ulceration from venous stasis where incompetent varices are a significant contributing factor which may include photographs.
- Procedures requested:
    - Specific procedures to be performed
    - Specific veins, including laterality (left or right) and segment, to be treated
    - Number of treatment session(s) being requested
    - If bilateral endovenous ablation is requested, document whether a bilateral or two unilateral sessions are being requested
    - Specify the veins to be treated in each session
    - For ablations, specify how all incompetent segments of the same vein are to be treated

ADDITIONAL INFORMATION

- Additional Venous Imaging Studies
    - For additional treatment sessions after previous varicose vein procedures, additional imaging is only required when the previous imaging did not identify the veins requested in the additional treatment session(s). Additional imaging is not required when an initial request was denied (for criteria not related to imaging) and the member is seeking subsequent approval. Initial imaging will be considered adequate unless there is a relevant intervening venous procedure(s), in which case new imaging studies may be requested.
- Conservative Therapy

- Compression stockings should be worn daily while the patient is out of bed. *Unna boot* or *compression wrap* may be utilized in lieu of compression stockings when there is documentation of an open venous stasis ulcer of the leg to be treated. For additional treatment requests after initial treatment, there must have been 3 months of conservative therapy after the most recent varicose vein procedure which has not successfully treated the patient's symptoms.

- Treatment Sessions
  - Each treatment session should address as much abnormality as is appropriate and reasonable and may include more than one vein and/or modality.
  - Endovenous laser or radiofrequency ablation of the entire incompetent saphenous vein usually can be accomplished in a single treatment session. Although additional procedures, including ligation or sclerotherapy, performed in the same treatment session on the same ablated saphenous vein are considered included components of the ablation procedure, procedures on other saphenous venous systems may be distinct procedural services.

CROSS REFERENCES

1. Cosmetic and Reconstructive Surgery, Surgery, Policy No. 12

BACKGROUND

The venous system of the lower extremities consists of the superficial system (e.g., great and small saphenous veins and accessory or tributary veins that travel in parallel with the great and small saphenous veins) and the deep system (e.g., popliteal and femoral veins). These two parallel systems are interconnected via perforator veins and at the saphenofemoral and the saphenopopliteal junctions.

One-way valves are present within all veins to direct the return of blood up the lower limb. Larger varicose veins, many protruding above the surface of the skin, typically are related to valve incompetence. As the venous pressure in the deep system is generally greater than that of the superficial system, valve incompetence leads to increased hydrostatic pressure transmitted to the unsupported superficial vein system. Backflow (venous reflux) with pooling of blood ultimately results in varicosities. In addition, clusters of varicosities may appear related to incompetent perforating veins, such as Hunter and Dodd, located in the mid- and distal thigh, respectively and/or associated with incompetence at the saphenofemoral junction. In some instances, the valvular incompetence may be isolated to a perforator vein, such as the Boyd perforating vein located in the anteromedial calf. These varicosities are often not associated with saphenous vein incompetence since the perforating veins in the lower part of the leg do not communicate directly with the saphenous vein.

Although many varicose veins are asymptomatic, when present, symptoms include itching, burning, heaviness, fatigue, and pain. In addition, chronic venous insufficiency secondary to venous reflux can lead to peripheral edema, hemorrhage, thrombophlebitis, venous ulceration, and chronic skin changes. In an effort to improve the consistency in diagnosing chronic venous disorders, particularly for patient selection in clinical trials, an international consensus committee developed CEAP classification.[2] In this system, classification is based on clinical manifestations (C), etiology (E), anatomical distribution (A), and underlying pathophysiology (P). (See Appendix 1)

Note: The term "varicose veins" does not apply to the telangiectatic dermal veins, which may be described as "spider veins" or "broken blood vessels." While abnormal in appearance, these veins typically are not associated with any symptoms, such as pain or heaviness, and their treatment is considered cosmetic.

TREATMENT OF SUPERFICIAL VARICOSE VEINS

Conservative Therapy

Treatment of venous reflux/venous insufficiency is aimed at reducing abnormal pressure transmission from the deep to the superficial veins. Varicose veins can usually be treated with non-surgical measures. Symptoms often decrease when the legs are elevated periodically, when prolonged standing is avoided, and when elastic compression stockings are worn.

Operative Therapy

If conservative treatment measures fail, additional treatment options typically focus first on identifying and correcting the site of reflux, and second on redirecting venous flow through veins with intact valves. Thus, conventional surgical treatment of varicosities is based on the following three principles:

- Control of the most proximal point of reflux, typically at the saphenofemoral junction, as identified by preoperative Doppler ultrasonography. Surgical ligation and division of the saphenofemoral or saphenopopliteal junction is performed to treat the valvular incompetence.
- Removal or occlusion by ablation of the refluxing great and/or small saphenous vein from the circulation. The classic strategy for isolation is vein stripping in conjunction with vein ligation and division.
- Removal or occlusion of the refluxing varicose tributaries. Strategies for removal include phlebectomy (i.e., ligation/division/stripping, powered phlebectomy, or stab avulsion) or occlusion by injection sclerotherapy; either at the time of the initial treatment, or subsequently. Over the years various minimally invasive alternatives to ligation and stripping have been investigated, including sclerotherapy and thermal ablation using radiofrequency energy (high frequency radiowaves), laser energy, or cryoablation (also called cryotherapy).

Endovenous Ablation

The objective of endovenous ablation techniques is to cause injury to the vessel, causing retraction and subsequent fibrotic occlusion of the vein.

<u>Thermal Ablation</u>

Three endovenous thermal ablation techniques have been investigated as minimally invasive alternatives to vein ligation and stripping.

- Radiofrequency (RF) ablation is performed by means of a specially designed catheter inserted through a small incision in the distal medial thigh to within 1-2 cm of the saphenofemoral junction. High frequency radio waves (200-300 kHz) are delivered

through the catheter electrode and cause direct heating of the vessel wall, causing the vein to collapse. The catheter is slowly withdrawn, closing the vein.

- Laser ablation is performed similarly; a laser fiber is introduced into the saphenous vein under ultrasound guidance; the laser is activated and slowly removed along the course of the saphenous vein. Laser ablation may be referred to as endovenous laser ablation (EVLA) or endovenous laser treatment (EVLT).
- Cryoablation uses extreme cold to cause injury to the vessel. Technical developments since thermal ablation procedures were initially introduced include the use of perivenous tumescent anesthesia which allows treatment of veins larger than 12 mm in diameter and helps to protect adjacent tissue from thermal damage during treatment of the lesser saphenous vein.
- There are two technologies that are not available in the United States:
    - Microwave ablation is performed via endovenous catheter using microwave energy to heat the vessel walls.
    - Steam ablation is catheter-based endovenous thermal ablation that uses high pressure pulses of steam to heat the vein to 120°C.

Mechanochemical Ablation

Endovenous mechanochemical ablation (MOCA) utilizes both sclerotherapy and mechanical damage to the lumen. Following ultrasound imaging, a disposable catheter with a motor drive is inserted into the distal end of the target vein and advanced to the saphenofemoral junction. As the catheter is pulled back, a wire rotates at 3500 rpm within the lumen of the vein, abrading the lumen. At the same time, a liquid sclerosant (sodium tetradecyl sulphate) is infused near the rotating wire. It is proposed that mechanical ablation allows for better efficacy of the sclerosant, without the need for the tumescent anesthesia used in thermal ablation.

Cyanoacrylate Adhesive

Cyanoacrylate adhesive is a clear, free-flowing liquate that polymerizes in the vessel via an anionic mechanism (i.e. polymerizes into a solid material upon contact with body fluids or tissues). The adhesive is gradually injected along the length of the vein in conjunction with ultrasound and manual compression. The acute coaptation halts blood flow through the vein until the implanted adhesive becomes fibrotically encapsulated and establishes chronic occlusion of the treated vein. Cyanoacrylate glue has been used as a surgical adhesive and sealant for a variety of indications, including gastrointestinal bleeding, embolization of brain arteriovenous malformations, and to seal surgical incisions or other skin wounds.

Sclerotherapy

The objective of sclerotherapy is to destroy the endothelium of the target vessel by injecting an irritant solution (either a detergent, osmotic solution, or a chemical irritant), ultimately resulting in the complete obliteration of the vessel. The success of the treatment depends on accurate injection of the vessel, an adequate injectant volume and concentration of sclerosant, and post-procedure compression. Compression theoretically results in direct apposition of the treated vein walls to provide more effective fibrosis and may decrease the extent of the thrombosis formation.

Sclerotherapy is an accepted and effective treatment of telangiectatic vessels. Historically, larger veins and very tortuous veins were not considered to be good candidates for sclerotherapy. Technical improvements in sclerotherapy, including the routine use of Duplex ultrasound to target refluxing vessels, luminal compression of the vein with anesthetics, and foam sclerosant in place of liquid sclerosant, have improved its effectiveness in these veins. Other concerns have arisen with these expanded uses of sclerotherapy. For example, use of sclerotherapy in the treatment of varicose tributaries without prior ligation, with or without vein stripping creates issues regarding its effectiveness in the absence of the control of the point of reflux and isolation of the refluxing saphenous vein. Sclerotherapy of the great saphenous vein raises issues regarding appropriate volume and concentration of the sclerosant and the ability to provide adequate post-procedure compression. Moreover, the use of sclerotherapy, as opposed to the physical removal of the vein with stripping, raises the issue of recurrence due to recanalization.

High-intenstiy focused ultrasound

High-intensity focused ultrasound (HIFU) is a noninvasive treatment that delivers focused ultrasound energy through the skin to heat and close incompetent superficial veins associated with varicose veins. Unlike catheter-based ablation, HIFU is performed without inserting a device into the treated vein.

TREATMENT OF PERFORATOR VEINS

Perforator veins cross through the fascia and connect the deep and superficial venous systems. Incompetent perforating veins were originally addressed with an open surgical procedure, called the Linton procedure, which involved a long medial calf incision to expose all posterior, medial, and paramedial perforators. While this procedure was associated with healing of ulcers, it was largely abandoned due to a high incidence of wound complications. The Linton procedure was subsequently modified by using a series of perpendicular skin flaps instead of a longitudinal skin flap to provide access to incompetent perforator veins in the lower part of the leg. The modified Linton procedure may be occasionally utilized for the closure of incompetent perforator veins that cannot be reached by less invasive procedures. Subfascial endoscopic perforator surgery (SEPS) is a less-invasive surgical procedure for treatment of incompetent perforators and has been reported since the mid-1980s. Guided by Duplex ultrasound scanning, small incisions are made in the skin and the perforating veins are clipped or divided by endoscopic scissors. The operation can be performed as an outpatient procedure. Endovenous ablation of incompetent perforator veins with sclerotherapy and radiofrequency has also been reported.

OTHER

Deep vein valve repair or reconstruction and replacement are being investigated.

Venous “glue” or “superglue” is not cleared for use in the United States for this indication. This is an adhesive delivered via endovenous catheter as a method for sealing the vein.

REGULATORY STATUS

Devices that have received specific U.S. Food and Drug Administration (FDA) marketing clearance for the endovenous treatment of superficial vein reflux include:

- The VenClose® radiofrequency system received FDA approval in 2016 and is approved for endovascular coagulation for superficial vein reflux.

- The Alma 810 nm diode tabletop laser received FDA approval in 2016 and is indicated for endoluminal or endovenous laser surgery for incompetent saphenous veins.

- The VenaSeal™ (Medtronic) Closure System was FDA approved in 2015. The system includes a liquid adhesive, catheter, guidewire, dispenser gun and tips, and syringes. The clear liquid adhesive, cyanoacrylate adhesive, is injected into the diseased vein and polymerizes into a solid material to permanently seal the vein.

- The CERMAVEIN Steam Vein Sclerosis (SVS™) system is being studied outside of the United States but does **not** have FDA approval or clearance for marketing.

- The ClariVein® Infusion Catheter (Vascular Insights) received marketing clearance through the 510(k) process in 2008 (K071468). It is used for mechanochemical ablation. Predicate devices were listed as the Trellis® Infusion System (K013635) and the Slip-Cath® Infusion Catheter (K882796). The system includes an infusion catheter, motor drive, stopcock and syringe and is intended for the infusion of physician-specified agents in the peripheral vasculature.

- Polidocanol is an injectable sclerosing agent that may be used for intravenous treatment of varicose veins.

    - Varithena® (Biocompatibles, Inc, a BTG group company), formerly Varisolve®, is a polidocanol sclerosant microfoam made with a proprietary gas mix that is dispersed from a canister with a controlled density and more consistent bubble size. FDA approval in 2013 was for the treatment of incompetent great saphenous veins, accessory saphenous veins, and visible varicosities of the great saphenous vein system above and below the knee.

    - In 2010, Asclera® (Merz North America, Inc) is an injectable solution with FDA approval for the treatment of uncomplicated spider veins (varicose veins $\leq$ 1mm in diameter) and reticular veins (varicose veins 1-3 mm in diameter) in the lower extremities.

- A modified Erbe Erbokryo® cryosurgical unit (Erbe USA) received FDA clearance for marketing in 2005. A variety of clinical indications are listed, including cryostripping of varicose veins of the lower limbs.

- The Trivex system is a device for transilluminated powered phlebectomy that received FDA clearance through the 510(k) process in October 2003. According to the label, the intended use is for “ambulatory phlebectomy procedures for the resection and ablation of varicose veins.”

- In 2002, the Diomed 810 nm surgical laser and EVLT ™ (endovenous laser therapy) procedure kit received FDA clearance through the 510(k) process, "… for use in the endovascular coagulation of the greater saphenous vein of the thigh in patients with superficial vein reflux."

- In 1999, the VNUS® Closure™ system (a radiofrequency device) received FDA clearance through the 510(k) process for "endovascular coagulation of blood vessels in

patients with superficial vein reflux." The VNUS RFS and RFS*Flex* devices received FDA clearance in 2005 for “use in vessel and tissue coagulation including: treatment of incompetent (i.e., refluxing) perforator and tributary veins. The modified VNUS® ClosureFAST™ Intravascular Catheter received FDA clearance through the 510(k) process in 2008.

EVIDENCE SUMMARY

Outcomes of interest for venous interventions include symptom control, healing and recurrence, recanalization of the vein, and neovascularization. Recanalization is the restoration of the lumen of a vein after it has been occluded; this occurs more frequently following treatment with endovenous techniques. Neovascularization is the proliferation of new blood vessels in tissue, and occurs more frequently following vein stripping. Direct comparisons of durability for endovenous and surgical procedures are complicated by these different mechanisms of recurrence. Relevant safety outcomes include the incidence of paresthesia, thermal skin injury, thrombus formation, thrombophlebitis, wound infection, and transient neurologic effects.

VARICOSE VEIN TREATMENT

Systematic Reviews

Juhani (2024) published a systematic review and network meta-analysis of interventions for great saphenous vein insufficiency that included 75 studies with 12,196 patients.[3] The analysis found that endovenous laser ablation (EVLA) with high ligation and stripping, EVLA alone, cyanoacrylate adhesive injection, cryostripping, and radiofrequency ablation (RFA) demonstrated significantly better technical success rates within five years compared to ultrasound-guided foam sclerotherapy, while Conservative Hemodynamic Cure for Venous Insufficiency and Varicose Veins (CHIVA) showed the lowest recurrence rate (RR = 0.35, p = 0.79) compared to RFA, and endovenous steam ablation was most effective in reducing post-intervention pain (MD = -2.73, $p < 0.001$) compared to high ligation and stripping. Study limitations included heterogeneity in intervention techniques and follow-up periods across included studies.

Bontinis (2024) published a systematic review that evaluated interventions for recurrent varicose vein disease by analyzing 28 studies of 2,228 limbs.[4] Endovenous thermal ablation (EVTA) demonstrated superior efficacy with the lowest duplex ultrasonography-detected recurrence rate (4.27%) compared with ultrasound-guided foam sclerotherapy (UGFS) at 11.19% and surgery at 23.27%, with statistically significant differences between surgery and both minimally invasive options. Similarly, EVTA showed the lowest clinical recurrence rate (2.37%) versus surgery (31.08%), with significant differences between these approaches. While paresthesia and deep vein thrombosis rates were comparable across interventions, surgery had significantly higher wound infection rates (4.34%) compared with EVTA (0%), along with notable hematoma (5.04%) and lymphatic complication (5.71%) rates. The reviewers concluded that EVTA demonstrated superior efficacy to surgery and should be used as the preferred treatment for recurrent varicose vein disease when feasible.

Farah (2022) published a systematic review and meta-analysis of varicose vein treatments to inform the clinical practice guideline for the Management of Varicose Veins by the Society for Vascular Surgery, American Venous Forum, and American Vein and Lymphatic Society.[5] The review compared outcomes of surgical stripping to endovenous ablation, by any method,

across 30 randomized controlled trials (RCTs) of 5,610 patients and 16 comparative observational studies of 3,220 patients. At one year, high ligation and stripping was associated with lower anatomic closure rates than endovenous laser ablation (relative risk [RR], 0.90; 95% confidence interval [CI], 0.83 to 0.97; I^2=0.00%; 2 studies). No statistically significant differences in quality of life were identified when high ligation and stripping was compared to radiofrequency ablation (standard mean difference [SMD]=0.19; 95% CI, -0.62 to 1; I^2=93.7%; 3 studies). After five years, high ligation and stripping was associated with a higher anatomic closure rate than ultrasound guided foam sclerotherapy (RR, 1.52; 95% CI, 1.09 to 2.13; 1 study); no statistically significant association was found when high ligation and stripping was compared to endovenous laser ablation (RR, 1.03; 95% CI, 0.86 to 1.25; 1 study). Disease-specific quality of life was better five years after treatment with high ligation and stripping than ultrasound guided foam sclerotherapy (-2.60; 95% CI, -3.99 to -1.22; p<0.001). There was no statistically significant difference in the generic quality of life score between high ligation and stripping and endovenous laser ablation (SMD, 0.04; 95% CI, -0.14 to 0.22; I^2=40.6%; 3 studies).

High ligation and stripping was significantly associated with increased risk of recurrent incompetence compared to radiofrequency ablation, while ultrasound guided foam sclerotherapy was associated with a higher risk compared to surgery (RR, 7.84; 95% CI, 1.81 to 34.01; I^2=0.00%; 3 studies) and (RR, 0.62; 95% CI, 0.41 to 0.94; I^2=19.60%; 2 studies), respectively. No statistically significant association was found for recurrent incompetence when high ligation and stripping was compared with endovenous laser ablation (RR, 1.20; 95% CI, 0.26 to 5.47; I^2=78.2%; 4 studies). At five years, compared with radiofrequency ablation, high ligation and stripping was significantly associated with recurrent varicosity (RR, 2.00; 95% CI, 1.22 to 3.27; 1 study). No statistically significant differences were found when high ligation and stripping was compared to endovenous laser ablation and ultrasound guided foam sclerotherapy (RR, 0.83; 95% CI, 0.58 to 1.18; I^2=83.6%; 3 studies) and (RR, 1.06; 95% CI, 0.74 to 1.54; I^2=65.60%; 2 studies), respectively.

Kheirelseid (2017) published a systematic review (SR) of nine RCTs that evaluated long-term outcomes (five years or more) of endovenous laser therapy, radiofrequency ablation, or ultrasound guided foam sclerotherapy for great saphenous vein-related varicose veins.[6] No difference in recurrence rate was seen for endovenous laser therapy or radiofrequency ablation versus conventional surgery. The authors concluded this study was too small to make a definitive determination on long-term effectiveness for varied varicose vein procedures.

Hamann (2017) published a SR of RCTs evaluating the long-term (greater than or equal to five years) impact on health outcomes for different types of treatment for the great saphenous vein, including ligation and stripping, endovenous thermal ablation and ultrasound guided foam sclerotherapy, for great saphenous vein incompetence.[7] Three RCTs and 10 follow-up reports on RCTs were included, of which one could not be included in the meta-analysis. At five years, endovenous thermal ablation and ligation stripping were more successful than ultrasound guided foam sclerotherapy. The reoccurrence of reflux was lower for ligation and stripping, than for endovenous thermal ablation and ultrasound guided foam sclerotherapy. Venous clinical severity scores were similar for ligation and stripping and endovenous thermal ablation. The authors stated the included studies had methodological limitations including unknown or high risk of bias and that more long-term RCTs are needed to compare success rates and clinical outcomes.

Vemulapalli (2017) published a SR that evaluated treatments for lower extremity varicose veins and/or venous insufficiency, reflux, or incompetence.[8] Included in the review were 53 RCTs (10,034 patients), which were poor to good quality and four additional studies. Various therapy comparisons could not be made because of heterogeneity in therapies, populations and outcomes. Long-term symptom scores were no different between high ligation/stripping and endovascular laser ablation. There were no short-term bleeding differences between high ligation/stripping and radiofrequency ablation. The authors stated there is lack of high quality evidence on the safety and effectiveness of treatments for chronic lower extremity venous disease. Additional studies must compare effectiveness and provide practice parameters.

Boersma (2016) published results from a SR and meta-analysis that compared the anatomical success rates and complication rates of six treatment modalities for small saphenous vein incompetence: surgery (n=9), endovenous laser ablation (EVLA) (n=28), radiofrequency ablation (RFA) (n=9), UGFS (n=6), and mechanochemical endovenous ablation (MOCA) (n=1).[9] Although the review included 49 articles (five RCTs and 44 cohort studies), nine were specific to RFA and were cohort studies. The pooled anatomical success rate for RFA in 386 incompetent small saphenous veins was 97.1% (95% CI 94.3% to 99.9%). RFA had a relatively low neurological complication rate (mean 9.7%) when compared to the overall neurological complication rate (mean 19.6%). The pooled anatomical success rate for UGFS in 494 incompetent small saphenous veins was 63.6% (95% CI 47.1% to 80.1%); however, more research is needed to determine these effects. The 28 articles specific to EVLA included both RCT's and cohort studies. The pooled anatomical success rate for EVLA in 2,950 incompetent small saphenous veins was 98.5% (95% CI 97.7% to 99.2%). EVLA had a low neurological complication rate (mean 4.8%) when compared to the overall neurological complication rate (mean 19.6%). There was one study on mechanochemical ablation (MOCA) and although the authors reported an anatomical success rate of 94%, more research is needed to determine these effects. The authors concluded that EVLA/RFA should be a preferred treatment over surgery and foam sclerotherapy in small saphenous vein incompetence. An updated Cochrane review from 2014 compared RFA, EVLA, and foam sclerotherapy versus ligation/stripping for saphenous vein varices.[10] Included in the review were 13 randomized studies with a combined total of 3,081 patients. The overall quality of the evidence was moderate. For EVLA versus surgery, there were no significant differences between the treatment groups for clinician noted or symptomatic recurrence, or for recanalization. Neovascularization and technical failure were reduced in the laser group (OR=0.05, $p<0.001$; and OR=0.29, $p<0.001$, respectively). For RFA versus surgery, there were no significant differences between the groups in clinician noted recurrence, recanalization, neovascularization, or technical failure. The authors concluded that sclerotherapy, EVLA, and RFA were at least as effective as surgery in the treatment of long saphenous vein varicose veins.

In 2012, a SR of RCTs and meta-analysis was published that compared the clinical outcomes of EVLA, RFA, UGFS, and surgery.[11] The review included 28 RCTs and reported no significant difference in primary failure and clinical recurrence with EVLA and RFA compared with surgery. The advantages of the endovenous ablation techniques over surgery were a lower rate of wound infections and hematoma, and a shorter recovery period.

RANDOMIZED CONTROL TRIALS

Lawaetz (2017) published a five-year follow-up on an RCT in which 500 patients (580 legs) received either endovenous radiofrequency ablation, endovenous laser ablation, ultrasound guided foam sclerotherapy or high ligation and stripping for great saphenous vein reflux.[12]

Recanalization occurred more often after ultrasound guided foam sclerotherapy, but there was no difference in technical efficacy between the procedures. There was a higher unknown reason for reoccurrence after endovenous laser ablation and high ligation and stripping.

van der Velden (2015) published results from a five-year follow-up comparing conventional surgery, endovenous laser ablation, and ultrasound-guided foam sclerotherapy in patients with great saphenous varicose veins.[13] A total of 224 legs were included (69 conventional surgery, 78 EVLA, and 77 UGFS), and 193 were evaluated at final follow up (86.2%). At the five-year follow-up, the Kaplan-Meier analysis showed obliteration or absence of the great saphenous vein in 85% of patients who underwent conventional surgery and 77% of patients who underwent EVLA (not significantly different). Grade I neovascularization was higher in the conventional surgery group (27% vs 3%, p<0.001), while grade II neovascularization was similar in the two groups (17% vs 13%).

Brittenden (2014) reported a multicenter randomized trial that compared foam sclerotherapy, EVLA, and surgical treatment in 798 patients.[14] The study was funded by U.K.'s Health Technology Assessment Programme of the National Institute for Health Research.[15] Veins greater than 15 mm were excluded from the study. At the six-week follow-up visit, patients who were assigned to treatment with foam or laser had the option of treatment with foam for any residual varicosities; this was performed in 38% of patients in the foam group and 31% of patients in the EVLA group. Six months after treatment, mean disease-specific quality of life was slightly worse after sclerotherapy than after surgery (p=0.006), and there were more residual varicose veins, although the differences were small. Disease-specific quality of life was similar for the laser and surgery groups. The frequency of procedural complications was similar for the foam sclerotherapy (6%) and surgery (7%) groups, but was lower in the laser group (1%). The rate of complications at 6 months (primarily lumpiness and skin staining), was highest for the sclerotherapy group.

Five-year follow-up data from the Brittenden trial was published in 2019 on disease-specific and generic quality of life.[16] Disease-specific quality of life after five years was significantly better for those who received laser ablation or surgery compared to foam sclerotherapy.

Biemans (2013) published results from the MAGNA trial, which randomized 223 consecutive patients (240 legs) with long saphenous vein reflux to EVLA, ligation and stripping, or physician compounded foam sclerotherapy (1 ml aethoxysclerol 3#: 3ml air).[17] At one-year follow-up, the anatomic success rates were similar between EVLA and stripping (88.5% and 88.2%, respectively), which were superior to foam sclerotherapy (72.2%). Ten percent of the stripping group showed neovascularization. Health-related quality of life improved in all groups. The CEAP classification improved in all groups with no significant difference between the groups. Transient adverse events were reported in 11 patients after stripping, seven after EVLA, and five after sclerotherapy.

ENDOVENOUS ABLATION

Endovenous ablation of varicose veins has been proposed as an alternative to ligation and/or stripping. Outcomes of interest include short- and long-term functional improvement and recurrence rates related either to recanalization of the saphenous vein or neovascularization. In terms of safety, relevant outcomes include the incidence of paresthesias, thermal skin or nerve injuries, thrombus formation, thrombophlebitis, and wound infection.

Vein Diameter

There is currently no standardized range for saphenous vein diameter most likely to be associated with severe symptoms or for which endovenous ablation is recommended. In studies of the correlation between great saphenous vein diameter and the presence or absence of reflux, the best cutoff measurement to predict reflux varied between studies from 5.05 mm to 7.3 mm.[18-21] Sensitivity and specificity ranged from 76% to 87% and 60% to 87%, respectively. It is important to note that there is heterogeneity among the populations included in the studies. In addition, there was heterogeneity between studies in measurement techniques (e.g., location, position).

Endovenous Laser and Radiofrequency Ablation

Systematic Reviews

Lim (2025) published a systematic review and meta-analysis of endovenous ablation and surgical stripping for varicose vein management that included 13 studies.[22] The analysis demonstrated that Endovenous Laser Ablation (EVLA) and Radiofrequency Ablation (RFA) achieved high occlusion rates (94.9% and 94.4%, respectively) comparable to surgical stripping (92.0%), while non-thermal methods had slightly lower occlusion rates (88.7%) but reduced early postoperative pain (Mechanochemical Ablation [MOCA]: 1.2/10 vs. EVLA: 3.8/10), with five-year recurrence rates of 38.6% for EVLA, 18.7% for RFA, and 34.6% for surgery. Quality of life improved across all treatments with Aberdeen Varicose Vein Questionnaire (AVVQ) scores decreasing by 7.8 points and Venous Clinical Severity Score (VCSS) decreasing by 3.5 points, while adverse events were higher for thermal ablation (6.8%) and surgical stripping (8.0%) compared to non-thermal methods (< 2.5%). Study limitations included limited long-term data for non-thermal methods and variability in outcome reporting across included studies.

Kalaij (2025) published a meta-analysis comparing endovenous microwave ablation (EMA) to endovenous laser ablation (EVLA) for treating varicose veins (VVs) in chronic great saphenous vein (GSV) insufficiency, including two randomized controlled trials (RCTs) and one cohort study.[23] EMA demonstrated significantly shorter operation duration compared to EVLA (mean difference: -6.62, 95% confidence interval (CI): -11.91 to -1.32, p = 0.01), though heterogeneity was high. Both techniques showed similar efficacy profiles including Aberdeen quality of life scores, visual analog scale scores, length of hospital stays, and six-month recanalization rates. Regarding safety, EMA had significantly lower incidence of ecchymosis compared to EVLA (odds ratio: 0.58), while other safety profiles were similar between groups. Study limitations included the small number of included studies (n = 3) and the need for longer follow-up periods beyond 12 months with standardized methodologies.

Cai (2023) published a Cochrane systematic review of superficial endovenous ablation for venous leg ulcers.[24] The review included two RCTs which compared endovenous ablative techniques with compression versus compression therapy alone for the treatment of venous leg ulcers in 506 participants. The authors identified high certainty evidence that combined endovenous ablation and compression compared with compression therapy alone, or compression with deferred endovenous treatment, improves time to complete ulcer healing (pooled hazard ratio 1.41, 95% CI 1.36 to 1.47; I^2=0%; 2 studies, 466 participants). There is moderate-certainty evidence that the proportion of ulcers healed at 90 days is probably higher with combined endovenous ablation and compression compared with compression therapy alone or compression with deferred endovenous treatment (risk ratio 1.14, 95% CI 1.00 to 1.30; I^2=0%; 2 studies, 466 participants). There is low-certainty evidence showing an unclear

effect on ulcer recurrence at one year in people with healed ulcers with combined endovenous treatment and compression when compared with compression alone or compression with deferred endovenous treatment (risk ratio 0.29, 95% CI 0.03 to 2.48; I^2 = 78%; 2 studies, 460 participants). The review authors concluded that endovenous ablation of superficial venous incompetence, combined with compression, improves leg ulcer healing compared to compression alone. Further research is needed to explore additional benefits of endovenous ablation in treating ulcers of greater than six months duration and the optimal modality of endovenous ablation.

He (2017) conducted a SR which evaluated the effectiveness and safety of endovenous laser ablation compared to radiofrequency ablation for the treatment of varicose veins.[25] The SR included a total of 12 studies (n=1,577) (10 RCTs and two nonrandomized studies).The meta-analysis of the combined studies concluded that there were no significant differences in effectiveness and safety outcomes between the two groups.

Woźniak (2016) also evaluated laser ablation compared to radiofrequency ablation.[26] The study included 510 adults with five year follow-up and reported similar conclusions to He (2017) summarized above. A SR of EVLA versus surgery was published in 2009.[27] Fifty-nine studies were included, with seven studies that directly compared EVLA and surgery. Randomized and nonrandomized studies directly comparing outcomes for EVLA or surgery were included for the assessment of safety or effectiveness, while case series with a minimum patient population of 100 were included for the assessment of safety alone. For all studies, it was calculated that 5,759 patients (6,702 limbs) were treated with EVLA and 6,395 patients (7,727 limbs) underwent surgery. Few differences were apparent between treatments with respect to clinical effectiveness outcomes, although long-term follow-up was lacking. Nonclinical effectiveness outcomes generally favored EVLA over surgery in the first two months after treatment. The authors concluded that while EVLA offers short-term benefits and appears to be as clinically effective as surgery up to 12 months after treatment, clinical trials with a minimum of three years of follow-up are required to establish the enduring effectiveness of EVLA.

A number of SRs of RCTs comparing various types of ablation to surgical treatment have been published. These reviews consistently reported moderate quality of evidence. Most of the reviews compared EVLA, RFA, and surgical treatment of varicose veins. Overall, these techniques had similar, statistically significant improvement in function and in pain relief compared to preoperative scores. RFA and EVLA had low rates of technical procedure failure rates, and short-term recannulization rates. Adverse effects were generally minor for all techniques. Though intraoperative pain was not reported, EVLA consistently resulted in significantly greater pain and bruising when compared to RFA for one to two weeks following the procedure. RFA had significantly more occurrences of superficial phlebitis. Recanalization was similar for EVLA and RFA at one-year follow-up.

The primary limitation of the current evidence is the lack of long-term data on recanalization rates for ablation techniques and neovascularization rates for ligation and stripping. In addition, many of the available studies used first-generation technology and, therefore, do not provide data on newer devices. For example, newer laser technology may result in decreased pain during and after the procedure. Newer RFA technology (e.g., ClosureFast RF catheter) may result in higher rates of vein occlusion.

Randomized Controlled Trials

The ongoing, and largest randomized study on EVLA, comparing endovenous laser ablation with costectomy and stripping of the great saphenous vein (RELACS), schedule to follow patients for five years, randomized 400 patients to EVLA performed by a surgeon at one site or to ligation and stripping performed by a different surgeon at a second location.[28] Fifty-four patients withdrew from the study after receiving the randomization result (from an independent site), due primarily to preference for the other treatment. At the two-year follow-up there was no significant difference between the groups for clinically recurrent varicose veins, medical condition on the Homburg Varicose Vein Severity Score, or disease-related quality of life. Saphenofemoral reflux was detected by ultrasonography more frequently after EVLA (17.8% vs 1.3%). At five-year follow-up, Kaplan-Meier analysis showed obliteration or absence of the great saphenous vein in 85% of patients who underwent conventional surgery and 77% of patients who underwent EVLA (not significantly different).15 Grade I neovascularization was higher in the conventional surgery group (27% vs 3%, p<0.001), while grade II neovascularization was similar in the 2 groups (17% vs 13%).

Rasmussen (2012) reported the five-year follow-up data comparing EVLA (n=121) with ligation and stripping (n=68).[29] Data was available on 98% of the patients. There was no significant difference between the two groups for clinical recurrence (EVLA 36%, stripping 35%) or in the percentage of reoperations (EVLA 38.6%, stripping 37.7%).

Literature on isolated treatment of the anterior accessory saphenous vein is limited. In a 2009 study, outcomes from a cohort of 33 patients who underwent EVLA of the anterior accessory saphenous vein were compared with 33 matched controls undergoing EVLA of the greater saphenous vein.[30] In 21 of the patients (64%) in the accessory saphenous vein group there had been no previous treatment of the greater saphenous vein. At 12-month follow-up there was no evidence of reflux in these patients, and the treated accessory saphenous vein was not visible with ultrasound. The Aberdeen Varicose Vein Symptom Severity Score had improved in both groups, with no significant difference between the two groups. Patient satisfaction scores were also similar.

Nonrandomized Trials

Geng (2025) published a retrospective cohort study comparing ultrasound-guided radiofrequency ablation (RFA) combined with tributary phlebectomy and foam sclerotherapy versus high ligation and stripping (HLS) combined with tributary phlebectomy for varicose veins in 2,740 patients (mean age 59.01 ± 12.03 years, 1,588 women) treated between October 2020 and October 2023, with 1,756 patients (64.1%) undergoing RFA and 984 patients (35.9%) undergoing HLS.[31] At 12 months, the RFA group had 7 recanalizations (0.40%) versus 0 in the HLS group (p = 0.112), symptomatic recurrence was 0.17% versus 0.20% (p = 1.000), reintervention rate was 2.62% versus 3.05% (p = 0.064), and each group had 2 cases of deep vein thrombosis. Minor complications in the HLS group included significantly higher rates of bruising (25.20% versus 20.16%, p = 0.002), pain (25.41% versus 20.39%, p = 0.002), and numbness (10.98% versus 3.30%, p < 0.001), while the RFA group had higher rates of induration (17.20% versus 3.25%, p < 0.001) and pigmentation (2.62% versus 0.81%, p = 0.001). Both groups showed significant improvements in Aberdeen Varicose Vein Questionnaire (AVVQ), Venous Clinical Severity Score (VCSS), and Chronic Venous Insufficiency Quality of Life Questionnaire (CIVIQ-14) scores (p < 0.05), with the RFA group demonstrating greater early improvement at 1 month.

Several case series have reported on endoluminal radiofrequency ablation.[32-35] The largest was reported by Merchant and colleagues, who analyzed the four-year data collected in the ongoing Closure Study Group registry focusing on the treatment of reflux of the long saphenous vein.[32] Data were available on 890 patients and 1,078 limbs treated at 32 centers. Clinical and duplex ultrasound follow-up was performed at one-week, six-months, and yearly for four-years. The vein occlusion rates were 91% at one week and 88.8% at four-years, although only 98 limbs had been followed up to the four-year mark. These results suggest that radiofrequency ablation results in durable occlusion. Radiofrequency ablation has typically been limited to vessels less than 12 mm in diameter. The rationale behind this patient selection criterion is that the electrodes must remain in direct contact with the vein wall during treatment and the largest diameter of the deployed radiofrequency electrodes is 12 mm. The authors noted that exsanguinations, perivenous tumescent infiltration, and external compression may promote electrode and vessel wall contact such that larger veins can be treated. However, in this large case series, there were only 58 limbs with vein sizes larger than 12 mm, and only 29 available for follow-up at six-months or one-year. While the occlusion rate was similar to that seen in smaller vessels, long-term data are inadequate to determine if this effect is durable.

Merchant and Pichot (2005) also reported the 5-year Closure Study Group registry data.[36] There were 1222 limbs in 1006 patients treated at 34 centers with radiofrequency ablation of various levels of the long saphenous vein, the short saphenous vein, and the accessory saphenous vein. At five-year follow-up using duplex ultrasound examination, 185 limbs were considered failures due to nonocclusion (12.4%), recanalization of a previously occluded vein (69.7%), or groin reflux of a vein with occluded trunk (17.8%). In the latter group, the groin reflux often involved an accessory vein. Logistic regression analysis of risk factors of gender, age, body mass index [BMI], vein diameter, and catheter pullback speed showed that each unit increase in BMI over 25 was associated with increasing risk of long-term failure. In addition, a catheter pull-back speed over the standard speed of 3 cm/min was associated with failure to occlude or recanalization. The authors pointed out that this anatomical failure did not necessarily result in clinical failure; most patients experienced initial symptom relief that was maintained over 5 years.

Many other clinical trials on laser ablation of varicose veins are case series[37-41] and registry data[36]. Using historical controls for comparison is difficult since treatment outcomes are variably reported. There are no consistent definitions of success versus failure, either based on patient or clinical assessment. In general, recurrence rates after ligation and stripping are estimated at around 20%. Doppler or Duplex ultrasound are perhaps the most objective form of assessment of recurrence, but many of the reports of the long-term outcomes of ligation and stripping did not use ultrasound studies for postoperative assessment. Only two studies have reported objective results of ligation and stripping at 12 and 24 months. Jones and colleagues reported on the results of a study that randomized 100 patients with varicose veins to undergo either ligation alone or ligation in conjunction with stripping.[42] The results of the ligation and stripping group are relevant to this discussion. At one year, reflux was detected in 9% of patients, rising to 26% at two years. Rutgers and Kitslaar reported on the results of a trial that randomized 181 limbs to undergo either ligation and stripping or ligation combined with sclerotherapy.[43] At two years, Doppler ultrasound demonstrated reflux in approximately 10% of patients, increasing to 15% at three years. Therefore, based on this crude assessment, the reflux rate of 13% for radiofrequency ablation at one year[44] and 6% for laser ablation at two years[37] is roughly comparable to the reflux rate of 9-10% reported by Jones et al and Rutgers and Kitslaar.

Cryoablation

Disselhoff (2008, 2011) reported two and five-year outcomes from a randomized trial that compared cryostripping with EVLA.[45, 46] One hundred and twenty patients were included with symptomatic uncomplicated varicose veins (CEAP C2) with saphenofemoral incompetence and greater saphenous vein reflux. At 10 days after treatment, EVLA had better results than cryostripping with respect to pain score over the first 10 days (2.9 vs. 4.4), resumption of normal activity (75% vs. 45%) and induration (15% vs. 52%). At the two-year follow-up, freedom from recurrent incompetence was observed in 77% of patients after EVLA and 66% of patients after cryostripping (not significantly different). At five years, 36.7% of patients were lost to follow-up; freedom from incompetence and neovascularization was found in 62% of patients treated with EVLA and 51% of patients treated with cryostripping (not significantly different). Neovascularization was more common after cryostripping, but incompetent tributaries were more common after EVLA. There was no significant difference between groups in the Venous Clinical Severity Score or Aberdeen Varicose Vein Severity Score at either two or five years.

Klem (2009) published results from a randomized trial that found endovenous cryoablation (n=249) to be inferior to conventional stripping (n=245) for treating patients with symptomatic varicose veins.[47] The percentage of patients with greater saphenous vein remaining was 44% in the endovenous cryoablation group and 15% in the conventional stripping group. The Aberdeen Varicose Vein Questionnaire also showed better results for conventional stripping (score of 11.7) in comparison with cryoablation (score of 8.0). There were no differences between the groups in SF-36 subscores, and neural damage was the same (12%) in both groups.

Cyanoacrylate Ablation

Systematic Reviews

Wen (2026) published a systematic review and meta-analysis comparing cyanoacrylate ablation (CA) to endovenous radiofrequency ablation (RFA) for chronic great saphenous vein (GSV) insufficiency, including 21 studies with 7,844 patients and 9,677 limbs.[48] There were no significant differences between CA and RFA in GSV occlusion rate or venous clinical severity score (VCSS). Pooled data showed that CA was associated with a lower incidence of ecchymosis (5.96% vs. 10.97%; P = 0.01) and paresthesia (1.24% vs. 2.97%; P = 0.04). No significant differences were observed between the two groups in the incidence of phlebitis, DVT, or pigmentation. The procedure time was significantly shorter in the CA group than in the RFA group (P < 0.001), however, these results are limited by significant heterogeneity in the pooled outcomes. Other limitations include a high proportion of retrospective cohort studies and inconsistent outcome reporting across studies. Amshar (2022) published a systematic review comparing cyanoacrylate embolization (CAE) and laser ablation (EVLA) in the treatment of saphenous vein insufficiency which included 1,432 ablation procedures.[49] Venous closure rates and VCSS did not differ significantly between CAE group and EVLA group. Pooled data showed that CAE group was associated with less periprocedural pain score (p<0.001), lower skin pigmentation rates (0.60% vs. 4.46%; p=0.008), and lower nerve damage rates (0% vs. 3.94%; p=0.007). Rates of phlebitis, deep vein thrombosis, and ecchymosis did not differ significantly between the groups. In addition, intervention time was significantly faster in CAE group compared to EVLA group. The authors concluded that CAE has similar efficacy compared to EVLA.

Garcia-Carpintero (2020) published a systematic review of endovenous cyanoacrylate adhesive treatment compared to radiofrequency ablation or endovenous laser ablation in 1,057 participants.[50] The authors concluded that all three treatment types reduced disease severity and there was no significant difference across the three treatment options. There were fewer adverse events with participants who received cyanoacrylate adhesive treatment compared to the other ablation techniques.

Randomized Controlled Trials

Alhewy (2024) published an RCT that compared VenaSeal cyanoacrylate closure with RFA in 248 patients with venous reflux, with follow-up extending to two years post-procedure.[51] The primary outcome was complete closure of the target GSV at three-month follow-up, but results for this outcome were not reported by the authors. At the one-month follow-up, all veins treated with cyanoacrylate closure remained occluded, while 154 out of 158 (97%) veins treated with RFA remained occluded. At 24 months, 122 out of 128 (95%) veins treated with cyanoacrylate closure and 146 out of 158 (93%) veins treated with RFA remained occluded. At month 24, there were six recanalizations in the cyanoacrylate group and 12 in the RFA group, with recanalization-free survival in the cyanoacrylate group found to be non-inferior to that of the RFA group (95.3% vs. 92.4%, respectively; $p<0.0001$ for 10% noninferiority). The cyanoacrylate group experienced fewer complications, with only two cases of paresthesia and 18 cases of bruises reported, whereas the RFA group encountered 18 cases of bruises, two cases of skin burns, and two cases of access site hematoma. Periprocedural outcomes showed a potentially shorter intervention time with cyanoacrylate closure versus RFA.

Nonrandomized Trials

Imai (2025) conducted a multicenter, prospective registry study in Japan to evaluate the efficacy and safety of VenaSeal CAC for treating incompetent great and small saphenous veins.[52] The study included 125 patients, and results showed a 92.6% overall vein closure rate at 1 year, with significant improvement in venous clinical severity scores and quality-of-life measures, though no significant change in EuroQol scores. Postoperative complications were observed in 20 patients, including hypersensitivity-type phlebitis in 7 patients and superficial venous thrombosis in 5 patients.

Morrison (2017) published a report on the 12-month outcomes of the VeClose trial that compared endovenous cyanoacrylate closure to radiofrequency ablation for great saphenous vein incompetence.[53] Ninety-five patients who underwent endovenous cyanoacrylate closure and ninety-seven patients who underwent radiofrequency ablation presented at the one-year follow-up evaluation. The authors concluded that although endovenous cyanoacrylate closure showed faster closer rates and fewer reopening episodes, quality of life was the same for both procedures. The study was not blinded, but may not have been possible because of the differences in the way the procedures are performed.

Morrison (2018) published 36 month follow-up data to the VeClose trial with follow-up on 146 (66%) patients (72 from CAC and 74 from RFA)[54]. Loss to follow-up was similar in the two groups. The complete closure rates for CAC and RFA were 94.4% and 91.9% ($p=0.005$ for non-inferiority), respectively. Recanalization-free survival through 36 months was not statistically different for the two groups. No significant device- or procedure-related adverse events were reported for either group.

Morrison (2020) reported five year outcomes from the VeClose trial. 89 patients of the 220 patients enrolled in the original study completed the 60-month follow-up.[55] At five years, Kaplan-Meier estimates for freedom from recanalization in the randomized CAC and RFA groups were 91.4% and 85.2%. Noninferiority of CAC compared with RFA was demonstrated. Sustained improvements in EQ-5D and quality of life measures through 60 months were demonstrated in both groups. Whereas patients assigned to C0 or C1 clinical class were excluded from the original study, more than half of all returning patients (64% [57/89]) were now assigned to C0 or C1, suggesting an improved clinical class from baseline. 41.1% of returning CAC patients and 39.4% of returning RFA patients were shown to be at least two CEAP classes lower than their baseline class. No adverse events were reported in either group between 36- and 60-month follow-up.

Yasmin (2017) published a retrospective review on results of VariClose (n-butyl cyanoacrylate) treatment for varicose veins.[56] One hundred and eighty patients with great saphenous vein diameter greater than 5.5mm and small saphenous vein diameter greater than 4mm and reflux greater than 5 seconds were treated and followed up at between three and seven months. No recanalization was observed and the venous clinical severity scores dropped to an average of 3.9 three months after the procedure versus 10.2 before. No long-term results were reported.

Bozkurt (2016) conducted a one year prospective comparative study (n=310) evaluating cyanoacrylate glue compared to endovenous laser ablation for venous insufficiency.[57] The authors concluded that periprocedural pain, ecchymosis, permanent paresthesia were less in the cyanoacrylate ablation group. There were no significant differences in closure rates at 12 months follow-up. In addition, there were no significant differences in severity scores nor the Aberdeen Varicose Vein Questionnaire. Additional studies are needed to evaluate the effectiveness and safety of this technique.

Mechanochemical Ablation

Systematic Review

Bontinis (2023) published a systematic review and meta-analysis that compared the safety and efficacy of thermal versus mechanochemical endovenous ablation (MOCA).[58] The review included 14 studies of 4,177 patients with a mean follow-up time of 25.7 months. Radiofrequency ablation (odds ratio [OR], 3.99; 95% CI, 1.82 to 10.53), cyanoacrylate ablation (OR, 3.09; 95% CI, 1.35 to 8.37), and endovenous laser ablation (OR, 2.72; 95% CI, 1.23 to 7.38) displayed increased odds for great saphenous vein closure compared to MOCA. Endovenous laser ablation resulted in an increased risk of postoperative paresthesia compared to MOCA (risk ratio [RR], 9.61; 95% CI, 2.32 to 62.29), cyanoacrylate ablation (RR, 7.90; 95% CI, 2.44 to 38.16), and radiofrequency ablation (RR, 6.96; 95% CI, 2.31 to 28.04). Regarding venous clinical severity score improvement, MOCA was inferior to radiofrequency ablation (mean difference, 0.96; 95% CI, 0.71 to 1.20), endovenous laser ablation (mean difference, 0.94; 95% CI, 0.61 to 1.24) and cyanoacrylate ablation (mean difference, 0.89; 95% CI, 0.65 to 1.15). No significant differences were identified in Aberdeen varicose vein questionnaire scores, thrombophlebitis, or ecchymosis.

Lim (2023) published a systematic review with meta-analysis of MOCA of superficial venous incompetence compared to endothermal ablation.[59] The meta-analysis included four RCTs of 654 patients. At one year, the anatomical occlusion rate was lower after MOCA than endovenous thermal ablation (RR 0.85, 95% CI, 0.78 to 0.91; p<0.001). No significant

differences were detected in procedural pain (mean difference -3.25, -14.25 to 7.74; p=0.560) or postprocedural pain (mean difference -0.63, -2.15 to 0.89; p=0.420).

Witte (2017) published a SR of 13 studies evaluating the anatomic, technical, and clinical success of MOCA using ClariVein® for the great and small saphenous veins.[60] Studies were of "moderate to good quality". Two and three year pooled anatomic outcomes for the great saphenous vein and small saphenous vein reported were 91% and 87% respectively. The authors stated MOCA using the ClariVein® and liquid sclerosant is associated with an anatomic success rate of 87%-92% and the risk of complications is low, but no RCTs were available to compare MOCA to endothermal ablation.

Vos (2017) published a SR of 15 prospective studies evaluating the anatomic and technical success of MOCA and cyanoacrylate vein ablation (CAVA) for great saphenous vein incompetence.[61] MOCA and CAVA pooled anatomic success were 94.8% and 94.1% at six months and 94.1% and 89% at one year. The authors stated additional RCTs of high quality comparing MOCA and CAVA to conventional procedures are needed. These will assist in establishing clinical outcomes and practice parameters.

Randomized Controlled Trials

Lim (2025) published a randomized clinical trial comparing five-year outcomes of endovenous laser ablation (EVLA) versus mechanochemical ablation (MOCA) for superficial venous incompetence that included 150 patients with 109 completing five-year follow-up.[62] The study found that anatomical occlusion following EVLA was significantly higher than MOCA (91% vs. 47%, $p < 0.001$) with an absolute risk reduction of 45% (95% CI 29-60%), and the rate of re-intervention was significantly lower following EVLA (8% vs. 21%, $p = 0.031$), though there were no significant differences in Venous Clinical Severity Score (EVLA 1 vs. MOCA 2, $p = 0.33$) or Aberdeen Varicose Vein Questionnaire scores (EVLA 3.06 vs. MOCA 3.63, $p = 0.86$) between groups. Study limitations included 27% loss to follow-up at five years and the single-center design.

Belramman (2022) published a comparison of pain outcomes between mechanochemical ablation and cyanoacrylate adhesive in the treatment of varicose veins.[63] A total of 167 patients were randomized to treatment groups and the primary outcome measure was pain score immediately after ablation. There were no differences between groups in improvement in clinical severity, generic and disease-specific QoL scores, and complete occlusion rates as both groups demonstrated significant, but comparable improvement.

Mohamed (2020) published results of a trial comparing endovenous laser ablation and mechanochemical ablation using ClariVein in the management of superficial venous insufficiency.[64] Patients (n=150) were randomized to MOCA with 1.5% sodium tetradecyl sulfate or to EVLA. Occlusion rates were lower in the MOCA group 77% compared to the EVLA group (91%) with no significant difference between the two treatments in intraprocedural pain scores. Clinical severity and quality of life scores were not significantly different between the groups at one year follow-up. Additional follow-up is continuing to evaluate durability of the treatments.

Holewijn (2019) published a non-inferioty trial examining three percent policocanol in the Mechanochemical endovenous Ablation to RADiOfrequeNcy Ablation (MARADONA).[65] The trial included 213 patients who were randomized before reimbursement for the procedure was suspended. Pain scores in the 14 days after the procedure were slightly lower, but

hyperpigmentation was higher. Anatomic failures were significantly greater in the MOCA group at one year and approached significance at two years. The study was underpowered for anatomic failures because of the early stoppage of the study. At one and two year follow-up, clinical and quality of life outcomes were similar in the two groups.

Lane (2017) published a multi-center RCT evaluating pain levels for 170 patients undergoing either mechanical occlusion chemically assisted ablation or radiofrequency ablation.[66] Pain, duplex ultrasound results, clinical outcomes and quality of life were evaluated at one and six months after treatment. Pain after mechanical occlusion chemically assisted ablation was lower than with radiofrequency ablation, but other outcomes including quality of life and safety did not differ.

Bootun (2014) published early one month results from an ongoing study comparing 119 patients randomized to mechanochemical ablation (MCA) (n=60) or RFA (n=59).[67] The maximum and average pain scores were significantly lower during MCA compared to RFA ($p<0.001$). At one-month follow-up, both groups showed complete or proximal occlusion rates of 92%, though data were available for only 67% of participants. These preliminary outcomes do not permit conclusions due to methodological limitations including the short-term follow-up and incomplete data. The authors noted that data from longer follow-up is being collected.

Nonrandomized Studies

Oud (2025) reported on a single-center, prospective cohort study evaluating the long-term effectiveness of MOCA using the ClariVein device for treating great saphenous vein incompetence.[68] The study had a mean follow-up of 8.4 years and was conducted as a continuation of a previous multicenter RCT, including 109 patients (115 treated limbs) who underwent treatment between 2012 and 2018. The primary outcome was anatomical success, defined as complete closure of the treated vein or a partially reopened segment measuring <10 centimeters. A secondary measure, called reflux-free anatomical success, required that any reopened segment did not show backward blood flow. Results are reported in Table 8. Approximately 7% of patients required repeat interventions due to treatment failure.

Thierens (2019) published a prospective cohort study with five year follow up data. Anatomic and clinical follow-ups were performed at four weeks, six months, and one, three, and five years after the procedure. Less than half of the study population remained at five years, however 79% had freedom from anatomic failure and clinical measures had worsened. Nearly 15% of the recanalizations occurred in the first year, which the authors considered to be due to technical issues when the procedure was initially introduced. It should be noted, however, that the more recent MARADONA trial from the same group of investigators using 3% polidocanol (described above) also saw a rate of recanalization of 16.5% in the first year and 20% in the second year. Without a control condition, it cannot be determined whether the loss of clinical improvement in this cohort study is due to recanalization or the usual progression of venous disease over time.

Tang (2017) published single-center study outcomes for 300 patients who received ClariVein® treatment for varicose veins.[69] Veins treated included great saphenous vein (n=184), bilateral great saphenous veins (n=62), short saphenous vein (n=23), and bilateral short saphenous veins (n=6). Evaluations occurred two months after the procedures. At two months, 13 out of 393 veins or 3.3% had to be retreated with ultrasound-guided foam sclerotherapy. The authors stated there were no adverse findings and results are promising, but these results are from a one surgeon’s experience and RCTs with long-term follow-up are needed.

The remainder of the evidence on MCA of varicose veins is limited to nonrandomized series and cohort studies.[70-75] In the only comparative study, van Eekeren and colleagues compared postoperative pain and early quality of life in 68 patients treated with either RFA or MCA of great saphenous veins.[73] Patients who did not want to be treated with MCA were offered treatment with RFA; this study design could potentially lead to selection bias. There was no significant between-group difference in procedure-related pain. Compared with RFA, patients treated with MCA had a 14.3 mm reduction in pain measured on a 100 mm visual analog scale (VAS) measured over the first 3 postoperative days (6.2 vs. 20.5) and a 13.8 mm reduction in pain (4.8 vs. 18.6 mm; p<0.001) over the first two weeks. MCA patients treated also had a significantly earlier return to normal activities (1.2 vs. 2.4 days) and return to work (3.3 vs. 5.6 days; p=0.02). There was a similar improvement in quality of life for the two groups when measured at six weeks. Longer studies are required to determine the durability of these effects.

Microwave Ablation

This technique has not been approved or cleared for marketing by the FDA.

Systematic Review

Javed (2025) published a systematic review and meta-analysis comparing endovenous microwave ablation (MWA) versus radiofrequency ablation (RFA) for treating lower limb varicose veins.[76] The analysis included four studies (one randomized controlled trial and three cohort studies) with 887 patients (436 underwent MWA and 451 underwent RFA). At one month, occlusion rates were 100% for both groups; at one year, pooled occlusion rates remained similarly high (MWA 97.5%, RFA 98.0%) with no significant difference between groups (odds ratio = 0.80, 95% confidence interval 0.33-1.92, p = 0.620, I^2 = 0%). Quality of life scores showed no significant difference between techniques at one year. For secondary outcomes, both procedures demonstrated comparable effectiveness for hospitalization days and procedural time, as well as similar adverse event rates. Sensitivity analysis favored RFA with fewer hospitalization days (mean difference = 0.14, 95% confidence interval 0.01-0.27, p = 0.050, I^2 = 0%) and shorter procedural time (mean difference = 8.68, 95% confidence interval 6.45-10.90, p < 0.00001, I^2 = 38.0%). The study concluded that both MWA and RFA are safe and highly effective for treating lower limb varicose veins with similar one-year outcomes.

Randomized Controlled Trials

Zhu (2026) published a multicenter, open-label, non-inferiority, randomized controlled trial comparing endovenous microwave ablation (EMA) to endovenous laser ablation (EVLA) for great saphenous vein (GSV) insufficiency.[77] A total of 180 patients with GSV reflux were randomized 1:1 to either EMA or EVLA. The primary outcome was GSV occlusion rate at six months postoperatively with a non-inferiority margin of 10%. EMA demonstrated non-inferiority to EVLA at 6 months with occlusion rates in the full analysis set of 94.32% versus 90.00% (risk difference [RD] 4.32%, 95% confidence interval [CI]: -4.00% to 13.06%) and in the per-protocol set of 97.65% versus 95.29% (RD 2.35%, 95% CI: -4.08% to 9.47%, p < 0.001 for both analyses). Both groups exhibited comparable and significant reductions in Venous Clinical Severity Score (VCSS) (EMA: 4.18 ± 2.24 to 1.10 ± 1.18; EVLA: 4.13 ± 2.50 to 0.93 ± 1.0) and Aberdeen Varicose Vein Questionnaire (AVVQ) scores (EMA: 6.03 ± 3.21 to 1.54 ± 2.28; EVLA: 6.30 ± 3.68 to 1.12 ± 1.72) over 12 months (time effect p < 0.001; group-by-time interaction p > 0.05). Kaplan-Meier analysis revealed no significant difference in the time to

GSV recanalization between the groups during long-term follow-up (log-rank test, p = 0.15). Device-related adverse events were rare (EMA, 2.27% versus EVLA, 2.22%; p = 1.00).

Two clinical trial reports include a preliminary randomized trial, compared endovenous microwave ablation (EMA) with high ligation and stripping (HLS).[78] At 24-months follow-up, there was no significant difference in outcomes between the two groups. The second, a retrospective comparison between laser (n=163 limbs in 138 patients) and microwave (n=143 limbs in 121 patients) ablation of the greater saphenous vein, found significantly lower ecchymosis, skin burn, and paresthesia in the laser ablation.[79] However, the recanalization rate was significantly higher in the laser ablation group at one week and six months postoperatively (p<0.01). Loss to follow-up at 24-months was about 19% in each group.

Steam Ablation

This technique has not been approved or cleared for marketing by the FDA. There is currently no published clinical trial evidence on this technique.

SCLEROTHERAPY

In general, reported outcomes of uncontrolled studies have varied for sclerotherapy, as have the periods of follow-up. In many studies the outcomes are reported in terms of cure rates, but the criteria for cure or failure are poorly defined. Studies have also reported subjective patient-assessed outcomes or physician assessment, both of which may be poorly defined. More recent studies included results of Doppler or duplex ultrasonography; however, the relationship between finding ultrasonographic evidence of recurrent reflux and clinical symptoms is uncertain. Finally, it should be noted that sclerotherapy of the long saphenous vein is a fundamentally different approach than stripping. With stripping, recurrences are likely related to an incomplete surgical procedure or to revascularization. With sclerotherapy, recurrences may be additionally related to recanalization of an incompletely fibrosed saphenous vein.

Systematic Reviews

Kabnick (2024) published a systematic review with meta-analysis of polidocanol 1% endovenous microfoam (Varithena, PEM) compared with endovenous thermal ablation (ETA).[80] The reviewers analyzed 13 studies (six RCTs, seven nonrandomized comparative studies) involving 233,801 patients, using both direct and indirect comparisons including common comparators (surgery and physician-compounded foam). For vein closure rates at approximately 12 months, PEM showed no statistically significant difference compared with ETA (OR 0.65, 95% CI 0.36 to 1.18), but was significantly superior to physician-compounded foam (OR 2.91, 95% CI 1.58 to 5.37). No significant difference in deep vein thrombosis risk was found between PEM and other treatments. The study couldn't reliably analyze Venous Clinical Severity Score improvements, venous ulcer healing, or patient-reported outcomes due to insufficient comparable data. This study is limited by pooling of studies that used different treatment techniques (e.g., PEM and physician compounded foam) and lack of blinding in several studies.

A SR from 2008 found that foam sclerotherapy of varicose veins is associated with a higher recurrence rate in patients with saphenofemoral incompetence compared to the rates of endovenous laser therapy or radiofrequency obliteration, while a 2009 SR suggested that outcomes from sclerotherapy are worse than those of surgery (ligation and stripping) for saphenous vein reflux.[81, 82]

Randomized Controlled Trials

Watanabe (2024) conducted a double-blinded trial RCT comparing transluminal injection of microfoam sclerosant plus endovenous laser ablation to endovenous laser ablation alone in 142 patients (160 legs) with small saphenous vein reflux.[83] At one year, the transluminal injection of microfoam sclerosant plus endovenous laser ablation reduced residual or recurrent reflux (4% vs. 16%; p=.027) and secondary interventions (4% vs. 16%; p=.027), without major complications. Improvements in venous clinical severity score were similar with both interventions.

Yin (2017) reported on a randomized control study for patients who received ultrasound guided foam sclerotherapy combined with great saphenous vein high ligation (n=73) or stripping and multistab avulsion or transilluminated powered phlebectomy of the great saphenous vein (n=90).[84] Only 73 patients who received ultrasound guided foam sclerotherapy and 74 patients in the control group completed follow-up at one, six, and 12 months following treatment. At 12 months reflux recurrence rate was 13.8% after ultrasound guided foam sclerotherapy and 13.5% for the control treatment. Minor and major complications, venous filling index, VCSS, and AVVQ scores were similar. Patient satisfaction, operating times, and hospital costs were more favorable for ultrasound guided foam sclerotherapy.

Gibson (2017) reported on a multi-center randomized placebo-controlled trial evaluating the safety and efficacy of Varithena®.[85] Patients with symptomatic varicose veins received Varithena® (n=39) or a placebo (n=38). Assessments took place at baseline and at weeks one, four, eight and 12 after treatment. The authors stated Varithena® improves vein appearance and symptoms in patients with varicose veins. The study had methodological limitations including small sample size and potential author conflicts of interest. In addition, outcomes for appearance and symptoms may be viewed as subjective; thus, additional larger RCTs, with long-term follow-up are needed to validate health outcomes for Varithena®.

Several controlled trials comparing sclerotherapy of varicose tributaries or the saphenous vein, with and without associated ligation and stripping, have reported that the absence of ligation and stripping was associated with an increased frequency of recurrence. These trials are difficult to interpret due to the lack of clarity about which vein– either the varicose tributaries or the saphenous vein itself – have undergone sclerotherapy. Nonetheless, these trials established the importance of control of the site of reflux (ligation) and isolation of the refluxing portion of the saphenous vein (stripping). The following are examples of these studies:

Results from the five year follow up published by van der Velden (2015) examined ultrasound-guided foam sclerotherapy in 77 legs.[13] The authors found obliteration or absence of the greater saphenous vein was observed in only 23% of patients treated with sclerotherapy compared to 85% of patients who underwent conventional surgery and 77% of patients who underwent EVLA. Thirty-two percent of legs treated initially with sclerotherapy required one or more reinterventions during follow-up compared with 10% in the conventional surgery and EVLA groups. However, clinically relevant grade II neovascularization was higher in the conventional surgery and EVLA groups (17% and 13%, respectively), compared with the sclerotherapy group (4%). EuroQol-5D scores improved equally in all groups.

King (2015) published results from the VANISH-1 study, a manufacturer-funded multicenter placebo RCT undertaken to evaluate the efficacy of relief of symptoms and safety of Varithena (0.5%, 1%, and 2%) compared with 0.125% (control) and placebo.[86] Seven-hundred and eighty patients were screened; 279 patients met the study criteria and were treated with either

placebo (n=56), or Varithena 0.125% (n=57), 0.5% (n=51), 1% (n=52), or 2% (n=63). Patients rated the duration and intensity of nine symptoms and activity levels during the previous 24 hours using the VVSymQscore instrument. At week eight VVSymQscores for pool Varithena (0.5% +1%+2%) patients were significantly superior to placebo ($p<0.001$), and VVSymQscores decreased significantly ($p<0.001$) from baseline at eight weeks for all Varithena individual doses. There were no serious AE's and no PE's; however, patients receiving higher Varithena dose concentrations (1% and 2%) had higher rates of treatment-emergent AE's, which occurred in ≥ 3% of patients. The most common kinds of treatment-emergent AE's included pain, superficial thrombophlebitis, and hematoma at the injection site.

Vasquez and Gasparis (2015) published results from a manufacturer sponsored multicenter randomized placebo-controlled study. The purpose of the study was to determine the efficacy and safety of Varithena (0.5%, 1.0%) and placebo, each administered with endovenous thermal ablation.[87] A total of 234 patients were screened; 117 patients met the study criteria and received treatment (38 placebo, 39 Varithena 0.5%, and 40 Varithena 1%). Patients were assessed using the Quality of Life/Symptoms (mVEINES-QOL/Sym) questionnaire, Patients Self-Assessment of Visible Varicose Veins (PA-V) and the Independent Photography Review-Visible Varicose Veins (IPR-V) instruments. Efficacy showed baseline scores were greater at week eight for pooled Variethena than for placebo for both IPR-V (−1.2 vs. −0.8 points, $p=0.001$) and PA-V (−1.8 vs. −1.6 points, $p=0.16$), however, only IPR-V change score reached statistical significance. The comparison of the individual dose concentrations of Variethena (0.5%, 1.0%) with placebo showed a similar pattern for both IPR-V and PA-V scores. Although no patients presented spontaneously with symptoms of thrombus, six patients were found to have venous thrombi, and all occurred during the first eight weeks post treatment. Through six months of follow-up, there were no reports of visual disturbance or migraine among Varithena recipients, no pulmonary emboli, and no AE-related study withdrawals. There was one serious AE, breast cancer, considered unrelated to the study drug.

Microfoam sclerotherapy was studied in the 2014 VANISH-2 study, an ongoing five year manufacturer-funded pivotal double-blind RCT undertaken to obtain FDA marketing approval for Varithena microfoam (BTG).[88] The study compared 0.5% or 1.0% polidocanol microfoam with subtherapeutic foam dose (0.125%) and endovenous placebo in 232 patients. The authors reported early eight week follow-up data[89] finding elimination of reflux and/or occlusion of the previously incompetent vein in 85.6% of the combined 0.5% and 1.0% groups, 59.6% in the 0.125% "subtherapeutic" group, and 1.8% of the placebo group. The improvement in the venous clinical severity score was significantly greater in the 0.5% and 1.0% groups (-5.10) compared with placebo (-1.52), but was not reported for the 0.125% group. The 1.0% dose of Varithena was selected for the 2013 FDA approval. Adverse events occurred in 60% of patients receiving foam sclerotherapy compared to 39% of placebo; 95% were mild or moderate and transient. The most common adverse events were retained coagulum, leg pain, and superficial thrombophlebitis. Deep vein thrombosis was detected by ultrasound in 2.8% of Varithena-treated patients with 1% having proximal symptomatic thrombi treated with anticoagulants. No pulmonary emboli were detected and no clinically significant cardiac or cardiopulmonary, neurologic, or visual adverse events were reported. In the short-term the rates of occlusion with this microfoam sclerotherapy were similar to those reported for EVLA or stripping. RCTs comparing EVLA or stripping with microfoam sclerotherapy with long-term outcomes are needed to evaluate comparative effectiveness. In 2015, Todd and Wright published an update to the VANISH-2 study and reported on findings at one year.[90] Results at year one showed symptoms improved when compared to week 8 (64% with total VVSymQ scores of 3 or less at week eight vs 85% at year one). Reductions from baseline in the

individual symptom scores that compose the VVSymQ score were also demonstrated, with all five HASTI symptoms showing a continued decrease from over time. In addition, improvements from baseline in appearance as assessed by both the patients themselves (PA-V score) and blinded experts reading standardized photographs (IPR-V score) were maintained, with a small trend toward further improvement between week eight and one year. Ten patients of the 232 in the total population had 12 AEs reported during the long-term follow-up period through year one, including one death; however, all were unrelated to treatment. Of the patients who had venous thrombus AEs during the main eight week trial, none had recurrent venous thrombus AEs, and all clots stabilized or resolved completely. No post-thrombotic syndrome or other clinically important sequelae were reported. No patient developed a new venous thrombus AE in the one year follow-up, and no pulmonary emboli were diagnosed at any time through the one year in this study.

A 2012 study was a noninferiority trial of foam sclerotherapy versus ligation and stripping in 430 patients.[91] Analysis was per protocol. Forty patients (17%) had repeat sclerotherapy. At two years, the probability of clinical recurrence was similar in the two groups (11.3% sclerotherapy vs 9.0% ligation and stripping), although reflux was significantly more frequent in the sclerotherapy group (35% vs 21%). Thrombophlebitis occurred in 7.4% of patients after sclerotherapy. There were two serious adverse events in the sclerotherapy group (deep venous thrombosis and pulmonary emboli) that occurred within one week of treatment.

Blaise (2010) reported three-year follow-up from a multicenter double-blind randomized trial (143 patients) that compared treatment of the greater saphenous vein with either 1% or 3% polidocanol foam.[92] Additional treatment with foam sclerotherapy was carried out at six weeks, three and six months if required to abolish persistent venous reflux. There were 49 additional injections in the 1% polidocanol group and 29 additional injections in the 3% group. At the three-year follow-up, venous reflux was observed in 21% of patients in the 1% group and 22% of patients in the 3% polidocanol group.

Neglen (1993) reported on a “partially randomized” trial that compared the outcomes of three different treatment strategies: 1) sclerotherapy alone; 2) ligation and stripping, or 3) ligation combined with sclerotherapy.[93] It was difficult to determine the target of the sclerotherapy. As described in the article, sclerosant was injected into all points of control (presumably at the junction of the perforator veins) and, "if possible, into the main stem of the long saphenous vein." Thus, it seems that the intent of the sclerotherapy was not the obliteration of the long saphenous vein as an alternative to stripping, but as a treatment of the varicose tributaries. Therefore, among those patients who underwent ligation plus sclerotherapy, this trial tested whether or not stripping could be eliminated from the overall approach. In the group who received sclerotherapy alone, almost 70% of patients self-reported a cure immediately postoperatively, which declined to about 30% after five years. This gradual recurrence rate for sclerotherapy alone is similar to that reported in the above studies. For the ligation and sclerotherapy group, 70% reported a cure immediately postoperatively, dropping to 50% after five years. The best long-term results were reported for the ligation and stripping group, which reported an 80% immediate cure rate, dropping to 70% after five years. The physician assessment of treatment outcome showed greater differences among the three groups. For example, based on physician assessment (observation and foot volumetric measurements), only 5% of the sclerotherapy group were considered cured after 5 years, compared to 10% in the ligation and sclerotherapy group and 60% in the ligation and stripping group.

Rutgers (1994) reported on a trial that randomized 156 patients with varicose veins and saphenofemoral incompetence to undergo either ligation and stripping or ligation and sclerotherapy.[43] The site of sclerotherapy was not described. At the three years follow-up, the cosmetic results were better in those limbs that had undergone stripping. Additionally, the clinical and Doppler ultrasound evidence of reflux was significantly less in those undergoing stripping.

Nonrandomized Studies

There has also been interest in injecting sclerosant into the saphenous vein either in conjunction with ligation as an alternative to stripping, as a stand-alone procedure, or as an alternative to both ligation and stripping.

Myers (2007) published results from a three-year follow-up prospective observational study of sclerotherapy in 489 patients with refluxing saphenous veins and related tributaries.[94] Out of 807 veins treated, 56% were associated with the great saphenous vein and 22% with the small saphenous vein; 22% were tributaries alone. Ultrasound at three to five days after each treatment showed successful occlusion in an average of 1.5 sessions for the group as a whole (65% in one session and 26% in two sessions). The Kaplan-Meier analysis showed three-year survival rates of 83% for tributaries, 53% for great saphenous veins, and 36% for small saphenous veins. These results do not support the use of sclerotherapy for refluxing saphenous veins.

Kanter and Thibault (1996) published results from a case series, which included 172 patients with 202 limbs who had varicose veins with associated saphenofemoral incompetence.[95] Using ultrasound guidance, sclerosant was injected into the long saphenous vein 3 to 4 cm distal to the saphenofemoral junction. Injections were given at 30- to 90-second intervals, proceeding distally as previously injected segments were observed to spasm. Immediately after therapy, a thigh compression stocking was applied. Two weeks after the initial procedure, patients were reevaluated with Duplex ultrasound and were re-treated if found to have persistent reflux. There was a clinical recurrence rate of 22.8% at one year.

Ninja published two case series (1996; 1997) evaluating sclerotherapy for patients with symptomatic vulvar varicosities.[96, 97] The first study included seven women and the second study included five women. Both studies concluded that all patients noticed marked improvements in symptoms after treatment. However, the sample sizes in these two studies were very small and they lacked a comparator group.

Adverse Effects

Although long-term sequelae have not been reported with sclerotherapy, transient adverse effects have been found in up to 8% of patients, including cerebrovascular accidents, transient ischemic attacks, speech and/or visual disturbance, migraine, shortness of breath, dizziness, and numbness.[98, 99] Bubbles appear in the right side of the heart between 9 and 59 seconds after injection and emboli have been detected in the middle cerebral artery following sclerotherapy of saphenous trunks and varices. Deep venous occlusion after ultrasound-guided sclerotherapy has also been reported; risk was found to be greater when treating veins greater than or equal to 5 mm in diameter (odds ratio of 3.7) and injecting 10 mL or more of foamed sclerosant (odds ratio of 3.6).[100] A SR of visual disturbance following sclerotherapy found this adverse effect to be rare and transient; further research was recommended to clarify the mechanism of action of sclerosants.[101]

HIGH-INTENSITY FOCUSED ULTRASOUND

Non-Randomized studies

Chabouni (2026) completed a real-world retrospective observational study investigating the effectiveness and safety of HIFU using a hemodynamic approach in 80 consecutive patients with Clinical, Etiological, Anatomical, and Pathophysiological stages C2 to C5 chronic venous insufficiency.[102] A single vascular surgeon treated several vein types, and Doppler ultrasound assessed technical success, defined as complete or partial occlusion with reduced reflux and greater than 50% vein-diameter reduction, at 1 month and 1 year; clinical improvement and adverse events were secondary outcomes. Technical success was 80.6% (95% confidence interval [CI], 74.8%–85.5%) at 1 month and 79% (95% CI, 73.8%–83.9%) at 1 year, while clinical improvement increased from 78.8% to 95.2%; outcomes were strongest for leg perforator and great saphenous veins. Adverse events occurred in 21.8% of cases, most commonly neuropathic pain and skin burns in 5% each, and reportedly resolved quickly. Limitations included the retrospective, uncontrolled, single-surgeon design, heterogeneous anatomy, 36% attrition at 1 year, use of per-protocol long-term analysis, and anatomical constraints.

Rodríguez Carvajal (2025) completed a retrospective observational study with prospective data collection investigating extracorporeal HIFU for superficial venous insufficiency in 102 consecutive patients with 164 treated veins.[103] Treated vessels included 65 great saphenous, 15 small saphenous, 12 anterior accessory saphenous, 48 perforator, and 24 other veins; the primary outcome was vein occlusion, with secondary measures of shrinkage, absence of reflux, clinical improvement, and complications through 12 months. Early occlusion rates were 85% to 96% and remained 85% to 90% at 12 months; reflux-free rates were 85% to 93% and shrinkage rates were 94% to 97% at 12 months. Venous Clinical Severity Score and Clinical, Etiological, Anatomical, and Pathophysiological classification improved significantly, and no major adverse events were reported. Limitations included the retrospective, nonrandomized, single-arm design, heterogeneous vein types, modest sample size, lack of an active comparator, and follow-up limited to 1 year.

Casoni (2024) completed a prospective observational study investigating high-intensity focused ultrasound (HIFU) for great saphenous vein (GSV) incompetence in 188 treated limbs.[104] The primary outcome was target-segment shrinkage or closure at 1 year, assessed during follow-up at 1 week and 3, 6, and 12 months. Shrinkage or closure rates were 93.3%, 98.2%, 97.6%, and 98.3%, respectively, suggesting sustained anatomic effectiveness through 1 year. The authors concluded that HIFU may be a promising noninvasive treatment for GSV incompetence. Limitations included the uncontrolled, single-arm design, lack of comparison with established ablation techniques, and follow-up limited to 1 year.

Other Treatments

FDA approval of the VenaSeal™ Closure System, which uses adhesive, was based on three manufacturer-sponsored clinical studies, one of which was a randomized controlled noninferiority trial. In the VeClose Study, 222 subjects with symptomatic long saphenous vein incompetence were randomized to undergo either the VenaSeal closure (n=108) or RFA (n=114).[105] A three-month follow-up was conducted during which no adjunctive procedures were allowed. There were a number of methodological limitations in this study, which include but are not limited to, a 14% loss of data, which was accounted for using various methods such as imputing missing data. While these analyses supported noninferiority, their reliability is

unclear. These results require validation in large RCTs with lower rates of data loss and longer-term follow-up.

PRACTICE GUIDELINE SUMMARY

AMERICAN VEIN AND LYMPHATIC SOCIETY (AVLS)

The AVLS published a position statement 1% polidocanol endovenous microfoam (VarithenaTM) for the treatment of chronic venous disease (2025).[106] The following conclusions and recommendations were provided:

> "Varithena™ offers a safe and effective option to comprehensively treat a broad spectrum of patients with C2-C6 disease. The procedure is a straightforward, minimally invasive procedure, eliminating the need for potentially painful tumescent anesthesia and allowing treatment with as few as one or two access sites. Varithena allows treatment flexibility with clinical data supporting efficacy in challenging anatomy and a wide variety of diameters up to 25.9 mm above and below the knee. Foam sclerotherapy is often the best or only option for treating some patterns of reflux (the below-knee GSV, recurrent reflux in a recanalized saphenous veins) and Varithena™ remains the only FDA approved foam sclerosant."

The AVLS published a position statement on mechanochemical chemically assisted ablation of varicose veins for venous insufficiency (2025).[107] The following conclusions and recommendations were made:

> "Mechanical occlusion chemically assisted venous ablation is effective in alleviating symptoms and a safe treatment option for venous insufficiency. As a non-thermal ablation method, MOCA [mechanical occlusion chemically assisted ablation] obviates the need for tumescent anesthesia and thus results in less procedural discomfort and risk of thermal nerve or skin injury. It may be used in both the below knee distal GSV [great saphenous veins] as well as the SSV [small saphenous veins] with no risk of thermal injury to the adjacent nerves. However, it is associated with significantly lower rates of vessel closure and higher recanalization rates when followed for more than 1 year compared to both radiofrequency ablation and endovenous laser ablation." "It is an available option for those in whom thermal ablation is not suitable."

The AVSL guidelines committee (2016) published a consensus statement on treatment options for incompetent accessory saphenous veins.[108] They performed a SR to evaluate clinical outcomes and treatment options. They stated treatment recommendations for symptomatic great saphenous veins should include endovenous thermal ablation (laser or radiofrequency) and ultrasound-guided foam sclerotherapy (Grade 1C-strong recommendation, low quality evidence).

The AVLS (2014) published a practice guideline for treatment of superficial veins of the lower leg.[109] Recommendations for the treatment of saphenous veins included laser and radiofrequency ablation, for the small and great saphenous veins and the anterior and posterior accessory of the great saphenous vein (Grade 1B-strong recommendation, moderate quality evidence). Mechanical or Chemical ablation could be used for truncal veins (Grade 2B-weak recommendation, moderate quality evidence). Open surgery is not recommended, unless the conditions do not respond to other recommended treatments (Grade 1B evidence).

Nonvisible symptomatic tributary veins could be treated with ultrasound-guided foam sclerotherapy or chemical ablation (Grade 1B evidence).

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE (NICE)

NICE (2013) published a clinical guideline for the diagnosis and management of varicose veins.[110] No new evidence was found in 2016 that would change the guideline recommendations.

"1.3.2 For people with confirmed varicose veins and truncal reflux:

- Offer endothermal ablation (see radiofrequency ablation of varicose veins [NICE interventional procedures guidance 8] and endovenous laser treatment of the long saphenous vein [NICE interventional procedures guidance 52]).
- If endothermal ablation is unsuitable, offer ultrasound-guided foam sclerotherapy (see interventional procedures guidance 440]).
- If ultrasound-guided foam sclerotherapy is unsuitable, offer surgery.

1.3.3 If offering compression bandaging or hosiery for use after interventional treatment, do not use for more than 7 days."

INTERSOCIETAL ACCREDITATION COMMISSION

In 2016, the Intersocietal Accreditation Commission (IAC) published standards and guidelines on vascular testing for accreditation.[111] The IAC has recommendations for peripheral venous testing in section 4B. The guideline for documentation of lower extremity venous duplex for reflux states the following (section 4.7.2B):

> 4.7.2.1B Transverse grayscale images without and with transducer compressions (when anatomically possible or not contraindicated) must be documented as required by the protocol and must include at a minimum: i. common femoral vein;
>
> ii. saphenofemoral junction;
> iii. mid femoral vein;
> iv. great saphenous vein;
> v. popliteal vein;
> vi. small saphenous vein.
>
> 4.7.2.2B Spectral Doppler waveforms with the extremity(s) in a dependent position, demonstrating baseline flow and response to distal augmentation and if reflux is present, duration of retrograde flow measured with calipers and documented as required by the protocol and must include at a minimum: i. common femoral vein;
>
> ii. saphenofemoral junction;
> iii. great saphenous vein;
> iv. mid femoral vein;
> v. popliteal vein;
> vi. small saphenous vein.
>
> 4.7.2.3B Transverse grayscale images of *diameter measurement* must be documented as required by the protocol and must include at a minimum:

i. saphenofemoral junction;
ii. great saphenous vein at proximal thigh;
iii. great saphenous vein at knee;
iv. small saphenous vein (at saphenopopliteal junction).

CYANOACRYLATE GLUE

National Institute for Health and Care Excellence (NICE)

NICE (2015) published a guidance on cyanoacrylate glue occlusion for varicose veins.[112] NICE recommendations included using cyanoacrylate glue occlusion for special circumstances. Evidence was limited in quantity and quality.

ENDOVENOUS ABLATION

Society for Vascular Surgery, the American Venous Forum, and The American Vein and Lymphatic Society

The 2014 Society for Vascular Surgery (SVS)/American Venous Forum (AVF) guidelines for management of venous ulcers included the following recommendations in favor of standard compressive therapy and ablation of incompetent superficial veins that have axial reflux directed to the bed of the ulcer[113]:

- In a patient with a venous leg ulcer and incompetent superficial veins to 1) improve ulcer healing (Grade 2B recommendation defined as a weak recommendation based on moderate quality evidence), and 2) prevent recurrence (Grade 1C recommendation defined as a strong recommendation based on low- to very low-quality evidence)
- To prevent ulceration in a patient with skin changes at risk for venous leg ulcer, and incompetent superficial veins (Grade 2C recommendation defined as a weak recommendation based on low- to very low- quality evidence)
- To aid in ulcer healing and to prevent recurrence in a patient who also has pathological perforating veins located beneath or associated with the ulcer bed (Grade 2C recommendation defined as a weak recommendation based on low- to very low- quality evidence)
- To prevent ulceration or ulcer recurrence in a patient with skin changes at risk for venous leg ulcer or healed venous ulcer and incompetent superficial veins (Grade 2C recommendation defined as a weak recommendation based on low- to very low-quality evidence).
- If a patient is expected to benefit from pathologic perforator vein ablation, percutaneous ablation with ultrasound-guided sclerotherapy or endovenous RFA or EVLA is recommended over open venous perforator surgery (Grade 1C recommendation defined as a strong recommendation based on low- to very low-quality evidence)

The SVS, AVF, and AVLS published an evidence-based clinical practice guideline for the Management of Varicose Veins of the Lower Extremities in 2023. The guideline gives the following recommendations for standard compressive therapy and other interventions for symptomatic varicose veins and axial reflux:[1]

- For patients with symptomatic varicose veins and axial reflux in the superficial truncal veins, we suggest compression therapy for primary treatment if the patient's ambulatory status and/or underlying medical conditions warrant a conservative approach, or if the patient prefers conservative treatment for either a trial period or definitive management (Grade 2C recommendation defined as a weak recommendation based on low to very-low quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the great saphenous vein or small saphenous vein who are candidates for intervention, we recommend superficial venous intervention over long term compression stockings (Grade 1B recommendation defined as strong recommendation based on moderate quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the anterior accessory great saphenous vein or posterior accessory great saphenous vein, who are candidates for intervention, we suggest superficial venous intervention over long-term compression stockings (Grade 2C recommendation defined as weak recommendation based on low to very-low quality evidence).

- In patients with symptomatic varicose veins who are candidates for endovenous therapy and wish to proceed with treatment, we suggest against a three-month trial of compression therapy before intervention (Grade 2B recommendation defined as a weak recommendation based on moderate quality evidence).

The guideline gives the following recommendations for endovenous ablation versus high ligation and stripping (HL&S):

- For patients with symptomatic varicose veins and axial reflux in the great saphenous vein, who are candidates for intervention, we recommend treatment with endovenous ablation over HL&S of the great saphenous vein (Grade 1B recommendation defined as a strong recommendation based on moderate quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the small saphenous vein, who are candidates for intervention, we recommend treatment with endovenous ablation over ligation and stripping of the small saphenous vein (Grade 1C recommendation defined as a weak recommendation based on low to very-low quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the anterior accessory great saphenous vein or posterior accessory great saphenous vein, who are candidates for intervention, we suggest treatment with endovenous ablation, with additional phlebectomy, if needed, over ligation and stripping of the accessory vein (Grade 2C recommendation defined as a weak recommendation based on low to very-low quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the great saphenous vein or small saphenous vein, we recommend treatment with HL&S of the saphenous vein if technology or expertise in endovenous ablation is not available or if the venous anatomy precludes endovenous treatment (Grade 1B recommendation defined as strong recommendation based on moderate quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the anterior accessory great saphenous vein or posterior accessory great saphenous vein, we suggest treatment with ligation and stripping of the accessory saphenous vein, with additional phlebectomy, if needed, if technology or expertise in endovenous ablations is not available or if the venous anatomy precludes endovenous treatment (Grade 2C recommendation defined as weak recommendation based on low to very-low quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the great saphenous vein who place a high priority on the long-term outcomes of treatment (quality of life and recurrence), we suggest treatment with endovenous laser ablation (EVLA), radiofrequency ablation (RFA), or HL&S over physician-compounded ultrasound-guided foam sclerotherapy (UGFS), because of long-term improvement of quality of life and reduced recurrence (Grade 2B recommendation defined as weak recommendation based on moderate quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the small saphenous vein, we suggest treatment with EVLA, RFA, or ligation and stripping from the knee to the upper or midcalf over physician-compounded UGFS because of long-term improvement of quality of life and reduced recurrence (Grade 2C recommendation defined as weak recommendation based on low to very-low quality evidence).

- For patients with symptomatic varicose veins and axial reflux in the anterior accessory great saphenous vein or posterior accessory great saphenous vein who place a high priority on the long-term outcomes of treatment (quality of life and recurrence), we suggest treatment of the refluxing superficial trunk with endovenous laser ablation, RFA, or HL&S, with additional phlebectomy, if needed, over physician-compounded UGFS because of long-term improvement of quality of life and reduced recurrence (Grade 2C recommendation defined as weak recommendation based on low to very-low quality evidence).

- The guideline does not make recommendations for saphenous vein diameter.

National Institute for Health and Care Excellence (NICE)

NICE (2016) published guidance on endovenous mechanochemical ablation for varicose veins.[114]

“Current evidence on the safety and efficacy of endovenous mechanochemical ablation for varicose veins appears adequate to support the use of this procedure provided that standard arrangements are in place for consent, audit and clinical governance. Clinicians are encouraged to collect longer-term follow-up data.”

NICE published a guidance in 2004 for endovenous laser treatment of the long saphenous vein.[115]

“Current evidence on the safety and efficacy of endovenous laser treatment of the long saphenous vein appears adequate to support the use of this procedure provided that the normal arrangements are in place for consent, audit and clinical governance. Current evidence on the efficacy of this procedure is limited to case series with up to 3 years follow-up. Clinicians are encouraged to collect longer-term follow-up data.”

NICE published a guidance in 2003 for radiofrequency ablation of varicose veins.[116]

"Current evidence on the safety and efficacy of radiofrequency ablation of varicose veins appears adequate to support the use of this procedure as an alternative to saphenofemoral ligation and stripping, provided that the normal arrangements are in place for consent, audit and clinical governance."

American College of Radiology

In 2023 the American College of Radiology (ACR) published appropriateness criteria for the treatment of lower extremity chronic venous disease, based on a systematic review of the evidence.[117] The ACR considers endovenous radiofrequency or laser ablation to be at least as effective or slightly more effective than surgery. The review authors of this guideline concluded that compared with conventional open surgery and EVLA, chemical sclerotherapy had worse outcomes at one, five, and eight-year follow-ups with higher rates of recurrent GSV reflux and saphenofemoral junction failure.

Society of Interventional Radiography, Cardiovascular Interventional Radiological Society of Europe, American College of Phlebology, Canadian Interventional Radiology Association[118]

The 2010 the Society of Interventional Radiography (SIR), Cardiovascular Interventional Radiological Society of Europe (CIRSE), American College of Phlebology (ACP), Canadian Interventional Radiology Association (CIRA) published a joint consensus statement on endovenous thermal ablation using either laser or radiofrequency devices under imaging guidance and monitoring an effective treatment of extremity venous reflux and varicose veins under the following conditions:

I. The endovenous treatment of varicose veins may be medically necessary when one of the following indications (A–E) is present:

   A. Persistent symptoms interfering with activities of daily living in spite of conservative/nonsurgical management. Symptoms include aching, cramping, burning, itching, and/or swelling during activity or after prolonged standing.
   B. Significant recurrent attacks of superficial phlebitis
   C. Hemorrhage from a ruptured varix
   D. Ulceration from venous stasis where incompetent varices are a contributing factor
   E. Symptomatic incompetence of the great or small saphenous veins (symptoms as in A above)

II. A trial of conservative, nonoperative treatment has failed. This would include mild exercise, avoidance of prolonged immobility, periodic elevation of legs, and compressive stockings.

III. The patient's anatomy is amenable to endovenous ablation.

SCLEROTHERAPY

National Institute for Health and Care Excellence (NICE)

NICE published a guidance in 2013 for sclerotherapy.[119]

"1.1 Current evidence on the efficacy of ultrasound-guided foam sclerotherapy for varicose veins is adequate. The evidence on safety is adequate, and provided that patients are warned of the small but significant risks of foam embolisation (see section 1.2), this procedure may be used with normal arrangements for clinical governance, consent and audit."

"1.2 During the consent process, clinicians should inform patients that there are reports of temporary chest tightness, dry cough, headaches and visual disturbance, and rare but significant complications including myocardial infarction, seizures, transient ischaemic attacks and stroke."

Society for Vascular Surgery, the American Venous Forum, and the American Vein and Lymphatic Society

The SVS, AVF, and AVLS published an evidence-based clinical practice guideline for the management of varicose veins of the lower extremities in 2023. The guideline gives the following recommendations concerning sclerotherapy in varicose vein treatment:[1]

- For patients with symptomatic telangiectasias and reticular veins, we recommend sclerotherapy with liquid or foam (Grade 1B recommendation defined as strong recommendation based on moderate quality evidence).
- For patients with symptomatic telangiectasias or reticular veins, we suggest transcutaneous laser treatment if the patient has sclerosant allergy, needle phobia, sclerotherapy, failure or small veins (<1 mm) with telangiectatic matting (Grade 2B recommendation defined as weak recommendation based on moderate quality evidence).
- For treatment of symptomatic varicose tributaries, we recommend mini phlebectomy or ultrasound guided sclerotherapy using physician-compounded foam (PCF) or polidocanol endovenous microfoam (PEM) (Grade1B recommendation defined as strong recommendation based on moderate quality evidence).For patients with symptomatic reflux in the major superficial venous trunks and associated varicosities undergoing initial ablation alone, we recommend follow-up for greater than three months to assess the need for staged phlebectomy or ultrasound-guided sclerotherapy for persistent or recurrent symptoms. Longer follow-up is recommended for those with recurrence or more advanced CEAP class.

The 2014 SVS/AVF guidelines[113] for management of venous ulcers included the following recommendations:

- Grade 1C (Strong recommendation, low quality or very-low quality evidence) For those patients who would benefit from pathologic perforator vein ablation, we recommend treatment by percutaneous techniques that include ultrasound-guided sclerotherapy or endovenous thermal ablation (radiofrequency or laser) over open venous perforator surgery to eliminate the need for incisions in areas of compromise skin.

SUMMARY

Medically Necessary

There is enough research to determine that treatment of certain symptomatic varicose veins using ligation, phlebectomy, endovenous treatment with radiofrequency or laser ablation, endovenous glue/adhesive, and sclerotherapy may improve short-term clinical outcomes (e.g., pain and return to work). Therefore, these procedures may be considered medically necessary in select individuals when the policy criteria are met.

Not Medically Necessary

Procedures not meeting the policy Criteria are considered not medically necessary. In addition, follow-up venous studies performed within six months following the most recent treatment in the absence of complications is considered not medically necessary.

Investigational

There is not enough research to show improvement in health outcomes for endovenous ablation or sclerotherapy of the investigational indications listed in the medical policy Criteria. Further, the current evidence has limitations including no comparator groups, small study population, and short-term follow-up.

There is not enough research to show that mechanochemical ablation of varicose veins improves individual outcomes and is safe. Therefore, the use of mechanochemical ablation of any vein is considered investigational.

There is not enough research to show that high-intensity focused ultrasound ablation of varicose veins improves health outcomes and is safe. Therefore, the use of high-intensity focused ultrasound ablation of any vein is considered investigational.

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CODES

Notes:

- This policy uses the nomenclature great saphenous vein and small saphenous vein, also known as greater or long and lesser or short saphenous veins, respectively. Current CPT nomenclature uses long and short saphenous veins.
- There is no specific CPT code for mechanochemical treatment devices (e.g., the ClariVein® device) which should be reported with an unlisted procedure code such as 37799. Per CPT definitions, it is inappropriate to use codes 37241-37244 or 37475-37479 to report this procedure.
- Varithena is not separately reimbursable using any CPT or HCPCS Code.
- There is no specific CPT code for transilluminated powered phlebectomy. Providers might elect to use CPT codes describing stab phlebectomy (37765 or 37766), excision of varicose vein cluster(s) (37785), or unlisted vascular surgery procedure (37799).
- There is no specific CPT for microfoam sclerotherapy. Providers might elect to use CPT codes describing sclerotherapy (36468-36471) or the unlisted vascular surgery procedure code 37799. Use of codes 36475-36476 would be inappropriate as the procedure is not ablation therapy.

Codes	Number	Description
CPT	0524T	Endovenous catheter directed chemical ablation with balloon isolation of incompetent extremity vein, open or percutaneous, including all vascular access, catheter manipulation, diagnostic imaging, imaging guidance and monitoring
	1099T	Ablation of incompetent vein(s), extremity, transcutaneous, high intensity-focused ultrasound (HIFU), inclusive of all imaging guidance and monitoring
	36465	Injection of non-compounded foam sclerosant with ultrasound compression maneuvers to guide dispersion of the injectate, inclusive of all imaging guidance and monitoring; single incompetent extremity truncal vein (eg, great saphenous vein, accessory saphenous vein)
	36466	Injection of non-compounded foam sclerosant with ultrasound compression maneuvers to guide dispersion of the injectate, inclusive of all imaging guidance and monitoring; multiple incompetent truncal veins (eg, great saphenous vein, accessory saphenous vein), same leg
	36468	Single or multiple injections of sclerosing solutions, spider veins (telangiectasia); limb or trunk
	36470	Injection of sclerosing solution; single incompetent vein
	36471	Injection of sclerosing solution; multiple incompetent veins, same leg
	36473	Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, mechanochemical; first vein treated
	36474	;subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)
	36475	Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, radiofrequency; first vein treated
	36476	;subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)
	36478	Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, laser; first vein treated
	36479	;subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)

Codes	Number	Description
	36482	Endovenous ablation therapy of incompetent vein, extremity, by transcatheter delivery of a chemical adhesive (eg, cyanoacrylate) remote from the access site, inclusive of all imaging guidance and monitoring, percutaneous; first vein treated
	36483	;subsequent vein(s) treated in a single extremity, each through separate access sites (list separately in addition to code for primary procedure)
	37700	Ligation and division of long saphenous vein at saphenofemoral junction, or distal interruptions
	37718	Ligation, division, and stripping, short saphenous vein (for bilateral procedure, use modifier 50)
	37722	Ligation, division, and stripping, long (greater) saphenous veins from saphenofemoral junction to knee or below
	37735	Ligation and division and complete stripping of long or short saphenous veins with radical excision of ulcer and skin graft and/or interruption of communicating veins of lower leg, with excision of deep fascia
	37760	Ligation of perforators veins, subfascial, radical (Linton type) including skin graft, when performed, open, 1 leg
	37761	Ligation of perforator vein(s), subfascial, open, including ultrasound guidance, when performed, 1 leg
	37765	Stab phlebectomy of varicose veins, one extremity; 10-20 stab incisions
	37766	Stab phlebectomy of varicose veins, one extremity; more than 20 incisions
	37780	Ligation and division of short saphenous vein at saphenopopliteal junction (separate procedure)
	37785	Ligation, division, and/or excision of varicose vein cluster(s), one leg
	37799	Unlisted procedure, vascular surgery
	93970	Duplex scan of extremity veins including responses to compression and other maneuvers; complete bilateral study
	93971	Duplex scan of extremity veins including responses to compression and other maneuvers; unilateral or limited studies
HCPCS	J3490	Unclassified drugs
	S2202	Echosclerotherapy

Appendix 1: CEAP Classification	
Clinical classification (C)	C0: no visible or palpable signs of venous disease C1: telangiectasias or reticular veins C2: varicose veins (≥3 mm diameter) C3: edema C4: skin and subcutaneous tissue changes C4a: pigmentation or eczema C4b: lipodermatosclerosis or atrophie blanche C5: healed venous ulcer C6: active venous ulcer
Each clinical class is further characterized by a subscript for symptomatic (S) or asymptomatic (A), for example, C2A or C5S.	
Etiologic classification (E)	Ec: congenital Ep: primary Es: secondary (postthrombotic) En: no venous cause identified
Anatomic classification (A)	As: superficial veins Ap: perforator veins Ad: deep veins An: no venous location identified

Pathophysiologic classification	
Basic CEAP	Pr: reflux Po: obstruction Pr,o: reflux and obstruction Pn: no venous pathophysiology identifiable
Advanced CEAP includes the addition of any of following 18 venous segments as locators:	
Superficial veins	Telangiectasias or reticular veins Great saphenous vein above knee Great saphenous vein below knee Small saphenous vein Nonsaphenous veins
Deep veins	Inferior vena cava Common iliac vein Internal iliac vein External iliac vein Pelvic: gonadal, broad ligament veins, other Common femoral vein Deep femoral vein Femoral vein Popliteal vein Crural: anterior tibial, posterior tibial, peroneal veins (all paired) Muscular: gastrocnemial, soleal veins, other
Perforating veins	Thigh Calf

Date of Origin: *October 1999*