

<b>7.01.124</b>	<b>Treatment of Varicose Veins/Venous Insufficiency</b>		
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<b>Section:</b>	7.0 Surgery	<b>Page:</b>	Page 1 of 39

## Policy Statement

### Great, Small, or Accessory Saphenous Veins

Saphenous vein treatment may be considered **medically necessary** when **all** of the following criteria have been met:

- Documentation to use **only one** of the following procedures (not combined use of different procedures or an unlisted procedure): surgery (ligation and stripping), radiofrequency endovenous thermal ablation, laser endovenous thermal ablation, [microfoam](#) sclerotherapy, or cyanoacrylate adhesion
- All saphenous veins in the same leg meeting criteria for treatment will be treated in the same session or have [documentation](#) submitted why that should not be done (see Policy Guidelines)
- There is demonstrated saphenous reflux and CEAP (Clinical, Etiology, Anatomy, Pathophysiology) class C2 or greater
- There is documentation of **one or more** of the following:
  - Ulceration secondary to venous stasis
  - Recurrent superficial thrombophlebitis
  - Hemorrhage or recurrent bleeding episodes from a ruptured superficial varicosity
  - Persistent pain, swelling, itching, burning, or other symptoms are associated with saphenous reflux, and **both** of the following:
    - The symptoms significantly interfere with activities of daily living
    - Conservative management including compression therapy for at least 6 weeks has not improved the symptoms

Treatment of saphenous veins by surgery, endovenous thermal ablation (radiofrequency or laser), [microfoam](#) sclerotherapy or cyanoacrylate that does not meet the criteria described above is considered **not medically necessary**.

Combining the use of **any two** medically necessary treatments (e.g., radiofrequency ablation [RFA] and [microfoam](#) sclerotherapy) during the same treatment session on the same vein or same type of vein is considered **not medically necessary**.

Sclerotherapy techniques (other than [microfoam](#) sclerotherapy) as the primary treatment of great, small, or accessory saphenous veins, is considered **investigational**. However, standard foam sclerotherapy can be used for cleanup of small sections of saphenous veins when needed after primary treatment by surgery, endovenous thermal ablation (radiofrequency or laser), [microfoam](#) sclerotherapy, or cyanoacrylate adhesive.

Stab avulsion, hook phlebectomy, or transilluminated powered phlebectomy of perforator, great, small, or accessory saphenous veins are considered **investigational**.

### Symptomatic Varicose Tributaries

Tributary varicosity treatment when performed either at the same time (or following prior treatment) as saphenous vein treatment may be considered **medically necessary** when **all** of the following criteria have been met:

- Documentation to use **one** of the following procedures (not an unlisted procedure): stab avulsion, hook phlebectomy, standard sclerotherapy (not including [microfoam](#) sclerotherapy), transilluminated powered phlebectomy
- Saphenous veins have been previously treated successfully or will be treated during the same session
- The tributaries are symptomatic

- [All tributaries in the same leg](#) meeting criteria for treatment will be treated in the same session (or have [documentation](#) submitted when that should not be done)
- Use of [microfoam](#) sclerotherapy or cyanoacrylate only when [using leftover product](#) during the [same session](#) as saphenous vein treatments using the same agent

When done separately from saphenous vein treatment, the use of [microfoam](#) sclerotherapy (does NOT apply to standard foam sclerotherapy) or cyanoacrylate to treat symptomatic varicose tributaries is considered **not medically necessary**, either:

- On a different date as saphenous vein treatment
- On the same date when saphenous vein treatment was done using a different modality (i.e., RFA, laser or surgery)

The following are considered **investigational**:

- Treatment of isolated tributary veins without prior or concurrent treatment of saphenous veins
- Isolated treatment of symptomatic varicose tributaries using any other techniques than those noted above
- Endovenous radiofrequency or laser ablation of tributary veins

### Perforator Veins

Perforator vein treatments for leg ulcers may use surgical ligation (including Subfascial Endoscopic Perforator Surgery-SEPS) or endovenous thermal ablation (radiofrequency or laser), [microfoam](#) or standard foam sclerotherapy or cyanoacrylate adhesion may be considered **medically necessary** when **all** of the following conditions have been met:

- There is demonstrated perforator reflux
- Any superficial saphenous veins (great, small, or accessory saphenous and symptomatic varicose tributaries) have been previously eliminated or will be eliminated at the same time
- Ulcers are present that have not resolved following prior treatment or have recurred after initial successful treatment
- The venous insufficiency is not secondary to deep venous thromboembolism

Stab avulsion, hook phlebectomy, transilluminated powered phlebectomy of perforator veins are considered **investigational**.

### Telangiectasia

- Treatment of telangiectasia such as spider veins, angiomas, and hemangiomas that are less than 3 millimeters in diameter are considered **not medically necessary**.

### Miscellaneous

The following are considered **investigational**:

- Mechanochemical ablation (MOCA) of any vein
- Endovenous cryoablation of any vein

## Policy Guidelines

### Documentation for Saphenous or Tributary Vein Treatments

If veins in a leg meeting criteria for treatment are planned to be treated during different sessions, documentation should include:

- For [microfoam](#) or cyanoacrylate, why manufacturer's literature on maximum dose per session would be exceeded
- For procedures requiring tumescent anesthesia, why a lower concentration of lidocaine (such as 0.05%) cannot be used
- For treatment of great and small saphenous veins or multiple tributaries, why patient position cannot be changed as needed to complete all necessary procedures

### Microfoam Sclerotherapy

Described in the CPT code as “non-compounded foam sclerosant,” the term microfoam refers to the brand name Varithena®, which uses a special blend of gases to create uniform, small bubbles. This is different from standard foam sclerotherapy which comes as a liquid (and can be the same basic agent as Varithena®) that can be used directly (as a liquid) or mixed back and forth using syringes to make it foamy. But the resulting standard foam does not have the same uniformly small bubbles as microfoam, so it performs differently in larger veins.

### Tributary Treatment Sessions

Tributary treatments do not need to be done at the same time as saphenous vein treatments. However, all tributary varicose veins that are documented as being medically necessary to treat should be treated during the same session unless documented as medically contraindicated (e.g., pain, anesthesia risk, etc.). If more than one session is needed for medical reasons, treatment should be done in the fewest sessions possible. Separate requests will need to be made for additional treatments (after completion of initial treatment, including results).

Multiple tributaries can be treated in the same session and is the preferred method (CPT code 36471). Separate sessions each treating a single vein (CPT code 36470) is not needed. The need for multiple sessions treating multiple tributaries needs to be clearly documented for more than one session to be approved during the same request.

### Classification of Venous Disease

The standard classification of venous disease is the CEAP (Clinical, Etiologic, Anatomic, Pathophysiologic) classification system. Table PG1 provides is the Clinical portion of the CEAP.

**Table PG1. Clinical Portion of the CEAP Classification System**

Class	Definition
C <sub>0</sub>	No visible or palpable signs of venous disease
C <sub>1</sub>	Telangiectasies or reticular veins
C <sub>2</sub>	Varicose veins
C <sub>2r</sub>	Recurrent varicose veins
C <sub>3</sub>	Edema
C <sub>4</sub>	Changes in skin and subcutaneous tissue secondary to CVD
C <sub>4a</sub>	Pigmentation and eczema
C <sub>4b</sub>	Lipodermatosclerosis or atrophie blanche
C <sub>4c</sub>	Corona phlebectatica
C <sub>5</sub>	Healed
C <sub>6</sub>	Active venous ulcer
C <sub>6r</sub>	Recurrent active venous ulcer
S	Symptomatic
A	Asymptomatic

Adapted from: [https://www.jvsvenous.org/article/S2213-333X\(20\)30063-9/pdf](https://www.jvsvenous.org/article/S2213-333X(20)30063-9/pdf)

CVD, Chronic venous disease. Each clinical class subcharacterized by a subscript indicating the presence (symptomatic, s) or absence (asymptomatic, a) of symptoms attributable to venous disease.

CEAP: Clinical, Etiologic, Anatomic, Pathophysiologic classification system.

### Coding

All of the following are incidental to the primary procedure and not separately reimbursable:

- All imaging guidance and monitoring (Doppler or Duplex ultrasound, or fluoroscopy) performed during the procedure (surgery, sclerotherapy, ablation, etc.) or for the purpose of mapping
- Endovenous balloon isolation (balloon sclerotherapy) using a double lumen balloon catheter for sclerotherapy
- Injection procedures with or without automatic power injection
- Introduction of needles or catheters
- Local anesthesia
- Sedation
- Use of optical magnifying glasses (loupes)

- Vascular access including venipuncture
- Microfoam, standard foam or liquid sclerosants, and cyanoacrylate are included in the fees paid for the procedures and are not paid separately or in addition to procedure fees

There is no specific CPT code for transilluminated powered phlebectomy (TIPP). Providers may bill the following CPT codes:

Stab Phlebectomy:

- **37765**: Stab phlebectomy of varicose veins, 1 extremity; 10-20 stab incisions
- **37766**: Stab phlebectomy of varicose veins, 1 extremity; more than 20 incisions

Unlisted vascular surgery procedure:

- **37799**: Unlisted procedure, vascular surgery

There is no specific CPT code for stab phlebectomy of varicose veins in 1 extremity using 1-9 stab incisions. Providers may bill the following CPT code:

- **37799**: Unlisted procedure, vascular surgery

The following CPT codes are specific for non-compounded microfoam sclerotherapy:

- **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 (e.g., 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 (e.g., great saphenous vein, accessory saphenous vein), same leg

Providers may bill the unlisted vascular surgery procedure code 37799 or the following CPT codes describing sclerotherapy (liquid or standard foam sclerosant):

- **36468**: Injection(s) of sclerosant for spider veins (telangiectasia), limb or trunk
- **36470**: Injection of sclerosant; single incompetent vein (other than telangiectasia)
- **36471**: Injection of sclerosant; multiple incompetent veins (other than telangiectasia), same leg

The following CPT codes would be used for radiofrequency ablation and endovenous laser ablation:

- **36475**: Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, radiofrequency; first vein treated
- **36476**: Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, radiofrequency; 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**: Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, laser; subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)

Each code is specific for the requested vein. For example, if 36475 is requested for treatment of the GSV, this would include treatment both above and below the knee; if 36475 was requested for treatment above the knee, and 36476 for below the knee, only 36475 would be allowed. The same applies to 36478 and 36479.

There are CPT codes specific to mechanochemical ablation:

- **36473:** Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, mechanochemical; first vein treated
- **36474:** Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, mechanochemical; subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)

The following CPT codes are specific to endovenous ablation using chemical adhesive such as cyanoacrylate:

- **36482:** Endovenous ablation therapy of incompetent vein, extremity, by transcatheter delivery of a chemical adhesive (e.g., cyanoacrylate) remote from the access site, inclusive of all imaging guidance and monitoring, percutaneous; first vein treated
- **36483:** Endovenous ablation therapy of incompetent vein, extremity, by transcatheter delivery of a chemical adhesive (e.g., cyanoacrylate) remote from the access site, inclusive of all imaging guidance and monitoring, percutaneous; subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)

**Effective January 1, 2019**, the following Category III code is specific to the catheter-assisted vein sclerotherapy (KAVS) procedure:

- **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

## Description

A variety of treatment modalities are available to treat varicose veins/venous insufficiency, including surgery, thermal ablation, sclerotherapy, mechanochemical ablation (MOCA), cyanoacrylate adhesive (CAC), and cryotherapy. The application of each modality is influenced by the severity of the symptoms, type of vein, source of venous reflux, and the use of other (prior or concurrent) treatment.

## Related Policies

- N/A

## Benefit Application

Benefit determinations should be based in all cases on the applicable contract language. To the extent there are any conflicts between these guidelines and the contract language, the contract language will control. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

Some state or federal mandates (e.g., Federal Employee Program [FEP]) prohibits plans from denying Food and Drug Administration (FDA)-approved technologies as investigational. In these instances, plans may have to consider the coverage eligibility of FDA-approved technologies on the basis of medical necessity alone.

## Regulatory Status

In 2015, the VenaSeal Closure System (Sapheon, part of Medtronic) was approved by the U.S. Food and Drug Administration (FDA) through the premarket approval (P140018) process for the permanent closure of clinically significant venous reflux through endovascular embolization with

coaptation. The VenaSeal Closure System seals the vein using a cyanoacrylate adhesive agent. FDA product code: PJO.

In 2013, Varithena(R)(formerly Varisolve), a sclerosant microfoam made with a proprietary gas mix, was approved by the FDA under a new drug application (205-098) 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.

The following devices were cleared for marketing by the FDA through the 501(k) process for endovenous treatment of superficial vein reflux:

In 1999, the VNUS Closure(R) System, a radiofrequency device, was cleared by the FDA through the 510(k) process for "endovascular coagulation of blood vessels in patients with superficial vein reflux." In 2005, the VNUS RFS(R) and RFSFlex(R) devices were cleared by the FDA for "use in vessel and tissue coagulation including treatment of incompetent (i.e., refluxing) perforator and tributary veins." In 2008, the modified VNUS ClosureFast(R) Intravascular Catheter was cleared by the FDA through the 510(k) process. FDA product code: GEI.

In 2002, the Diomed 810 nm surgical laser and EVLT(R) (endovenous laser therapy) procedure kit were cleared by the FDA through the 510(k) process ".....for use in the endovascular coagulation of the great saphenous vein of the thigh in patients with superficial vein reflux." FDA product code: GEX.

In 2005, a modified Erbe Erbokryo cryosurgical unit (Erbe USA) was approved by the FDA for marketing. A variety of clinical indications are listed, including cryostripping of varicose veins of the lower limbs. FDA product code: GEH.

In 2003, the Trivex system (InaVein), a device for transilluminated powered phlebectomy, was cleared by the FDA through the 510(k) process for "ambulatory phlebectomy procedures for the resection and ablation of varicose veins." FDA product code: DNQ.

In 2008, the ClariVein Infusion Catheter (Vascular Insights) was cleared by the FDA through the 510(k) process (K071468) for mechanochemical ablation. The FDA determined that this device was substantially equivalent to 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. FDA product code: KRA

## Rationale

### Background

#### Venous Reflux/Venous Insufficiency

The venous system of the lower extremities consists of the superficial veins (this includes the great and small saphenous and accessory, or duplicate, veins that travel in parallel with the great and small saphenous veins), the deep system (popliteal and femoral veins), and perforator veins that cross through the fascia and connect the deep and superficial systems. One-way valves are present within all veins to direct the return of blood up the lower limb. Because the venous pressure in the deep system is generally greater than that of the superficial system, valve incompetence at any level may lead to backflow (venous reflux) with pooling of blood in superficial veins. Varicose veins with visible varicosities may be the only sign of venous reflux, although itching, heaviness, tension, and pain may also occur. Chronic venous insufficiency secondary to venous reflux can lead to thrombophlebitis, leg ulcerations, and hemorrhage. The CEAP classification of venous disease considers the clinical, etiologic, anatomic, and pathologic characteristics of venous insufficiency, ranging from class 0 (no visible sign of disease) to class 6 (active ulceration).

### Treatment of Saphenous Veins and Tributaries

Saphenous veins include the great and small saphenous and accessory saphenous veins that travel in parallel with the great or small saphenous veins. Tributaries are veins that empty into a larger vein. Treatment of venous reflux has traditionally included the following:

- Identification by preoperative Doppler ultrasonography of the valvular incompetence
- Control of the most proximal point of reflux, traditionally by suture ligation of the incompetent saphenofemoral or saphenopopliteal junction
- Removal of the superficial vein from circulation, e.g., by stripping of the great and/or small saphenous veins.
- Removal of varicose tributaries (at the time of the initial treatment or subsequently) by stab avulsion (phlebectomy) or injection sclerotherapy.

Minimally invasive alternatives to ligation and stripping have been investigated. They include forms of sclerotherapy, cyanocrylate adhesive, and thermal ablation using cryotherapy, high-frequency radio waves (200-300 kHz), or laser energy.

### Thermal Ablation

Radiofrequency ablation is performed using a specially designed catheter inserted through a small incision in the distal medial thigh to within 1 to 2 cm of the saphenofemoral junction. The catheter is slowly withdrawn, closing the vein. Laser ablation is performed similarly; a laser fiber is introduced into the great saphenous vein under ultrasound guidance; the laser is activated and slowly removed, along the course of the saphenous vein. Cryoablation uses extreme cold. The objective of endovenous techniques is to injure the vessel, causing retraction and subsequent fibrotic occlusion of the vein. Technical developments since thermal ablation procedures were initially introduced include the use of perivenous tumescent anesthesia, which allows successful treatment of veins larger than 12 mm in diameter and helps to protect adjacent tissue from thermal damage during treatment of the small saphenous vein.

### 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 chemical irritant), ultimately occluding the vessel. Treatment success depends on accurate injection of the vessel, an adequate injectate volume and concentration of sclerosant, and compression. Historically, larger veins and very tortuous veins were not considered good candidates for sclerotherapy due to technical limitations. Technical improvements in sclerotherapy have included the routine use of Duplex ultrasound to target refluxing vessels, luminal compression of the vein with anesthetics, and a foam/sclerosant injectate in place of liquid sclerosant. Foam sclerosants are produced by forcibly mixing a gas (e.g., air or carbon dioxide) with a liquid sclerosant (e.g., polidocanol or sodium tetradecyl sulfate). Physician-compounded foam is produced at the time of treatment. A commercially available microfoam sclerosant with a proprietary gas mix is available that is proposed to provide smaller and more consistent bubble size than what is produced with physician-compounded sclerosant foam.

### Endovenous Mechanochemical Ablation

Endovenous mechanochemical ablation uses 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 sulfate) is infused near the rotating wire. It is proposed that mechanical ablation allows for better efficacy of the sclerosant, and results in less pain and risk of nerve injury without the need for the tumescent anesthesia used with endovenous thermal ablation techniques (radiofrequency ablation, endovenous laser ablation).

### **Cyanoacrylate Adhesive**

A cyanoacrylate adhesive is a clear, free-flowing liquid that polymerizes in the vessel via an anionic mechanism (i.e., polymerizes into a solid material on contact with body fluids or tissue). 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 surgical incisions or other skin wounds.

### **Transilluminated Powered Phlebectomy**

Transilluminated powered phlebectomy is an alternative to stab avulsion and hook phlebectomy. This procedure uses two instruments: an illuminator, which also provides irrigation, and a resector, which has an oscillating tip and suction pump. Following removal of the saphenous vein, the illuminator is introduced via a small incision in the skin and tumescence solution (anesthetic and epinephrine) is infiltrated along the course of varicosity. The resector is then inserted under the skin from the opposite direction, and the oscillating tip is placed directly beneath the illuminated veins to fragment and loosen the veins from the supporting tissue. Irrigation from the illuminator is used to clear the vein fragments and blood through aspiration and additional drainage holes. The illuminator and resector tips may then be repositioned, thereby reducing the number of incisions needed when compared with stab avulsion or hook phlebectomy. It has been proposed that transilluminated powered phlebectomy might decrease surgical time, decrease complications such as bruising and lead to a faster recovery than established procedures.

### **Literature Review**

Evidence reviews assess the clinical evidence to determine whether the use of technology improves the net health outcome. Broadly defined, health outcomes are the length of life, quality of life, and ability to function including benefits and harms. Every clinical condition has specific outcomes that are important to patients and managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens; and whether the magnitude of that change is clinically significant. The net health outcome is a balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of technology, two domains are examined: the relevance, and quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy; however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

### **Treatment of Saphenous Veins**

#### **Clinical Context and Therapy Purpose**

Treatment of venous reflux/venous insufficiency seeks to reduce abnormal pressure transmission from the deep to the superficial veins. Conservative medical treatment consists of elevation of the extremities, graded compression, and wound care when indicated. Conventional surgical treatment consists of identifying and correcting the site of reflux by ligation of the incompetent junction followed by stripping of the vein to redirect venous flow through veins with intact valves. While most venous reflux is secondary to incompetent valves at the saphenofemoral or saphenopopliteal junctions, reflux may also occur at incompetent valves in the perforator veins or the deep venous system. The competence of any single valve is not static and may be



pressure-dependent. For example, accessory saphenous veins may have independent saphenofemoral or saphenopopliteal junctions that become incompetent when the great or small saphenous veins are eliminated, and blood flow is diverted through the accessory veins.

The following section addresses the efficacy of the conventional treatments, specifically on the appropriate length of a trial of compression therapy and evaluation of recurrence rates for surgical treatment (i.e., ligation and stripping) compared with compression therapy.

### Compression Therapy

A Cochrane review by O'Meara et al (2009) evaluated compression for venous leg ulcers included 39 RCTs with 47 different comparisons.<sup>1</sup> This review was updated in 2012 and included 48 RCTs with 59 different comparisons.<sup>2</sup> Most RCTs were small. Measures of healing were the time to complete healing, the proportion of ulcers healed within the trial period (typically 12 weeks), the change in ulcer size, and the rate of change in ulcer size. Evidence from eight trials indicated that venous ulcers healed more rapidly with compression than without. Findings suggested that multicomponent systems (bandages or stockings) were more effective than single-component compression. Also, multicomponent systems containing an elastic bandage appeared more effective than those composed mainly of inelastic constituents. Although these meta-analyses did not include time to healing, studies included in the review reported the mean time to ulcer healing was approximately two months, while the median time to healing in other reports was three to five months.

A Cochrane review by Shingler et al (2011) assessed compression stockings as initial treatment for varicose veins in patients without venous ulceration.<sup>3</sup> Selected were 7 studies involving 356 participants with varicose veins without healed or active venous ulceration (CEAP [Clinical, Etiology, Anatomy, Pathophysiology] class C2-C4). Six studies compared different types or pressures of stockings. Subjectively, participants' symptoms improved, but results were not compared with a control arm. Due primarily to inadequate reporting, the methodologic quality of the selected trials was unclear. Meta-analyses were not performed due to inadequate reporting and suspected heterogeneity. Reviewers concluded that there was insufficient high-quality evidence to determine whether compression stockings were effective as the sole and initial treatment of varicose veins in patients without venous ulceration, or whether any type of stocking was superior to another type.

### Ligation and Stripping

Systematic literature reviews have indicated a similar healing rate of venous ulcers with superficial vein surgery and conservative compression treatments but a reduction in ulcer recurrence rate with surgery.<sup>4,5</sup> In general, recurrence rates after ligation and stripping are estimated at 20% in short-term follow-up. Jones et al (1996) reported on the results of a trial that randomized 100 patients with varicose veins to ligation alone or ligation plus stripping.<sup>6</sup> At 1 year, reflux was detected in 9% of patients, rising to 26% at 2 years. Rutgers and Kitslaar (1994) reported on the results of a trial that randomized 181 limbs to ligation and stripping or to ligation plus sclerotherapy.<sup>7</sup> At 2 years, Doppler ultrasound demonstrated reflux in approximately 10% of patients after ligation and stripping, increasing to 15% at 3 years.

### Alternatives to Ligation and Stripping

The purpose of endovenous thermal ablation (radiofrequency or laser), microfoam sclerotherapy, mechanochemical ablation (MOCA), cyanoacrylate adhesive (CAC), or cryoablation in patients who have varicose veins/venous insufficiency and saphenous vein reflux is to provide a treatment option that is an alternative to or an improvement on existing treatments.

The question addressed in this evidence review is: Do these alternative treatments improve the net health outcome in individuals who have varicose veins/venous insufficiency and saphenous vein reflux?

The following PICO was used to select literature to inform this review.

### **Patients**

The relevant populations of interest are those who have varicose veins/venous insufficiency and saphenous vein reflux.

### **Interventions**

The therapies being considered are endovenous thermal ablation (radiofrequency or laser), microfoam sclerotherapy, mechanochemical ablation, cyanoacrylate adhesive, or cryoablation.

### **Comparators**

Established treatments for varicose veins/venous insufficiency and saphenofemoral junction reflux are conservative therapy with compression bandages and ligation and stripping, with which the endovenous thermal procedures are compared. The less invasive endovenous thermal ablation (radiofrequency or laser) have become the standard treatments by which the newer treatments are compared. Endovenous thermal ablation techniques require tumescent anesthesia, which involves multiple injections along the vein and is associated with moderate pain. Compression stockings and avoidance of strenuous activities are recommended. Procedures that have more recently been developed (MOCA, CAC, and cryotherapy) do not require tumescent anesthesia are now compared with the thermal ablation procedures.

### **Outcomes**

Outcomes of interest for venous interventions include 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 the durability of endovenous and surgical procedures are complicated by these mechanisms of recurrence. Relevant safety outcomes include the incidence of paresthesia, thermal skin injury, thrombus formation, thrombophlebitis, wound infection, and transient neurologic effects.

Specific measures may include the visual analog score (VAS) for pain, the Venous Clinical Severity Score (VCSS), and the Aberdeen Varicose Veins Questionnaire (AVVQ). AVVQ scores range from 0 to 100 (worst possible quality of life). Follow-up at one and two years from RCTs is of interest to monitor treatment success (vein occlusion and recanalization), with follow-up to five years to assess durability of the treatment.

### **Study Selection Criteria**

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse effects, single-arm studies that capture longer periods of follow up and/or larger populations were sought.
- Studies with duplicative or overlapping populations were excluded.

## **Treatment of Saphenous Veins: Endovenous Thermal Ablation (Laser or Radiofrequency) Review of Evidence**

### **Systematic Reviews**

A Cochrane review by Nesbitt et al (2014) compared endovenous ablation (radiofrequency and laser) with foam sclerotherapy or ligation and stripping for saphenous vein varices.<sup>8</sup> Included in the review were 13 randomized studies (total n=3081 patients). The overall quality of the evidence was moderate. There was no significant difference between

sclerotherapy and surgery in the rate of recurrence, as rated by clinicians (odds ratio [OR], 1.74;  $p=0.06$ ) or for symptomatic recurrence (OR=1.28). For endovenous laser ablation vs surgery, there were no significant differences between the treatment groups for clinician-reported or symptomatic recurrence, or for recanalization. Neovascularization and technical failure were reduced in the laser group (OR=0.05,  $p<0.001$ ; OR=0.29,  $p<0.001$ , respectively). For endovenous radiofrequency ablation (RFA) versus surgery, there were no significant differences between groups in clinician-reported recurrence, recanalization, neovascularization, or technical failure. Reviewers concluded that sclerotherapy, endovenous laser ablation, and RFA are at least as effective as surgery in the treatment of great saphenous varicose veins.

A Cochrane review by Paravastu et al (2016) compared endovenous laser ablation or RFA with surgical repair for short saphenous veins with reflux at the saphenopopliteal junction.<sup>9</sup> Three RCTs identified compared endovenous laser ablation with surgery. There was moderate-quality evidence that recanalization or persistence of reflux at 6 weeks occurred less frequently after endovenous laser ablation than after surgery (OR=0.07; 95% confidence interval [CI], 0.02 to 0.22), and low-quality evidence that recurrence of reflux was lower after endovenous laser ablation at 1 year (OR=0.24; 95% CI, 0.07 to 0.77).

### Randomized Controlled Trials

The largest RCT was reported by Brittenden et al (2014) and compared foam sclerotherapy, endovenous laser ablation, and surgical treatment in 798 patients.<sup>10</sup> The trial was funded by the U.K.'s National Institute for Health Research. Veins greater than 15 mm in diameter were excluded from the trial. At the 6-week follow-up visit, patients assigned to treatment with foam or laser had the option of treatment with foam for any residual varicosities; this optional treatment was performed in 38% of patients in the foam group and 31% of patients in the endovenous laser ablation group. 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 for the laser group (1%).

The 2012 Comparable effectiveness of endovenous laser ablation and high ligation with stripping of the great saphenous vein (RELACS) study randomized 400 patients to endovenous laser ablation performed by a surgeon at 1 site or to ligation and stripping performed by a different surgeon at a second location.<sup>11</sup> At two-year follow-up, there were no significant differences between groups for clinically recurrent varicose veins, medical condition measured on the Homburg Varicose Vein Severity Score, or disease-related quality of life. Saphenofemoral reflux was detected by ultrasonography more frequently after endovenous laser treatment (17.8% vs 1.3%). The follow-up rate at five years was 81%.<sup>12</sup> Same-site recurrences were more frequent in the endovenous laser ablation group (18% with endovenous laser ablation vs 5% with surgery,  $p=0.002$ ), but different-site recurrences were more frequent in the surgically treated group (50% with surgery vs 31% with endovenous laser ablation,  $p=0.002$ ). Overall, there was no significant difference in recurrence rates between groups. There were also no significant differences between groups in disease severity or quality of life at five years.

Christenson et al (2010) compared endovenous laser ablation with ligation and stripping in 200 limbs (100 in each group).<sup>13</sup> At 1-year follow-up, 98% of the limbs were reported to be free of symptoms. At two-year follow-up, the endovenous laser ablation group had two veins completely reopened and five partially reopened, which was significantly greater than in the ligation and stripping group. In the 2013 Comparative Study of the Treatment of Insufficient Greater Saphenous Vein: Surgery vs Ultrasound Guided Sclerotherapy With Foam and Endovenous Laser Therapy (MAGNA) trial, 223 consecutive patients (240 legs) with great saphenous vein reflux were randomized to endovenous laser ablation, ligation and stripping, or foam sclerotherapy.<sup>14</sup> At one-year follow-up, the anatomic success rates were similar for endovenous laser ablation (88.5%) and stripping (88.2%), which were both superior to foam sclerotherapy (72.2%). Ten percent of the stripping group showed neovascularization. At five years, health-related quality of life and CEAP classification improved in all groups with no significant differences among them.<sup>15</sup> Grade I neovascularization was higher in the

conventional surgery group (27% vs 3%,  $p < 0.001$ ), while grade II neovascularization did not differ significantly between surgical (17%) and endovenous laser ablation (13%) groups.

Wallace et al (2018) published the five-year outcomes of an RCT consisting of endovenous laser ablation compared with conventional surgery for great saphenous varicose veins comparing surgery and endovenous laser ablation (EVLA) as treatments for symptomatic great saphenous varicose veins.<sup>16</sup> Data from 218 patients were available at 5-year follow-up. The clinical recurrence rate was 34.4% for the surgery group and 20.9% for EVLA ( $p = 0.010$ ). Patients-quality of life, assessed using EuroQol Five Dimensions (EQ-5D) and AVVQ, was significantly improved from baseline for both surgery (EQ-5D: 0.859 to 1.0,  $p = 0.002$ ; AVVQ: 13.69 to 4.59,  $p < 0.001$ ) and EVLA (EQ-5D: 0.808 to 1.0,  $p = 0.002$ ; AVVQ: 12.73 to 3.35,  $p < 0.001$ ). Technical success assessed by duplex ultrasound examination was 85.4% for surgery and 93.2% for EVLA ( $p = 0.074$ ).

The primary limitation of all of the studies was the lack of blinding.

**Table 1. Summary of Key RCT Characteristics**

Study; Trial	Countries	Sites	Dates	Participants	Interventions	
					Active	Comparator
Brittenden (2014) <sup>10</sup>	UK	11	2008-2012	Individuals with primary varicose veins	Foam sclero-therapy (n=286) or EVLA (n=210)	Surgical treatment (n=289)
Rass (2012); <sup>11</sup> RELACS	US	2	2004-2007	Individuals with GSV insufficiency	EVLA (n=185)	Surgical treatment (n=161)
Wallace (2018) <sup>16</sup>	UK	1	2004-2009 <sup>1</sup>	Individuals with GSV insufficiency	EVLA (n=108)	Surgical treatment (n=110)

RCT: randomized controlled trial; GSV: great saphenous vein; EVLA: endovenous laser ablation.

<sup>1</sup> Date of original intervention study

**Table 2. Summary of Key RCT Results**

Study	AVVQ Score at Baseline;6 Months	Frequency of Procedural Complications	Rate of Same-Site Recurrence	Clinically Recurrent Varicose Veins	AVVQ Score at Baseline;5 years
Brittenden (2014) <sup>10</sup>					
Foam	17.69.9; 9.17.9	6%			
Laser	17.89.1; 7.98.4	1%			
Surgery	18.29.1; 7.87.5	7%			
P-value		<0.001			
Rass (2012) <sup>11</sup> RELACS					
Laser			18%	16.2%	
Surgery			5%	23.1%	
P-value			0.002	0.15	
Wallace (2018)					
Laser				20.9%	13.69; 4.59
Surgery				34.3%	12.73; 3.35
P-value				0.010	<0.001

AVVQ: Aberdeen Varicose Veins Questionnaire; RCT: randomized controlled trial; RELACS: A prospective, Randomised, two-centre study to evaluate surgical treatments of great saphenous vein insufficiency; Endovenous LASer treatment versus Crossectomy and Stripping.

The literature on the isolated treatment of the anterior accessory saphenous vein is limited. In a study by Theivacumar et al (2009), outcomes from a cohort of 33 patients who underwent endovenous laser ablation of the anterior accessory saphenous vein were compared with 33 matched controls undergoing endovenous laser ablation of the great saphenous vein.<sup>17</sup> For 21 (64%) of the patients in the accessory saphenous vein group, there had been no previous

treatment of the great 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. AVVQ scores had improved in both groups, with no significant difference between them. Patient satisfaction scores were also similar.

### **Subsection Summary: Endovenous Thermal Ablation (Laser or Radiofrequency)**

There are multiple large RCTs and systematic reviews of RCTs assessing endovenous ablation using radiofrequency or laser energy of the saphenous veins. Comparison with ligation and stripping at 2- to 5-year follow-up has indicated similar recurrence rates for the different treatments. Evidence has suggested that ligation and stripping may lead to neovascularization, while thermal ablation may lead to recanalization, resulting in similar outcomes for endovenous thermal ablation and surgery. Laser ablation and RFA have similar success rates.

### **Treatment of Saphenous Veins: Sclerotherapy Physician-Compounded Sclerotherapy**

#### **Review of Evidence**

Hamann et al (2017) conducted a meta-analysis of RCTs reporting 5-year follow-up.<sup>18</sup> The meta-analysis (3 RCTs, 10 follow-up studies) included 611 legs treated with endovenous laser ablation, 549 treated with high ligation and stripping, 121 with sclerotherapy, and 114 with high ligation and endovenous laser ablation. Ultrasound-guided sclerotherapy had significantly worse outcomes than the other 3 treatments, with anatomic success rates of 34% for sclerotherapy compared with 83% to 88% for the other 3 treatments ( $p < 0.001$ ).

In the 2013 MAGNA trial (previously described), 223 consecutive patients (240 legs) with great saphenous vein reflux were randomized to endovenous laser ablation, ligation and stripping, or physician-compounded foam sclerotherapy (1 mL aethoxysclerol 3%: 3 cc air).<sup>14</sup> At 1-year follow-up, the anatomic success rate of foam sclerotherapy (72.2%) was inferior to both endovenous laser ablation (88.5%) and stripping (88.2%). Twenty-one patients in the sclerotherapy group had partial occlusion with reflux, though the clinical complaint was completely relieved. At 5-year follow-up, obliteration or absence of the great saphenous vein was observed in only 23% of patients treated with sclerotherapy compared with 85% of patients who underwent conventional surgery and 77% of patients who underwent endovenous laser ablation.<sup>15</sup> 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 endovenous laser ablation groups. However, clinically relevant grade II neovascularization was higher in the conventional surgery (17%) and endovenous laser ablation (13%) groups than in the sclerotherapy group (4%). EQ-5D scores improved equally in all groups.

Vahaaho et al (2018) published a study looking at the 5-year follow-up of patients with symptomatic great saphenous vein (GSV) insufficiency.<sup>19</sup> Between 2008 and 2010, 166 individuals were randomized to receive open surgery, EVLA, or ultrasound-guided foam sclerotherapy. The GSV occlusion rate was 96% (95% CI: 91-100%) for open surgery, 89% (95% CI: 82-98%) for EVLA, and 51% (95% CI: 38-64%) for ultrasound-guided foam sclerotherapy ( $p < 0.001$ ). For patients with no additional treatment during follow-up, occlusion rates for open surgery, EVLA, and ultrasound-guided foam sclerotherapy were 96%, 89%, and 41%, respectively. The study was limited by the lack of blinding and by non-standardized foam application.

A noninferiority trial by Shadid et al (2012) compared foam sclerotherapy with ligation and stripping in 430 patients.<sup>20</sup> The analysis was per protocol. Forty (17%) patients had repeat sclerotherapy. At 2 years, the probability of clinical recurrence was similar in both 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. Two serious adverse events in the sclerotherapy group (deep venous thrombosis, pulmonary emboli) occurred within one week of treatment. Lam et al (2018) reported 8-year follow-up with 53% of the patients in the original trial.<sup>21</sup> All measures of treatment success (e.g.,

symptomatic GSV reflux, saphenofemoral junction failure, and recurrent reflux in the GSV) were lower in the physician-compounded sclerotherapy group compared to the ligation and stripping group.

### **Microfoam Sclerotherapy**

#### **Review of Evidence**

In 2013, polidocanol (Varithena) microfoam was approved under a new drug application for the treatment of varicose veins. Efficacy data derived from two randomized, blinded, multicenter studies.<sup>22</sup> One compared polidocanol at 0.5%, 1.0%, and 2.0% with endovenous placebo or a subtherapeutic dose of polidocanol foam. The primary endpoint was an improvement in symptoms at week eight, as measured by the Varicose Vein Symptoms Questionnaire. The improvement in symptoms was greater in the pooled polidocanol treatment group ( $p < 0.001$ ) and in each of the individual dose-concentration groups compared with vehicle alone. Secondary and tertiary endpoints (appearance, duplex ultrasound response, quality of life) were also significantly better for the polidocanol groups compared with controls. This second study, called to evaluate the efficacy and safety of polidocanol endovenous microfoam 0.5% and 1.0% compared to placebo for the treatment of saphenofemoral junction incompetence (VANISH-2), was published by Todd et al (2014)<sup>23</sup>. At the 8-week assessment, there was 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% of patients in the 0.125% group, and 1.8% of the placebo group. Analysis of data from both studies showed a dose-response from 0.5% to 2.0% for improvement in appearance and from 0.5% to 1.0% for Duplex responders. The polidocanol 1.0% dose was selected for the U.S. Food and Drug Administration (FDA) approval. Safety analysis found deep vein thrombosis detected by ultrasound in 2.8% of polidocanol-treated patients, with 1% of patients having proximal symptomatic thrombi; these patients were treated with anticoagulants. There was no sign of an increase in neurologic adverse events, and there were no adverse cardiac or cardiopulmonary effects following treatment with polidocanol injectable foam. Rates of occlusion with Varithena are similar to those reported for endovenous laser ablation or stripping. A randomized trial comparing endovenous laser ablation and stripping with this new preparation of foam sclerotherapy is needed to evaluate its comparative effectiveness. Evaluation out to five years is continuing.

Vasquez et al (2017) reported on a double-blinded RCT that evaluated the addition of polidocanol microfoam to endovenous thermal ablation.<sup>24</sup> A total of 117 patients who were candidates for both endovenous thermal ablation and treatment of visible varicosities received endovenous thermal ablation plus placebo ( $n=38$ ) or polidocanol 0.5% ( $n=39$ ) or 1% ( $n=40$ ). At 8-week follow-up, physician-blinded vein appearance was significantly better with the combined polidocanol groups ( $p=0.001$ ), but the improvement in patient ratings was not statistically significant. At 6-month follow-up, the percentages of patients who achieved a clinically meaningful change were significantly higher in both physician (70.9% vs 42.1%,  $p=0.001$ ) and patient (67% vs 50%,  $p=0.034$ ) ratings. The proportion of patients who received additional treatment for residual varicosities between week 8 and month 6 was modestly reduced (13.9% for the polidocanol vs 23.7% for placebo,  $p=0.037$ ).

#### **Subsection Summary: Sclerotherapy**

For physician-compounded sclerotherapy, there is high variability in success rates of the procedure and some reports of serious adverse events. Results of a noninferiority trial of physician-compounded sclerotherapy indicated that once occluded, recurrence rates at two years are similar to those of ligation and stripping. By comparison, rates of occlusion with the FDA-approved microfoam sclerotherapy (polidocanol 1%) are similar to those reported for endovenous laser ablation or stripping.

## Treatment of Saphenous Veins: Mechanochemical Ablation Review of Evidence

### Randomized Trials

Four RCTs with over 100 patients each (range, 132 to 213) have been identified that compared MOCA to thermal ablation. Study characteristics and study results are presented in Tables 3 and 4. Study limitations are described in Tables 5 and 6.

Two publications (Bootun et al [2016], Lane et al [2017]) reported on early results from an RCT of 170 patients that compared ClariVein with RFA.<sup>25,26</sup> Maximum visual analog scale pain scores (out of 100) during the procedure were significantly lower in the MOCA group (median, 15 mm) than in the RFA group (median, 34 mm;  $p=0.003$ ). Average visual analog scale pain scores during the procedure were also modestly lower in the MOCA group (median, 10 mm) than in the RFA group (median, 19.5 mm;  $p=0.003$ ). Occlusion rates, clinical severity scores, disease-specific quality of life, and generic quality of life scores were similar between groups at one and six months. Limitations of this study are described in Tables 5 and 6. Only 71% of patients were available for follow-up at 6 months, limiting the evaluation of closure rates at this time point (see Table 6).

Vahaaho et al (2019) reported an RCT that compared MOCA with endovenous thermal ablation (EVLA or RFA).<sup>19</sup> Liquid sclerosant at a concentration of 1.5% was used. Out of 132 patients enrolled, 7 patients were later excluded and 117 (88.6%) attended the 1-year follow-up evaluation. Occlusion of the great saphenous vein was observed in 45 of 55 (82%) of the MOCA group compared to 100% of the EVLA and RFA groups ( $p=0.002$ ). Another randomized trial (Lam et al [2016]) reported interim results of a dose-finding study, finding greater closure with use of polidocanol 2% or 3% (liquid) than with polidocanol 1%.<sup>27</sup> Therefore, it is uncertain whether the concentration of sclerosant in the study by Vahaaho et al (2019) was optimal (see Table 5).

Three percent polidocanol was tested in the Mechanochemical endovenous Ablation to RADiOfrequeNcy Ablation (MARADONA) non-inferiority trial reported by Holewijn et al (2019).<sup>28</sup> Although the study was powered for 400 participants, only 213 patients 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 1 year and approached significance at 2-years; with the note that the study was underpowered for anatomic failures because of the early stoppage of the study. At 1 and 2-years, clinical and quality of life outcomes were similar in the two groups.

A fourth RCT reported by Mohamed et al (2020) is the ongoing Randomised Clinical Trial Comparing Endovenous Laser Ablation and Mechanochemical Ablation (ClariVein) in the Management of Superficial Venous Insufficiency (LAMA).<sup>29</sup> Patients ( $n=150$ ) were randomized to MOCA with 1.5% sodium tetradecyl sulfate or to EVLA. Anatomic success (occlusion) rates were lower in the MOCA group 77% compared to the EVLA group (91%) with no significant difference between the 2 treatments in intraprocedural pain scores. In contrast to the difference in anatomical occlusion rates, clinical severity and quality of life scores were not significantly different between the groups at 1 year follow-up. Follow-up is continuing to evaluate durability of the treatments.

**Table 3. Summary of Key RCT Characteristics**

Study; Trial	Countries	Sites	Dates	Participants	Interventions	
					Active	Comparator
Bootun et al (2016), <sup>25</sup> Lane et al (2017) <sup>26</sup>				170 patients with varicose veins	MOCA	RFA
Vahaaho et al (2019) <sup>19</sup>				132 patients with varicose veins	MOCA with 1.5% polidocanol	Thermal ablation (EVLA or RFA)

Study; Trial	Countries	Sites	Dates	Participants	Interventions	
Holewijn et al (2019) <sup>28</sup> . (MARADONA)	E.U.	4	2012-2015	213 patients with GSV incompetence and CEAP C2 - C5	MOCA wit 2 mL of 3% polidocanol for the first 10 to 15 cm and 1.5% polidocanol for the remainder	RFA
Mohamed et al (2020) <sup>29</sup> . LAMA	U.K.	1	2015-2018	150 patients with symptomatic superficial venous incompetence CEAP grades 2 to 6	MOCA (n=75) with 1.5% sodium tetradecyl sulfate	EVLA (n=75)

EVLA: endovenous laser ablation; CEAP: clinical etiologic anatomic pathological; GSV: Great saphenous vein; LAMA: A Randomised Clinical Trial Comparing Endovenous Laser Ablation and Mechanochemical Ablation (ClariVein) in the Management of Superficial Venous Insufficiency;

MOCA: mechanochemical ablation; RCT: randomized controlled trial; RFA: radiofrequency ablation.

**Table 4. Summary of Key RCT Results**

Study	Pain	Post-procedure Occlusion Rate	Occlusion Rate at Follow-up	Clinical Severity	Clinical Severity at Follow-up		Quality of Life
Booton (2016), <sup>25</sup> Lane (2017) <sup>26</sup> .	During Procedure - VAS		6 mo occlusion rates				
N			71%			71%	
MOCA	10 mm						
RFA	19.5 mm						
p-value	0.003	NS	NS	NS	NS	NS	NS
Vahaaho (2019) <sup>19</sup> .			1 yr			1 yr	
N			117 (88.6%)			117 (88.6%)	
MOCA			45 of 55 (82%)				
EVLA or RFA			100%				
p-Value			0.002				
Holewijn et al (2019) <sup>28</sup> . MARADONA	For 14 days after the procedure median (range)	30 day failure rate	1 yr recanalization rate	2 yr recanalization rate	1 yr VCSS	2 yr VCSS	AVVQ improved
N			153 (72%)	157 (73%)	153 (72%)	157 (73%)	
MOCA	0.2 (0.0-0.8)	5 (4.9%)	15 (16.5%)	21 (20%)	1.8	1.0	88%
RFA	0.5 (0.2-1.3)	1 (1%)	5 (5.8%)	12 (11.7%)	1.7	1.0	89%
p-Value	0.01	0.10	0.025	0.066	0.695	0.882	0.90
Mohamed et al (2020) <sup>29</sup> . LAMA	Median (IQR)		Occlusion at 1 yr		VCSS		AVVQ Median (IQR)
N			138 (92%)				
MOCA	15 (9-29)		53/69 (77%)				2.0 (0.0-5.3)
EVLA	22 (9-44)		63/69 (91%)				2.0 (0.0-4.8)
p-Value	0.21		0.020		NS		NS

AVVQ: Aberdeen varicose vein questionnaire; EVLA: endovenous laser ablation; IQR: intraquartile range; LAMA: A Randomised Clinical Trial Comparing Endovenous Laser Ablation and Mechanochemical Ablation (ClariVein) in the Management of Superficial Venous Insufficiency

MARADONA: Mechanochemical endovenous Ablation to RADiOfrequeNcy Ablation; MOCA: mechanochemical ablation; NS: not significant; RCT: randomized controlled trial; RFA: radiofrequency ablation; VAS: visual analog scale.; VCSS: venous clinical severity score



**Table 5. Study Relevance Limitations**

Study	Population <sup>a</sup>	Intervention <sup>b</sup>	Comparator <sup>c</sup>	Outcomes <sup>d</sup>	Follow-Up <sup>e</sup>
Bootun et al (2016); <sup>25</sup> Lane et al (2017) <sup>26</sup> .				1.Primary outcome was pain during the procedure	1. Outcomes only out to 6 mo, which is insufficient to assess durability
Vahaaho et al (2019) <sup>19</sup> .	4. Strict inclusion criteria that may not be representative of intended use.	3. The concentration of sclerosant (1.5% polidocanol) may not have been optimal.			1. Outcomes only out to 1 yr, which is insufficient to assess durability
Holewijn et al (2019) <sup>28</sup> . (MARADONA)	4. Patients with bilateral reflux were excluded due to dosing limits of polidocanol				
Mohamed et al (2020) LAMA <sup>29</sup> .					1. Outcomes out to 1 yr, follow-up is continuing

LAMA: A Randomised Clinical Trial Comparing Endovenous Laser Ablation and Mechanochemical Ablation (ClariVein) in the Management of Superficial Venous Insufficiency; MARADONA: Mechanochemical endovenous Ablation to RADiOfrequeNcy Ablation

The study limitations stated in this table are those notable in the current review; this is not a comprehensive limitations assessment.

<sup>a</sup> Population key: 1. Intended use population unclear; 2. Clinical context is unclear; 3. Study population is unclear; 4. Study population not representative of intended use.

<sup>b</sup> Intervention key: 1. Not clearly defined; 2. Version used unclear; 3. Delivery not similar intensity as comparator; 4. Not the intervention of interest.

<sup>c</sup> Comparator key: 1. Not clearly defined; 2. Not standard or optimal; 3. Delivery not similar intensity as intervention; 4. Not delivered effectively.

<sup>d</sup> Outcomes key: 1. Key health outcomes not addressed; 2. Physiologic measures, not validated surrogates; 3. No CONSORT reporting of harms; 4. Not establish and validated measurements; 5. Clinical significant difference not prespecified; 6. Clinical significant difference not supported.

<sup>e</sup> Follow-Up key: 1. Not sufficient duration for benefit; 2. Not sufficient duration for harms.

**Table 6. Study Design and Conduct Limitations**

Study	Allocation <sup>a</sup>	Blinding <sup>b</sup>	Selective Reporting <sup>c</sup>	Follow-Up <sup>d</sup>	Power <sup>e</sup>	Statistical <sup>f</sup>
Bootun et al (2016); <sup>25</sup> Lane et al (2017) <sup>26</sup> .		1. Patients not blinded to treatment (assessors of duplex ultrasound were blinded)		1. There was high loss to follow-up (76% at 1 mo and 71% follow-up at 6 mo)		
Vahaaho et al (2019) <sup>19</sup> .		1, 2, 3. Patients, surgeons, and assessors were not blinded to treatment				
Holewijn et al (2019) <sup>28</sup> . (MARADONA)		1, 2, 3. Patients, surgeons, and assessors were not blinded to treatment			3. Underpowered for anatomic success due to early termination of recruitment	4. Results of non-inferiority analysis were not reported

Study	Allocation <sup>a</sup>	Blinding <sup>b</sup>	Selective Reporting <sup>c</sup>	Follow-Up <sup>d</sup>	Power <sup>e</sup>	Statistical <sup>f</sup>
Mohamed et al (2020) LAMA <sup>29</sup>		1, 2, 3. Patients, surgeons, and assessors were not blinded to treatment				2. 14 day pain scores were not analyzed by repeated measures ANOVA

ANOVA: analysis of variance; LAMA: A Randomised Clinical Trial Comparing Endovenous Laser Ablation and Mechanochemical Ablation (ClariVein) in the Management of Superficial Venous Insufficiency; MARADONA: Mechanochemical endovenous Ablation to RADiOfrequeNcy Ablation  
The study limitations stated in this table are those notable in the current review; this is not a comprehensive limitations assessment.

<sup>a</sup> Allocation key: 1. Participants not randomly allocated; 2. Allocation not concealed; 3. Allocation concealment unclear; 4. Inadequate control for selection bias.

<sup>b</sup> Blinding key: 1. Not blinded to treatment assignment; 2. Not blinded outcome assessment; 3. Outcome assessed by treating physician.

<sup>c</sup> Selective Reporting key: 1. Not registered; 2. Evidence of selective reporting; 3. Evidence of selective publication.

<sup>d</sup> Follow-Up key: 1. High loss to follow-up or missing data; 2. Inadequate handling of missing data; 3. High number of crossovers; 4. Inadequate handling of crossovers; 5. Inappropriate exclusions; 6. Not intent to treat analysis (per protocol for noninferiority trials).

<sup>e</sup> Power key: 1. Power calculations not reported; 2. Power not calculated for primary outcome; 3. Power not based on clinically important difference.

<sup>f</sup> Statistical key: 1. Intervention is not appropriate for outcome type: (a) continuous; (b) binary; (c) time to event; 2. Intervention is not appropriate for multiple observations per patient; 3. Confidence intervals and/or p values not reported; 4. Comparative treatment effects not calculated.

### Prospective Cohort Studies

A prospective cohort study that had 5 year follow-up was reported by Thierens et al (2019).<sup>30</sup> Study inclusion criteria are described in Table 7. Anatomic and clinical follow-ups were performed at 4 weeks, 6 months, and 1, 3, and 5 years after the procedure (Table 8). With slightly less than half of the participants remaining in the study through 5 years, 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. For example, there has been an increase in the concentration of sclerosant over time. 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.<sup>28</sup> 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.

**Table 7. Summary of Prospective Cohort Study Characteristics**

Study	Country	Participants	Treatment Delivery	Follow-Up
Thierens et al, (2019) <sup>30</sup>	Netherlands	C2 to C5 varicose veins, GSV diameter of 3 to 12 mm and primary GSV insufficiency determined by duplex ultrasound examination	MOCA with 2% polidocanol as sclerosant	5 yr

GSV: Great saphenous vein; MOCA: mechanochemical ablation

**Table 8. Summary of Prospective Cohort Study Results**

Outcome Measure	Baseline	1 yr	3 yr	5 yr
Thierens et al, (2019) <sup>30</sup>	n=94	90	71	58
Freedom from anatomic failure (SE)		85.6% (0.033)	80.1% (0.039)	78.7% (0.041)
AVVQ score	8.9	2.3	5.6	6.3
VCSS score	4.0	1.0	1.0	2.0

Outcome Measure	Baseline	1 yr	3 yr	5 yr
Clinical improvement		80%	74%	65%

AVVQ: Aberdeen varicose vein questionnaire; MOCA: mechanochemical ablation; VAS: visual analog scale.; VCSS: venous clinical severity score; SE: standard error

### Subsection Summary: Mechanochemical Ablation

MOCA is a combination of liquid sclerotherapy and mechanical abrasion of the lumen. The evidence on MOCA includes 4 RCTs that compared MOCA to thermal ablation with 6 mo to 2 yr results, a prospective cohort with follow-up out to 5 years, and retrospective case series. Results to date have been mixed regarding a reduction in intraprocedural pain, which is a proposed benefit of MOCA compared to thermal ablation procedures. Occlusion rates at 6 mo to 2 years in the RCTs indicate lower anatomic success rates compared to thermal ablation, but a difference in clinical outcomes at these early time points has not been observed. Experience with other endoluminal ablation procedures suggests that lower anatomic success in the short term is associated with recanalization and clinical recurrence between 2 to 5 years. The possibility of later clinical recurrence is supported by a prospective cohort study with 5-year follow-up following treatment with MOCA. However, there have been improvements in technique since the cohort study was begun, and clinical progression is frequently observed with venous disease. Because of these limitations of the single arm studies, longer follow-up in the more recently conducted RCTs is needed to establish the efficacy and durability of this procedure compared with the criterion standard of thermal ablation.

### Treatment of Saphenous Veins: Cyanoacrylate Adhesive

The VenaSeal pivotal study (VeClose), a multicenter noninferiority trial with 222 patients, compared VenaSeal with RFA for the treatment of venous reflux.<sup>31,32</sup> The pivotal registration study for the VeClose study and follow-up through 36 months have been published. These reports are summarized in Tables 9 and 10. The primary endpoint (the proportion of patients with complete closure of the target GSV at 3 months measured by ultrasound) was noninferior to RFA, with a 99% closure rate for VenaSeal compared with 96% for RFA. The secondary endpoint (intraoperative pain) was similar for both groups (2.2 on a 10-point scale for VenaSeal vs 2.4 for RFA,  $p=0.11$ ). Ecchymosis at day 3 was significantly lower in the cyanoacrylate group; 67.6% of patients treated with cyanoacrylate had no ecchymosis compared with 48.2% of patients following RFA ( $p<0.01$ ). Scores on the AVVQ and Venous Clinical Severity Score improved to a similar extent in both groups. The mean time to return to work in a prospective cohort of 50 patients reported by Gibson and Ferris (2017) was 0.2 days.<sup>33</sup>

For the CAC and RFA groups, the complete occlusion rates were 97.2% and 97.0%. Freedom from recanalization was also similar between the two groups ( $p=0.08$ ).<sup>34</sup> Twenty-four month results were reported by Gibson et al (2018), which included 171 patients (87 from CAC and 84 from RFA).<sup>35</sup> Thirty-six month results were reported by Morrison et al (2019), with follow-up on 146 (66%) patients (72 from CAC and 74 from RFA).<sup>36</sup> 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 2 groups. No significant device- or procedure-related adverse events were reported for either group.

VariClose CAC was compared with RFA and EVLA by Eroglu and Yasim (2018) in an RCT with 525 patients (Table 9).<sup>37</sup> Periprocedural outcomes showed a shorter intervention time, less pain, and shorter return to work with CAC compared to endovenous thermal ablation (see Table 10). There was no significant difference in occlusion rates between the three treatments at 6, 12, and 24 month follow-up.

**Table 9. Summary of Key RCT Characteristics**

Study; Trial	Countries	Sites	Dates	Participants	Interventions <sup>2</sup>	
					Active	Comparator
FDA SSED (2015); <sup>31</sup> Morrison et al (2015, 2017, 2019); <sup>32,38,36</sup> Gibson et al (2018); <sup>33</sup> [VeClose trial]	US	10	2013-2014	Age ≥21 and ≤ 70 years with symptomatic <sup>1</sup> GSV reflux and CEAP C2- C4b GSV diameter while standing of 3-12 mm	108 VenaSeal CAC	114 RFA
Eroglu and Yasim (2018) <sup>37</sup>	Asia	1	NR	525 patients ≥ 18 years with incompetence of the GSV (>5.5 mm in diameter) or SSV (>4 mm in diameter) and reflux >0.5 sec.	175 VariClose CAC	125 RFA and 125 EVLA

CAC: cyanoacrylate ; CEAP: Clinical Etiology Anatomy Pathophysiology; EVLA: endovenous laser ablation; FDA: Food and Drug Administration; GSV: great saphenous vein; NR: not reported; RCT: randomized controlled trial; RFA: radiofrequency ablation; SSV: small saphenous vein; SSED; Summary of Safety and Effectiveness Data;

<sup>1</sup> One or more of the following symptoms related to the target vein: aching, throbbing, heaviness, fatigue, pruritus, night cramps, restlessness, generalized pain or discomfort, swelling.

<sup>2</sup> Protocol mandated use of compression stockings for 7 days post-procedure

**Table 10. Perioperative Outcomes**

Eroglu and Yasim (2018) <sup>37</sup>	Duration of Procedure min (sd)	Average Perioperative Pain <sup>1</sup>	2 or More Analgesics Used Daily n (%)	1 Day to Return to Work n (%)	2 Days to Return to Work n (%)	3 or More Days to Return to Work n (%)
N	503	503	456	456	456	456
VariClose	15.3 (2.6)	1 (mild)	105 (62.5)	161 (95.8)	7 (4.2)	0 (0)
RFA	27.3 (7.7)	2 (moderate)	98 (65.8)	75 (50.3)	53 (35.6)	21 (14.1)
EVLA	35.0 (5.2)	2 (moderate)	105 (75.5)	105 (75.5)	24 (17.3)	10 (7.2)
p-Value	<0.001		0.1472	<0.0012		

<sup>1</sup>Scale of 1 to 4; <sup>2</sup>overall p-Value

EVLA: endovenous laser ablation; RFA: radiofrequency ablation.

**Table 11. Summary of Key RCT Results**

Study	Vein Closure <sup>1</sup> n (%)	Vein Closure 12 months n (%)	Vein Closure 24 months n (%)	Vein Closure 36 months n (%) or VCSS	Device Related Event n (%)
FDA SSED (2015); <sup>31</sup> Morrison et al (2015, 2017, 2019); <sup>32,38,36</sup> Gibson et al (2018); <sup>33</sup> [VeClose trial]	<b>3 months</b>				
N	222	189	171	146	222
VenaSeal	107 (99.1%) <sup>2</sup>	92 (96.7%)	82/86 (95.3%)	68/72 (94.4%)	31 (27%)
RFA	109 (95.6%) <sup>2</sup>	91 (96.8%)	79/84 (94.0%)	68/74 (91.9%)	7 (6%)
Eroglu and Yasim (2018) <sup>37</sup>	<b>6 months</b>			<b>VCSS at 24 months</b>	
N		503	456	456	
VariClose	98.1%	94.1%	95.1%	2.7	
RFA	94.7%	92.5%	94.2%	3.7	
EVLA	92.6%	90.9%	91.5%	3.5	
p-Value	NS	NS	NS	<0.001	

EVLA: endovenous laser ablation; FDA: Food and Drug Administration; NS: not significant; RCT: randomized controlled trial; RFA: radiofrequency ablation; SSED: Summary of Safety and Effectiveness Data; VCSS:

venous clinical severity score.

<sup>1</sup>Complete closure defined as Doppler ultrasound showing vein closure along entire treated vein segment with no discrete segments of patency exceeding 5 cm. Central laboratory confirmation.

<sup>2</sup> Used prespecified data imputation method (Last Observation Carried Forward)

Notable limitations of the studies are shown in Tables 12 and 13. The primary limitation of the pivotal study of VenaSeal is the loss to follow-up at two and three years, with equal loss to follow-up was similar in the two groups. The study by Eroglu and Yasim (2018) had unequal loss to follow-up after patients were informed of the treatment allocation. Different expectations in the CAC group compared to the control groups may have influenced subjective outcomes. In addition VariClose is not currently approved for marketing in the U.S.; both CAC products use N-butyl cyanoacrylate.

**Table 12. Study Relevance Limitations**

Study	Population <sup>a</sup>	Intervention <sup>b</sup>	Comparator <sup>c</sup>	Outcomes <sup>d</sup>	Follow-Up <sup>e</sup>
Morrison (2015), <sup>32</sup> Morrison (2017), <sup>38</sup> Gibson (2018) <sup>35</sup> Morrison (2019) <sup>36</sup> . [VeClose trial]					1. Follow-up scheduled to continue to 60 months
Eroglu and Yasim (2018) <sup>37</sup> .		2. This specific cyanoacrylate product is not currently available in the US			

The evidence gaps stated in this table are those notable in the current review; this is not a comprehensive gaps assessment.

<sup>a</sup> Population key: 1. Intended use population unclear; 2. Clinical context is unclear; 3. Study population is unclear; 4. Study population not representative of intended use.

<sup>b</sup> Intervention key: 1. Not clearly defined; 2. Version used unclear; 3. Delivery not similar intensity as comparator; 4. Not the intervention of interest.

<sup>c</sup> Comparator key: 1. Not clearly defined; 2. Not standard or optimal; 3. Delivery not similar intensity as intervention; 4. Not delivered effectively.

<sup>d</sup> Outcomes key: 1. Key health outcomes not addressed; 2. Physiologic measures, not validated surrogates; 3. No CONSORT reporting of harms; 4. Not establish and validated measurements; 5. Clinical significant difference not prespecified; 6. Clinical significant difference not supported.

<sup>e</sup> Follow-Up key: 1. Not sufficient duration for benefit; 2. Not sufficient duration for harms.

**Table 13. Study Design and Conduct Limitations**

Study	Allocation <sup>a</sup>	Blinding <sup>b</sup>	Selective Reporting <sup>d</sup>	Follow-Up <sup>e</sup>	Power <sup>d</sup>	Statistical <sup>f</sup>
Morrison (2015), <sup>32</sup> Morrison (2017), <sup>38</sup> Gibson (2018) <sup>35</sup> Morrison (2019) <sup>36</sup> . [VeClose trial]		1, 2, 3. The outcome was assessed by the treating physician and patients were not blinded		1. >20% loss to follow-up		3. variable reporting of CI and p values
Eroglu and Yasim (2018) <sup>37</sup> .		1, 2, 3. Patients were notified of the group assignment a day before the procedure		6. Not intent-to-treat analysis and unequal loss to follow-up. 21 patients did not receive the allocated intervention, 19 of whom were in the control groups		

The evidence gaps stated in this table are those notable in the current review; this is not a comprehensive gaps assessment.

<sup>a</sup> Allocation key: 1. Participants not randomly allocated; 2. Allocation not concealed; 3. Allocation concealment unclear; 4. Inadequate control for selection bias.

<sup>b</sup> Blinding key: 1. Not blinded to treatment assignment; 2. Not blinded outcome assessment; 3. Outcome

assessed by treating physician.

<sup>c</sup> Selective Reporting key: 1. Not registered; 2. Evidence of selective reporting; 3. Evidence of selective publication.

<sup>d</sup> Follow-Up key: 1. High loss to follow-up or missing data; 2. Inadequate handling of missing data; 3. High number of crossovers; 4. Inadequate handling of crossovers; 5. Inappropriate exclusions; 6. Not intent to treat analysis (per protocol for noninferiority trials).

<sup>e</sup> Power key: 1. Power calculations not reported; 2. Power not calculated for primary outcome; 3. Power not based on clinically important difference.

<sup>f</sup> Statistical key: 1. Intervention is not appropriate for outcome type: (a) continuous; (b) binary; (c) time to event; 2. Intervention is not appropriate for multiple observations per patient; 3. Confidence intervals and/or p values not reported; 4. Comparative treatment effects not calculated.

Eroglu et al (2017) reported closure rates of 94.1% at 30 months in a prospective cohort of 159 patients.<sup>39</sup> Thirty-three-month follow-up was reported by Zierau (2015) for 467 (58.7%) of 795 veins treated at 1 institution in Germany.<sup>40</sup> An inflammatory reddening of the skin was observed at 1 week posttreatment in 11.7% of cases. No permanent skin responses were observed. Of the 467 veins reexamined, the sealing rate was 97.7%. This series had a high loss to follow-up.

### Section Summary: Cyanoacrylate Adhesive

Evidence assessing CAC for the treatment of varicose veins and venous insufficiency includes a multicenter noninferiority trial with follow-up through 36 months, an RCT with follow-up through 24 months, and a prospective cohort with 30 month follow-up. The short-term efficacy of VenaSeal CAC has been shown to be noninferior to RFA at up to 36-month follow-up. At 24 and 36 months the study had greater than 20% loss to follow-up, but loss to follow-up was similar in the two groups at the long-term follow-up and is not expected to influence the comparative results. A second RCT (n=525) with the same active CAC ingredient (N-butyl cyanoacrylate) that is currently available outside of the U.S. found no significant differences in vein closure between CAC and thermal ablation controls at 24-month follow-up. The CAC procedure and return to work were shorter and pain scores were lower compared to thermal ablation; the subjective pain scores may have been influenced by differing expectations in this study. A prospective cohort reported high closure rates at 30 months. Overall, results indicate that outcomes from CAC are at least as good as thermal ablation techniques, the current standard of care.

### Treatment of Saphenous Veins: Cryoablation

Klem et al (2009) reported on a randomized trial that found endovenous cryoablation (n=249) to be inferior to conventional stripping (n=245) for treating patients with symptomatic varicose veins.<sup>34</sup> Forty-four percent of patients had residual GSV remaining with cryoablation while 15% had residual vein remaining with conventional stripping. AVVO scores also showed better results for conventional stripping (score, 11.7) than cryoablation (score, 8.0). There were no differences between groups in 36-Item Short-Form Health Survey summary scores or neural damage (12% in both groups).

Disselhoff et al (2008, 2011) reported on 2- and 5-year outcomes from a randomized trial that compared cryoablation with endovenous laser ablation.<sup>41,42</sup> Included were 120 patients with symptomatic uncomplicated varicose veins (CEAP class C2) with saphenofemoral incompetence and GSV reflux. At 10 days after treatment, endovenous laser ablation provided better results than cryoablation with respect to pain scores over the first 10 days (2.9 vs 4.4), resumption of normal activity (75% vs 45%), and induration (15% vs 52%), all respectively. At 2-year follow-up, freedom from recurrent incompetence was observed in 77% of patients after endovenous laser ablation and in 66% of patients after cryoablation (p=NS). At 5 years, 36.7% of patients were lost to follow-up; freedom from incompetence and neovascularization were found in 62% of patients treated with endovenous laser ablation and in 51% of patients treated with cryoablation (p=NS). Neovascularization was more common after cryoablation, but incompetent tributaries were more common after endovenous laser ablation. There were no significant differences between groups in the Venous Clinical Severity Score or AVVO scores at either the two or five-month follow-ups for endovenous laser ablation.

**Subsection Summary: Cryoablation**

Two RCTs have suggested that cryotherapy is ineffective for treating varicose veins compared with available alternatives.

**Tributary Varicosities****Clinical Context and Therapy Purpose**

The purpose of ablation (stab avulsion, sclerotherapy, or phlebectomy) of tributary veins in patients who have varicose tributary veins is to provide a treatment option that is an alternative to or an improvement on existing therapies.

The question addressed in this evidence review is: Does the use of ablation (stab avulsion, sclerotherapy, or phlebectomy) of tributary veins improve the net health outcome in individuals who have varicose tributary veins?

The following PICO was used to select literature to inform this review.

**Patients**

The relevant population of interest is individuals who have varicose tributary veins.

**Interventions**

The therapy being considered is ablation (stab avulsion, sclerotherapy, or phlebectomy) of tributary veins.

Transilluminated powered phlebectomy is an alternative to stab avulsion and hook phlebectomy. This procedure uses two instruments: an illuminator, which also provides irrigation, and a resector, which has an oscillating tip and suction pump. Following removal of the saphenous vein, the illuminator is introduced via a small incision in the skin and tumescence solution (anesthetic and epinephrine) is infiltrated along the course of varicosity. The resector is then inserted under the skin from the opposite direction, and the oscillating tip is placed directly beneath the illuminated veins to fragment and loosen the veins from the supporting tissue. Irrigation from the illuminator is used to clear the vein fragments and blood through aspiration and additional drainage holes. The illuminator and resector tips may then be repositioned, thereby reducing the number of incisions needed when compared with stab avulsion or hook phlebectomy. It has been proposed that transilluminated powered phlebectomy might decrease surgical time, decrease complications such as bruising and lead to a faster recovery than established procedures.

**Comparators**

The following therapy is currently being used to treat varicose tributary veins: conservative therapy.

**Outcomes**

The general outcomes of interest are reductions in symptoms and morbid events, change in disease status, and improvements in quality of life. Follow-up at 6- and 12-months is of interest for ablation (stab avulsion, sclerotherapy, or phlebectomy) of tributary veins to monitor relevant outcomes.

**Study Selection Criteria**

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse effects, single-arm studies that capture longer periods of follow up and/or larger populations were sought.

- Studies with duplicative or overlapping populations were excluded.

### **Sclerotherapy and Phlebectomy**

Early studies established ligation and stripping as the criterion standard for treating saphenofemoral incompetence based on improved long-term recurrence rates, with sclerotherapy used primarily as an adjunct to treat varicose tributaries. A Cochrane review by Tisi et al (2006), based primarily on RCTs from the 1980s, concluded that: "The evidence supports the current place of sclerotherapy in modern clinical practice, which is usually limited to treatment of recurrent varicose veins following surgery and thread veins."<sup>43</sup> Sclerotherapy and phlebectomy are considered appropriate in the absence of reflux of the saphenous system (e.g., post- or adjunctive treatment to other procedures such as surgery).<sup>44</sup> El-Sheikha et al (2014) reported on a small randomized trial of concomitant or sequential (if needed) phlebectomy following endovenous laser ablation for varicose veins.<sup>45</sup> Quality of life and clinical severity scores were similar between the groups by 1 year, with 16 (67%) of 24 patients in the sequential phlebectomy group receiving a secondary intervention.

The bulk of the literature discussing the role of ultrasound guidance refers to sclerotherapy of the saphenous vein, as opposed to the varicose tributaries. For example, Yamaki et al (2012) reported on a prospective RCT that compared visual foam sclerotherapy plus ultrasound-guided foam sclerotherapy of the GSV with visual foam sclerotherapy for varicose tributary veins.<sup>46</sup> Fifty-one limbs in 48 patients were treated with ultrasound-guided foam sclerotherapy plus visual foam sclerotherapy of the varicose tributaries, and 52 limbs in 49 patients were treated with foam sclerotherapy alone. At 6-month follow-up, complete occlusion was found in 23 (45.1%) limbs treated with ultrasound plus visually guided foam sclerotherapy and in 22 (42.3%) limbs treated with visual sclerotherapy alone. Reflux was absent in 30 (58.8%) limbs treated with ultrasound plus visual guidance and in 37 (71.2%) treated with visual guidance alone ( $p=NS$ ). The authors noted that, for the treatment of tributary veins in clinical practice, most patients receive a direct injection of foam without ultrasound guidance.

A small proportion of patients may present with tributary varicosities in the absence of saphenous reflux. For example, as reported by Michaels et al (2006), of 1009 patients recruited for an RCT, 64 patients had minor varicose veins without reflux, 34 of whom agreed to be randomized to sclerotherapy or conservative treatment.<sup>47</sup> At baseline, 92% had symptoms of heaviness, 69% had cosmetic concerns, 53% reported itching, and 30% reported relief of symptoms using compression hosiery. At 1-year follow-up, there was an improvement in clinicians-assessment of the anatomic extent of varicose veins, with 85% of patients in the sclerotherapy group showing improvement compared with 29% of patients in the conservative therapy group. Symptoms of aching were milder or eliminated in 69% of the sclerotherapy group and 28% of the group treated with conservative therapy.

### **Transilluminated Powered Phlebectomy**

A meta-analysis by Luebke and Brunkwall (2008) included 5 studies that compared TIPP with conventional surgery.<sup>48</sup> Results showed a significant advantage of TIPP over the conventional treatment for the number of incisions, mean cosmetic score, and duration of the procedure. However, TIPP also increased the incidence of hematoma and resulted in worse mean pain scores. Included in the meta-analysis was an RCT by Chetter et al (2006) that compared TIPP ( $n=29$ ) with a multiple stab incision procedure ( $n=33$ ).<sup>49</sup> A single surgeon performed all but two of the procedures, and there was no difference in operating time. Patients treated with TIPP had an average of 5 incisions, compared with 20 for the multiple stab procedure. However, the blinded evaluation revealed that bruising or discoloration was higher for the TIPP group at one and six weeks postsurgery. At 6 weeks after surgery, patients in the TIPP group showed no reductions in pain (-2 points on the Burford Pain Scale), while patients in the multiple stab incision group had a significant reduction in pain scores compared with presurgical baseline (-20 points). Six weeks postsurgery, quality of life measures had improved in the multiple stab incision group but not in the TIPP group. Thus, although TIPP required fewer surgical incisions, in this single-center



study, it was associated with longer recovery due to more extensive bruising, prolonged pain, and reduced early postoperative quality of life.

### **Section Summary: Tributary Varicosities**

The evidence on the use of stab avulsion, sclerotherapy, and phlebectomy includes RCTs and systematic reviews of RCTs. The literature has indicated that sclerotherapy is effective for the treatment of tributary veins following occlusion of the saphenofemoral or saphenopopliteal junction and saphenous veins. No studies have been identified comparing RFA or laser ablation of tributary veins with standard procedures (microphlebectomy and/or sclerotherapy). TIPP is effective at removing varicosities; outcomes are comparable with available alternatives such as stab avulsion and hook phlebectomy. However, there is limited evidence that TIPP is associated with more pain, bruising, discoloration, and a longer recovery, and the current literature does not show an advantage of TIPP over conventional treatment.

### **Perforator Reflux**

#### **Clinical Context and Therapy Purpose**

Perforator veins cross through the fascia and connect the deep and superficial venous systems. Incompetent perforating veins were originally treated 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 occasionally be used to close incompetent perforator veins that cannot be reached by less invasive procedures.

The question addressed in this evidence review is: Does the use of ablation of perforator veins reduce venous insufficiency in individuals who have perforator vein reflux?

The following PICO was used to select literature to inform this review.

#### **Patients**

The relevant population of interest is individuals who have perforator vein reflux.

#### **Interventions**

The therapy being considered is ablation with subfascial endoscopic perforator surgery (SEPS) of perforator veins. SEPS is a less invasive surgical procedure for the 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 surgery can be performed as an outpatient procedure. Endovenous ablation of incompetent perforator veins with sclerotherapy and radiofrequency ablation has also been reported.

#### **Comparators**

The following is currently being used to treat perforator vein reflux: conservative therapy or treatment of saphenous veins alone.

#### **Outcomes**

The general outcomes of interest are reductions in symptoms and morbid events, change in disease status, and improvements in quality of life. These may be assessed by VAS, AVVQ, and VCSS, along with ulcer healing and recurrence.

Follow-up at two years is of interest for ablation (e.g., SEPS) of perforator veins to monitor relevant outcomes.

### Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse effects, single-arm studies that capture longer periods of follow up and/or larger populations were sought.
- Studies with duplicative or overlapping populations were excluded.

### Review of Evidence

A systematic literature review by O'Donnell (2008) indicated there was a lack of evidence on the role of incompetent perforator vein surgery performed in conjunction with superficial saphenous vein surgery.<sup>5</sup> These conclusions were based on 4 RCTs published since 2000 that compared superficial vein surgery with conservative therapy for advanced chronic venous insufficiency (CEAP classes C5-C6). The four trials included two level I (large subject population) and two level II (small subject population) studies. Two trials combined surgical treatment of the incompetent perforator veins with concurrent or prior treatment of the superficial saphenous veins; the other two treated the GSV alone. The 2 randomized studies (2004, 2007) in which the GSV alone was treated (including the ESCHAR trial) showed a significant reduction in ulcer recurrence compared with conservative therapy.<sup>50,51</sup>

Treatment of the GSV alone has been reported to improve perforator function. For example, Blomgren et al (2005) showed that reversal of perforator vein incompetence (28 [41%] of 68 previously incompetent perforators) was more common than new perforator vein incompetence (41 [22%] of 183 previously competent perforators) following superficial vein surgery.<sup>52</sup> O'Donnell (2008) discussed additional (lower quality) evidence to suggest deep venous valvular involvement rather than incompetent perforators in venous insufficiency.<sup>5</sup> Thus, although incompetence of perforator veins is frequently cited as an important etiologic factor in the pathogenesis of venous ulcer, current evidence does not support the routine ligation or ablation of perforator veins.

### Subfascial Endoscopic Perforator Surgery

A Cochrane review by Lin et al (2019) evaluated the efficacy of SEPS for the treatment of venous ulcers<sup>53</sup>. They identified 4 RCTs, 2 compared SEPS plus compression with compression alone (n=208), one compared SEPS with the Linton procedure (n=39), and one compared SEPS plus saphenous vein surgery with saphenous vein surgery alone (n=75). Results are shown in Table 14. The authors concluded that:

- Compared with compression alone, there was low certainty evidence that SEPS may increase the rate of ulcer healing compared to compression alone, but it was uncertain whether SEPS reduced the rate of ulcer recurrence.
- Compared with the Linton procedure, it was uncertain whether there was a difference in ulcer healing, and very uncertain whether there was a difference in ulcer recurrence. Based on very low certainty evidence, the Linton procedure was possibly associated more adverse events.
- Compared to saphenous vein surgery alone, it was uncertain whether there was a difference in ulcer healing or the risk of ulcer recurrence. It was uncertain whether SEPS led to an increase in adverse events (very low certainty due to imprecision and risk of reporting bias)

**Table 14. Meta-analysis Results**

Comparator	Ulcer Healing	Ulcer Recurrence	Adverse Events
Compression alone N	196	208	
Risk ratio (95% CI)	1.17 (1.03 to 1.33)	0.85 (0.26 to 2.76)	
Linton Procedure N	39	39	39
Risk ratio (95% CI)	0.95 (0.83 to 1.09)	0.47 (0.10 to 2.30)	0.04 (0.00 to 0.60)

Comparator	Ulcer Healing	Ulcer Recurrence	Adverse Events
Saphenous Vein Surgery	22	75	75
Risk ratio (95% CI)	0.96 (0.64 to 1.43)	1.03 (0.15 to 6.91)	2.05 (0.86 to 4.90)

CI: confidence interval; NNT: number needed to treat.

<sup>1</sup> If the M-A includes a quantitative synthesis then include numbers analyzed, measures of effect (absolute or relative) with CI and measure of heterogeneity. If the M-A includes only a qualitative synthesis then include the ranges of N and effects.

In a meta-analysis of subfascial endoscopic perforator surgery for chronic venous insufficiency, Luebke and Brunkwall (2009) concluded that "its use should not be employed routinely and could only be justified in patients with persistent ulceration thought to be of venous origin, and in whom any superficial reflux has already been ablated and postthrombotic changes excluded."<sup>54</sup> Reviewers also stated that the "introduction of less invasive techniques for perforator vein ablation, such as ultrasound-guided sclerotherapy or radiofrequency ablation, may diminish the role of subfascial endoscopic perforator surgery in the future."

### Section Summary: Perforator Reflux

The literature has shown that the routine ligation and ablation of incompetent perforator veins is not necessary for treating varicose veins and venous insufficiency concurrent with superficial vein procedures. However, when combined superficial vein procedures and compression therapy have failed to improve symptoms (i.e., ulcers), treatment of perforator vein reflux may be as beneficial as any alternative (e.g., deep vein valve replacement). Comparative studies are needed to determine the most effective method of ligating and ablating incompetent perforator veins. There is some low quality evidence that SEPS is as effective as the Linton procedure with a reduction in adverse events. Although only one case series has been identified showing an improvement in health outcomes, endovenous ablation with specialized laser or RFA probes has been shown to effectively ablate incompetent perforator veins with a potential decrease in morbidity compared with surgical interventions.

### Summary of Evidence

#### Saphenous Veins

For individuals who have varicose veins/venous insufficiency and saphenous vein reflux who receive endovenous thermal ablation (radiofrequency or laser), the evidence includes RCTs and systematic reviews of controlled trials. Relevant outcomes are symptoms, change in disease status, morbid events, quality of life, and treatment-related morbidity. There are a number of large RCTs and systematic reviews of RCTs assessing endovenous thermal ablation of the saphenous veins. Comparison with the standard of ligation and stripping at 2- to 5-year follow-up has supported the use of both endovenous laser ablation and RFA. Evidence has suggested that ligation and stripping lead to more neovascularization, while thermal ablation leads to more recanalization, resulting in similar clinical outcomes for endovenous thermal ablation and surgery. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who have varicose veins/venous insufficiency and saphenous vein reflux who receive microfoam sclerotherapy, the evidence includes RCTs. Relevant outcomes are symptoms, change in disease status, morbid events, quality of life, and TRM. For physician-compounded sclerotherapy, there is high variability in success rates and some reports of serious adverse events. By comparison, rates of occlusion with the microfoam sclerotherapy (polidocanol 1%) approved by the FDA are similar to those reported for endovenous laser ablation or stripping. Results of a noninferiority trial of physician-compounded sclerotherapy have indicated that once occluded, recurrence rates at two years are similar to those of ligation and stripping. Together, this evidence indicates that the more consistent occlusion with the microfoam sclerotherapy preparation will lead to recurrence rates similar to ligation and stripping in the longer term. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

Based on the available evidence, clinical input obtained in 2015, and clinical practice guidelines, the use of endovenous RFA, endovenous laser ablation, and microfoam sclerotherapy are considered to improve outcomes when used in the saphenous veins. For treatment of saphenous tributaries at the same time or following treatment of the saphenous vein, stab avulsion, hook phlebectomy, sclerotherapy, or transilluminated powered phlebectomy improve outcomes.

For individuals who have varicose veins/venous insufficiency and saphenous vein reflux who receive MOCA, the evidence includes 4 RCTs with 6 mo to 2 yr results that compared MOCA to thermal ablation, a prospective cohort with follow-up out to 5 years, and retrospective case series. Relevant outcomes are symptoms, change in disease status, morbid events, quality of life, and TRM. MOCA is a combination of liquid sclerotherapy with mechanical abrasion. A potential advantage of this procedure compared with thermal ablation is that MOCA does not require tumescent anesthesia and may result in less pain during the procedure. Results to date have been mixed regarding a reduction in intraprocedural pain compared to thermal ablation procedures. Occlusion rates at 6 mo to 2 year from RCTs indicate lower anatomic success rates compared to thermal ablation, but a difference in clinical outcomes at these early time points has not been observed. Experience with other endoluminal ablation procedures suggests that lower anatomic success in the short term is associated with recanalization and clinical recurrence between 2 to 5 years. The possibility of later clinical recurrence is supported by a prospective cohort study with 5-year follow-up following treatment with MOCA. However, there have been improvements in technique since the cohort study was begun, and clinical progression is frequently observed with venous disease. Because of these limitations of the single arm studies, longer follow-up in the more recently conducted RCTs is needed to establish the efficacy and durability of this procedure compared with the criterion standard of thermal ablation. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have varicose veins/venous insufficiency and saphenous vein reflux who receive CAC, the evidence includes two RCTs and a prospective cohort. Relevant outcomes are symptoms, change in disease status, morbid events, quality of life, and TRM. Evidence includes a multicenter noninferiority trial with follow-up through 36 months, an RCT with follow-up through 24 months, and a prospective cohort with 30-month follow-up. The short-term efficacy of VenaSeal CAC has been shown to be noninferior to RFA at up to 36 months. At 24 and 36 months the study had greater than 20% loss to follow-up, but loss to follow-up was similar in the 2 groups at the long-term follow-up and is not expected to influence the comparative results. A second RCT (n=525) with the same active CAC ingredient (N-butyl cyanoacrylate) that is currently available outside of the U.S. found no significant differences in vein closure between CAC and thermal ablation controls at 24-month follow-up. The CAC procedure and return to work were shorter and pain scores were lower compared to thermal ablation, although the subjective pain scores may have been influenced by differing expectations in this study. A prospective cohort reported high closure rates at 30 months. Overall, results indicate that outcomes from CAC are at least as good as thermal ablation techniques, the current standard of care. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who have varicose veins/venous insufficiency and saphenous vein reflux who receive cryoablation, the evidence includes RCTs and multicenter series. Relevant outcomes are symptoms, change in disease status, morbid events, quality of life, and TRM. Results from a recent RCT of cryoablation have indicated that this therapy is inferior to conventional stripping. Studies showing a benefit on health outcomes are needed. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Varicose Tributary Veins**

For individuals who have varicose tributary veins who receive ablation (stab avulsion, sclerotherapy, or phlebectomy) of tributary veins, the evidence includes RCTs and systematic

reviews of RCTs. Relevant outcomes are symptoms, change in disease status, morbid events, quality of life, and treatment-related morbidity. The literature has shown that sclerotherapy is effective for treating tributary veins following occlusion of the saphenofemoral or saphenopopliteal junction and saphenous veins. No studies have been identified comparing RFA or laser ablation of tributary veins with standard procedures (microphlebectomy and/or sclerotherapy). TIPP is effective at removing varicosities; outcomes are comparable to available alternatives such as stab avulsion and hook phlebectomy. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

### Perforator Veins

For individuals who have perforator vein reflux who receive ablation (e.g., subfascial endoscopic perforator surgery) of perforator veins, the evidence includes RCTs and systematic reviews of RCTs. Relevant outcomes are symptoms, change in disease status, morbid events, quality of life, and treatment-related morbidity. The literature has indicated that the routine ligation or ablation of incompetent perforator veins is not necessary for the treatment of varicose veins/venous insufficiency at the time of superficial vein procedures. However, when combined superficial vein procedures and compression therapy have failed to improve symptoms (i.e., ulcers), treatment of perforator vein reflux may be as beneficial as an alternative (e.g., deep vein valve replacement). Comparative studies are needed to determine the most effective method of ligating or ablating incompetent perforator veins. Subfascial endoscopic perforator surgery is possibly as effective as the Linton procedure with a reduction in adverse events. Although only one case series has been identified showing an improvement in health outcomes, endovenous ablation with specialized laser or radiofrequency probes has been shown to effectively ablate incompetent perforator veins with a potential decrease in morbidity compared with surgical interventions. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

### Supplemental Information

#### Clinical Input From Physician Specialty Societies and Academic Medical Centers

While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.

In response to requests from Blue Cross Blue Shield Association, input was received from 4 physician specialty societies in 2015. There was no agreement on the need to treat varicose tributaries to improve functional outcomes in the absence of saphenous vein disease. Input was also mixed on the use of mechanochemical ablation and cyanoacrylate adhesive.

### Practice Guidelines and Position Statements

#### Society for Vascular Surgery and American Venous Forum

The Society for Vascular Surgery and the American Venous Forum (2011) published joint clinical practice guidelines.<sup>55</sup> Table 15 provides the recommendations.

**Table 15. Guidelines on Management of Varicose Veins and Associated Chronic Venous Diseases**

Recommendation	Grade <sup>a</sup>	SOR	QOE
<b><i>Compression therapy for venous ulcerations and varicose veins</i></b>			
Compression therapy is recommended as the primary treatment to aid healing of venous ulceration	1B	Strong	Moderate
To decrease the recurrence of venous ulcers, ablation of the incompetent superficial veins in addition to compression therapy is recommended	1A	Strong	High
Use of compression therapy for patients with symptomatic varicose veins is recommended	2C	Weak	Low
Compression therapy as the primary treatment if the patient is a candidate for saphenous vein ablation is not recommended	1B	Strong	Moderate

Recommendation	Grade <sup>a</sup>	SOR	QOE
<b>Treatment of the incompetent great saphenous vein</b>			
Endovenous thermal ablation (radiofrequency or laser) is recommended over chemical ablation with foam or high ligation and stripping due to reduced convalescence and less pain and morbidity. Cryostripping is a technique that is new in the United States, and it has not been fully evaluated.	1B	Strong	Moderate
<b>Varicose tributaries</b>			
Phlebectomy or sclerotherapy are recommended to treat varicose tributaries	1B	Strong	Moderate
Transilluminated powered phlebectomy using lower oscillation speeds and extended tumescence is an alternative to traditional phlebectomy	2C	Weak	Low
<b>Perforating vein incompetence</b>			
Selective treatment of perforating vein incompetence in patients with simple varicose veins is not recommended	1B	Strong	Moderate
Treatment of pathologic perforating veins (outward flow of $\geq 500$ ms duration, with a diameter of $\geq 3.5$ mm) located underneath healed or active ulcers (CEAP class C5-C6) is recommended	2B	Weak	Moderate

QOE: quality of evidence; SOR: strength of recommendation.

<sup>a</sup> Grading: strong = 1 or weak = 2, based on a level of evidence that is either high quality = A, moderate quality = B, or low quality = C.

### Society of Interventional Radiography et al.

In 2010, the Society of Interventional Radiography, along with Cardiovascular Interventional Radiological Society of Europe, American College of Phlebology, and Canadian Interventional Radiology Association, published consensus quality improvement guidelines for the treatment of lower extremity superficial venous insufficiency using endovenous thermal ablation.<sup>56</sup>

In a joint statement, American Venous Forum and Society of Interventional Radiography (2007) recommended reporting standards for endovenous ablation for the treatment of venous insufficiency.<sup>57</sup> They recommended that reporting in clinical studies should include the symptoms of venous disease, history of the disease and prior treatment, the presence of major comorbidities, and any exclusion criteria. It was noted that potential candidates for endovenous ablation might include patients with reflux in an incompetent great saphenous vein or smaller saphenous vein or a major tributary branch of the great or smaller saphenous veins such as the anterior thigh circumflex vein, posterior thigh circumflex vein, or anterior accessory great saphenous vein. The presence of reflux in these veins is important to document using duplex ultrasound imaging, and the ultrasound criteria used to define reflux should be indicated. It was also stated that, in current practice, most vascular laboratories consider the presence of venous flow reversal for greater than 0.5 to 1.0 second with proximal compression, Valsalva maneuver, or distal compression and release to represent pathologic reflux.

### American Vein and Lymphatic Society

In 2015, the American Vein and Lymphatic Society (AVL, previously named the American College of Phlebology) published guidelines on the treatment of superficial vein disease.<sup>58</sup>

AVL gave a Grade 1 recommendation based on high quality evidence that compression is an effective method for the management of symptoms, but when patients have a correctable source of reflux definitive treatment should be offered unless contraindicated. AVL recommends against a requirement for compression therapy when a definitive treatment is available. AVL gave a strong recommendation based on moderate quality evidence that endovenous thermal ablation is the preferred treatment for saphenous and accessory saphenous vein incompetence, and gave a weak recommendation based on moderate quality evidence that mechanochemical ablation may also be used to treat venous reflux.

In 2017, AVL published guidelines on the treatment of refluxing accessory saphenous veins.<sup>35</sup> The College gave a Grade 1 recommendation based on level C evidence that patients with symptomatic incompetence of the accessory saphenous veins be treated with endovenous thermal ablation or sclerotherapy to reduce symptomatology. The guidelines noted that

although accessory saphenous veins may drain into the great saphenous vein before it drains into the common femoral vein, they can also empty directly into the common femoral vein.

### National Institute for Health and Care Excellence

In 2013, the U.K.'s National Institute for Health and Care Excellence (NICE) updated its guidance on ultrasound-guided foam sclerotherapy for varicose veins.<sup>59</sup> NICE stated that:

"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 embolization (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."

NICE (2016) revised its guidance on endovenous mechanochemical ablation, concluding that "Current evidence on the safety and efficacy of endovenous mechanochemical ablation for varicose veins appears adequate to support the use of this procedure...."<sup>55</sup>

NICE (2013) published guidance on the diagnosis and management of varicose veins in the leg.<sup>60</sup> The NICE (2015) published a technology assessment on the clinical effectiveness and cost-effectiveness of foam sclerotherapy, endovenous laser ablation, and surgery for varicose veins.<sup>57</sup> Five-year trial results are currently being evaluated.

### U.S. Preventive Services Task Force Recommendations

Not applicable.

### Medicare National Coverage

There is no national coverage determination. In the absence of a national coverage determination, coverage decisions are left to the discretion of local Medicare carriers.

### Ongoing and Unpublished Clinical Trials

Some currently unpublished trials that might influence this review are listed in Table 16.

**Table 16. Summary of Key Trials**

NCT No.	Trial Name	Planned Enrollment	Completion Date
<b>Ongoing</b>			
NCT03392753	Randomised Controlled Trial of Mechanochemical Ablation Versus Cyanoacrylate Adhesive for the Treatment of Varicose Veins	180	Dec 2020
NCT03722134	Mechanochemical Ablation vs Thermal Ablation in Patients With Great Saphenous Vein Insufficiency	132	Dec 2020
NTR4613 <sup>a</sup>	Mechanochemical endovenous ablation versus radiofrequency ablation in the treatment of primary small saphenous vein insufficiency (MESSI trial)	160	Apr 2020
NCT01936168	Mechanochemical endovenous ablation versus radiofrequency ablation in the treatment of primary great saphenous vein incompetence (MARADONA)	213	Dec 2020
NCT03835559	Randomized Controlled Trial Comparing the Clinical Outcomes After Cyanoacrylate Closure and Surgical Stripping for Incompetent Saphenous Veins	146	Feb 2021
NCT02627846	A Randomised Clinical Trial Comparing Endovenous Laser Ablation and Mechanochemical Ablation (ClariVein) in the Management of Superficial Venous Insufficiency (LAMA)	140	Aug 2025

NCT: national clinical trial. NTR: Netherlands Trial Registry.

<sup>a</sup> Denotes industry-sponsored or cosponsored trial.

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62. *Cardiovascular Diagnosis and Therapy.* Minimally invasive treatments for perforator vein insufficiency. 2016; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5220201/#:~:text=Minimally%20invasive%20treatments%20have%20replaced,laser%20or%20radiofrequency%20energy%20sources>. Accessed July 15, 2020.
63. *Journal of Vascular Surgery.* Treatment of superficial and perforator venous incompetence without deep venous insufficiency: is routine perforator ligation necessary?. 2003; <https://www.sciencedirect.com/science/article/pii/S0741521403009339>. Accessed July 15, 2020.
64. Blue Cross Blue Shield Association. Medical Policy Reference Manual, No. 7.01.124 (May 2020).

## Documentation for Clinical Review

### Please provide the following documentation:

- History and physical and/or consultation notes including:
  - All prior varicose vein treatments to date and response (including conservative management)
  - Leg and vein to be treated
  - Reason for varicose vein treatment
  - Type of treatment/procedure requested
  - Copy of all Doppler and/or Duplex ultrasounds documenting reflux within the last three months

### Post Service (in addition to the above, please include the following):

- Varicose vein treatment operative/procedure report(s)

<b>Coding</b>
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*This Policy relates only to the services or supplies described herein. Benefits may vary according to product design; therefore, contract language should be reviewed before applying the terms of the Policy. Inclusion or exclusion of codes does not constitute or imply member coverage or provider reimbursement.*

**MN/IE**

**The following services may be considered medically necessary in certain instances and investigational in others. Services may be considered medically necessary when policy criteria are met. Services may be considered investigational when the policy criteria are not met or when the code describes application of a product in the position statement that is investigational.**

Type	Code	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
	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 (e.g., 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 (e.g., great saphenous vein, accessory saphenous vein), same leg
	36468	Injection(s) of sclerosant for spider veins (telangiectasia), limb or trunk
	36470	Injection of sclerosant; single incompetent vein (other than telangiectasia)
	36471	Injection of sclerosant; multiple incompetent veins (other than telangiectasia), same leg
	36473	Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, mechanochemical; first vein treated
	36474	Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, mechanochemical; 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	Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, radiofrequency; 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	

Type	Code	Description
	36479	Endovenous ablation therapy of incompetent vein, extremity, inclusive of all imaging guidance and monitoring, percutaneous, laser; subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)
	36482	Endovenous ablation therapy of incompetent vein, extremity, by transcatheter delivery of a chemical adhesive (e.g., cyanoacrylate) remote from the access site, inclusive of all imaging guidance and monitoring, percutaneous; first vein treated
	36483	Endovenous ablation therapy of incompetent vein, extremity, by transcatheter delivery of a chemical adhesive (e.g., cyanoacrylate) remote from the access site, inclusive of all imaging guidance and monitoring, percutaneous; subsequent vein(s) treated in a single extremity, each through separate access sites (List separately in addition to code for primary procedure)
	37500	Vascular endoscopy, surgical, with ligation of perforator veins, subfascial (SEPS)
	37700	Ligation and division of long saphenous vein at saphenofemoral junction, or distal interruptions
	37718	Ligation, division, and stripping, short saphenous vein
	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 perforator 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, 1 extremity; 10-20 stab incisions
	37766	Stab phlebectomy of varicose veins, 1 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), 1 leg
	37799	Unlisted procedure, vascular surgery
	76942	Ultrasonic guidance for needle placement (e.g., biopsy, aspiration, injection, localization device), imaging supervision and interpretation
	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 study
HCPCS	S2202	Echosclerotherapy

### Policy History

This section provides a chronological history of the activities, updates and changes that have occurred with this Medical Policy.

Effective Date	Action
10/11/2000	New Policy Adoption
02/26/2002	Coding Update

Effective Date	Action
10/29/2002	Coding Update
09/01/2003	Policy Revision
05/01/2006	Policy Revision
08/01/2006	Policy Revision
06/28/2007	BCBSA Medical Policy adoption
12/10/2008	Policy Title Revision, criteria revised, BCBSA Medical Policy Adoption
09/03/2009	Administrative Review
07/01/2011	Policy revision with position change
01/30/2015	Policy title change from Varicose Vein Treatments Policy revision with position change effective 03/30/2015
03/30/2015	Policy revision with position change Coding update
09/01/2016	Policy revision without position change
02/01/2017	Policy revision without position change Coding update
07/01/2017	Policy revision without position change
02/01/2018	Coding update
07/01/2018	Policy revision without position change
02/01/2019	Policy Guidelines clarification Coding update
04/01/2019	Policy revision without position change
09/01/2019	Policy revision with position change
05/01/2020	Administrative update. Policy statement and guidelines updated.
08/01/2020	Annual review. Policy statement, guidelines and literature updated.

### Definitions of Decision Determinations

**Medically Necessary:** Services that are Medically Necessary include only those which have been established as safe and effective, are furnished under generally accepted professional standards to treat illness, injury or medical condition, and which, as determined by Blue Shield, are: (a) consistent with Blue Shield medical policy; (b) consistent with the symptoms or diagnosis; (c) not furnished primarily for the convenience of the patient, the attending Physician or other provider; (d) furnished at the most appropriate level which can be provided safely and effectively to the patient; and (e) not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of the Member's illness, injury, or disease.

**Investigational/Experimental:** A treatment, procedure, or drug is investigational when it has not been recognized as safe and effective for use in treating the particular condition in accordance with generally accepted professional medical standards. This includes services where approval by the federal or state governmental is required prior to use, but has not yet been granted.

**Split Evaluation:** Blue Shield of California/Blue Shield of California Life & Health Insurance Company (Blue Shield) policy review can result in a split evaluation, where a treatment, procedure, or drug will be considered to be investigational for certain indications or conditions, but will be deemed safe and effective for other indications or conditions, and therefore potentially medically necessary in those instances.

### Prior Authorization Requirements (as applicable to your plan)

Within five days before the actual date of service, the provider must confirm with Blue Shield that the member's health plan coverage is still in effect. Blue Shield reserves the right to revoke an

authorization prior to services being rendered based on cancellation of the member's eligibility. Final determination of benefits will be made after review of the claim for limitations or exclusions.

Questions regarding the applicability of this policy should be directed to the Prior Authorization Department at (800) 541-6652, or the Transplant Case Management Department at (800) 637-2066 ext. 3507708 or visit the provider portal at [www.blueshieldca.com/provider](http://www.blueshieldca.com/provider).

*Disclaimer: This medical policy is a guide in evaluating the medical necessity of a particular service or treatment. Blue Shield of California may consider published peer-reviewed scientific literature, national guidelines, and local standards of practice in developing its medical policy. Federal and state law, as well as contract language, including definitions and specific contract provisions/exclusions, take precedence over medical policy and must be considered first in determining covered services. Member contracts may differ in their benefits. Blue Shield reserves the right to review and update policies as appropriate.*