Treatment of Varicose Veins/Venous Insufficiency

Policy # 00034
Original Effective Date: 08/26/2002
Current Effective Date: 01/18/2017

Applies to all products administered or underwritten by Blue Cross and Blue Shield of Louisiana and its subsidiary, HMO Louisiana, Inc. (collectively referred to as the "Company"), unless otherwise provided in the applicable contract. Medical technology is constantly evolving, and we reserve the right to review and update Medical Policy periodically.

Great or Small Saphenous Veins

When Services May Be Eligible for Coverage
Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:
• Benefits are available in the member’s contract/certificate, and
• Medical necessity criteria and guidelines are met.

Based on review of available data, the Company may consider treatment of the great or small saphenous veins by surgery (ligation and stripping), endovenous radiofrequency or laser ablation, or microfoam sclerotherapy for symptomatic varicose veins/venous insufficiency to be eligible for coverage when the following criteria have been met:

Patient Selection Criteria
Coverage eligibility will be met when all of the following criteria are met:

There is demonstrated saphenous reflux and CEAP [Clinical, Etiology, Anatomy, Pathophysiology] class C2 or greater; AND

There is documentation of one or more of the following indications:
• Ulceration secondary to venous stasis; or
• Recurrent superficial thrombophlebitis; or
• Hemorrhage or recurrent bleeding episodes from a ruptured superficial varicosity; or
• Persistent pain, swelling, itching, burning, or other symptoms are associated with saphenous reflux, AND the symptoms significantly interfere with activities of daily living, and conservative management including compression therapy for at least three months has not improved the symptoms.

When Services Are Considered Not Medically Necessary
Based on review of available data, the Company considers the use of treatment for great or small saphenous veins by surgery, endovenous radiofrequency or laser ablation, or microfoam sclerotherapy that does not meet the criteria described above to be not medically necessary.

Accessory Saphenous Veins

When Services May Be Eligible for Coverage
Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:
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- Benefits are available in the member’s contract/certificate, and
- Medical necessity criteria and guidelines are met.

Based on review of available data, the Company may consider treatment of accessory saphenous veins by surgery (ligation and stripping), endovenous radiofrequency or laser ablation, or microfoam sclerotherapy for symptomatic varicose veins/venous insufficiency to be eligible for coverage when the following criteria have been met:

Patient Selection Criteria
Coverage eligibility will be met when all of the following criteria are met:
Incompetence of the accessory saphenous vein is isolated, OR the great or small saphenous veins had been previously eliminated (at least 3 months); AND there is demonstrated accessory saphenous reflux; AND there is documentation of one or more of the following indications:
- Ulceration secondary to venous stasis; or
- Recurrent superficial thrombophlebitis; or
- Hemorrhage or recurrent bleeding episodes from a ruptured superficial varicosity; or
- Persistent pain, swelling, itching, burning, or other symptoms are associated with saphenous reflux, AND the symptoms significantly interfere with activities of daily living, AND conservative management including compression therapy for at least three months has not improved the symptoms.

When Services Are Considered Not Medically Necessary
Based on review on available data, the Company considers treatment of accessory saphenous veins by surgery or endovenous radiofrequency or laser ablation, or microfoam sclerotherapy that does not meet the criteria described above is not medically necessary.

Symptomatic Varicose Tributaries

When Services Are Eligible for Coverage
Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:
- Benefits are available in the member’s contract/certificate, and
- Medical necessity criteria and guidelines are met.

Based on review of available data, the Company may consider the following treatments to be eligible for coverage as a component of the treatment of symptomatic varicose tributaries when performed either at the same time or following prior treatment (surgical, radiofrequency or laser) of the saphenous veins (none of these techniques has been shown to be superior to another):
- Stab avulsion
- Hook phlebectomy
- Sclerotherapy
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- Transilluminated powered phlebectomy

When Services Are Considered Investigational
Coverage is not available for investigational medical treatments or procedures, drugs, devices or biological products.
Based on review of available data, the Company considers treatment of symptomatic varicose tributaries when performed either at the same time or following prior treatment of saphenous veins using any other techniques than noted above to be investigational.*

Perforator Veins

When Services May Be Eligible for Coverage
Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:
- Benefits are available in the member's contract/certificate, and
- Medical necessity criteria and guidelines are met.

Based on review of available data, the Company may consider surgical ligation (including subfascial endoscopic perforator surgery) or endovenous radiofrequency or laser ablation, or ultrasound-guided microfoam sclerotherapy of incompetent perforator veins as a treatment of leg ulcers associated with chronic venous insufficiency may be considered to be eligible for coverage when the following conditions have been met:
- There is demonstrated perforator reflux; AND
- The superficial saphenous veins (great, small, or accessory saphenous and symptomatic varicose tributaries) have been previously eliminated; AND
- Ulcers have not resolved following combined superficial vein treatment and compression therapy for at least three months; AND
- The venous insufficiency is not secondary to deep venous thromboembolism.

When Services Are Considered Not Medically Necessary
Based on review on available data, the Company considers ligation or ablation of incompetent perforator veins performed concurrently with superficial venous surgery is considered to be not medically necessary.**

Telangiectasia

Based on review on available data, the Company considers treatment of telangiectasia such as spider veins, angiomata, and hemangiomata cosmetic and is not a covered benefit.
Other

When Services Are Considered Investigational

Coverage is not available for investigational medical treatments or procedures, drugs, devices or biological products.

Based on review of available data, the Company considers techniques for conditions not specifically listed above to be investigational* including, but not limited to:

- Sclerotherapy techniques, other than microfoam sclerotherapy, of greater, lesser, or accessory saphenous veins
- Sclerotherapy of isolated tributary veins without prior or concurrent treatment of saphenous veins
- Stab avulsion, hook phlebectomy, or transilluminated powered phlebectomy of perforator, greater or lesser saphenous, or accessory saphenous veins
- Endovenous radiofrequency or laser ablation of tributary veins
- Endovenous cryoablation of any vein
- Mechnochemical ablation of any vein
- Cyanoacrylate adhesive of any vein

Note:
The standard classification of venous disease is the CEAP (Clinical, Etiologic, Anatomic, Pathophysiologic) classification system. The following is the Clinical portion of the CEAP.

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The Etiologic, Anatomic, And Pathophysiologic portions of the classifications are online (http://www.veinforum.org/uploadDocs/1/Revised-CEAP-Classification---May-2004.pdf).

Background/Overview

A variety of treatment modalities are available to treat varicose veins/venous insufficiency, including surgical approaches, thermal ablation, and sclerotherapy. The application of each of these treatment options is influenced by the severity of the symptoms, type of vein, source of venous reflux, and the use of other (prior or concurrent) treatments.
The venous system of the lower extremities consists of the superficial veins (this includes the greater and lesser saphenous and accessory, or duplicate, veins that travel in parallel with the greater and lesser 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 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 considers the clinical, etiologic, anatomic, and pathologic (CEAP) characteristics of venous insufficiency, ranging from class 0 (no visible sign of disease) to class 6 (active ulceration).

Treatment of venous reflux/venous insufficiency is aimed at reducing 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 in 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 greater or lesser saphenous veins are eliminated and blood flow is diverted through the accessory veins.

Saphenous Veins and Tributaries
Saphenous veins include the great and small saphenous and accessory saphenous veins that travel in parallel with the greater or lesser saphenous veins. Tributaries are veins that empty into a larger vein. Treatment of venous reflux typically includes the following:

1. Identification by preoperative Doppler ultrasonography of the valvular incompetence
2. Control of the most proximal point of reflux, traditionally by suture ligation of the incompetent saphenofemoral or saphenopopliteal junction
3. Removal of the superficial vein from circulation, for example by stripping of the greater and/or lesser saphenous veins
4. 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. These include sclerotherapy, transilluminated powered phlebectomy (TIPP), and thermal ablation using cryotherapy, high-frequency radio waves (200-300 kHz), or laser energy.

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 resulting in the occlusion of the
vessel. The success of the treatment 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 to be 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 commonly produced by forcibly mixing a gas (eg, air or carbon dioxide) with a liquid sclerosant (eg, polidocanol or sodium tetradecyl sulfate). The foam is produced at the time of treatment. Varithena™ (previously known as Varisolve, BTG Plc, London) is a proprietary microfoam sclerosant that is dispersed from a canister with a controlled density and more consistent bubble size.

Endovenous Mechanochemical Ablation
Endovenous mechanochemical ablation (MOCA™) utilizes both sclerotherapy and mechanical damage to the lumen. Following ultrasound imaging, a disposable catheter with a motor drive is inserted into the distal end of the target vein and advanced to the saphenofemoral junction. As the catheter is pulled back, a wire rotates at 3500 rpm within the lumen of the vein, abrading the lumen. At the same time, a liquid sclerosant (sodium tetradecyl 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 need for the tumescent anesthesia used with thermal endovenous ablation techniques (radiofrequency ablation [RFA] and endovenous laser treatment [EVLT]).

Thermal Ablation
Radiofrequency ablation is performed by means of 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 greater saphenous vein under ultrasound guidance; the laser is activated and slowly removed along the course of the saphenous vein. Cryoablation uses extreme cold to cause injury to the vessel. The objective of endovenous techniques is to cause injury to 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.

Cyanoacrylate Adhesive
Cyanoacrylate adhesive is a clear, free-flowing liquid that polymerizes in the vessel via an anionic mechanism (ie, 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 to seal surgical incisions or other skin wounds.
Transilluminated Powered Phlebectomy
Transilluminated powered phlebectomy is an alternative to stab avulsion or hook phlebectomy. This procedure uses 2 instruments: an illuminator, which also provides irrigation, and a resector, which has an oscillating tip and can perform suction. 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 the 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 TIPP might result in decreased operative time, decreased complications such as bruising, and faster recovery compared with the established procedures.

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

Other
Deep vein valve replacement is being investigated.

Outcomes of interest for venous interventions include healing and recurrence, recannulation of the vein, and neovascularization. Recannulation (recanalization) is the restoration of the lumen of a vein after it has been occluded; this occurs more frequently following treatment with endovenous techniques. Neovascularization is the proliferation of new blood vessels in tissue and occurs more frequently following vein stripping. Direct comparisons of durability for endovenous and surgical procedures are complicated by these different mechanisms of recurrence. Relevant safety outcomes include the incidence of paresthesia, thermal skin injury, thrombus formation, thrombophlebitis, wound infection, and transient neurologic effects.
In 2015, the VenaSeal® Closure System (Sapheon, a part of Medtronic) was approved by the FDA through the premarket approval 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: PJQ.

In 2013, Varithena (formerly known as Varisolve®; BTG Plc, London), a sclerosant microfoam made with a proprietary gas mix, was approved by FDA under a new drug application 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 have received specific FDA marketing clearance for the endovenous treatment of superficial vein reflux:

- In 1999, the VNUS® Closure™ Closure™ system (a radiofrequency device) received FDA clearance through the 510(k) process for “endovascular coagulation of blood vessels in patients with superficial vein reflux.” The VNUS RFS™ and RFSFlex™ devices received FDA clearance in 2005 for “use in vessel and tissue coagulation including: treatment of incompetent (ie, refluxing) perforator and tributary veins.” The modified VNUS ClosureFAST™ Intravascular Catheter received FDA clearance through the 510(k) process in 2008.
- In 2002, the Diomed 810 nm surgical laser and EVLT™ (endovenous laser therapy) procedure kit received FDA clearance through the 510(k) process, “...for use in the endovascular coagulation of the greater saphenous vein of the thigh in patients with superficial vein reflux.”
- A modified Erbe Erbokryo® cryosurgical unit (Erbe USA) received FDA clearance for marketing in 2005. A variety of clinical indications are listed, including cryostripping of varicose veins of the lower limbs.
- The Trivex® system (InaVein LLC) is a device for transilluminated powered phlebectomy that received FDA clearance through the 510(k) process in October 2003. According to the label, the intended use is for “ambulatory phlebectomy procedures for the resection and ablation of varicose veins.”
- The ClariVein® Infusion Catheter (Vascular Insights) received marketing clearance through the 510(k) process in 2008 (K071468). It is used for mechanochemical ablation. Predicate devices were listed as the Trellis® Infusion System (K013635) and the Slip-Cath™ Infusion Catheter (K882796). The system includes an infusion catheter, motor drive, stopcock and syringe and is intended for the infusion of physician-specified agents in the peripheral vasculature. FDA product code: KRA.

Centers for Medicare and Medicaid Services (CMS)
There is no national coverage determination (NCD). In the absence of an NCD, coverage decisions are left to the discretion of local Medicare carriers.
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Rationale/Source  
This evidence review has been updated periodically using the MEDLINE database. The most recent literature update was performed through July 7, 2015. Following is a summary of key studies to date.

Treatment of Saphenous Reflux  
Compression Therapy  
A 2009 Cochrane review on compression for venous leg ulcers included a total of 39 randomized controlled trials (RCTs), with 47 different comparisons. The review was updated in 2012, and included 48 RCTs with 59 different comparisons. Most of the RCTs were small. Objective 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 8 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. In addition, 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 that the mean time to ulcer healing was approximately 2 months, while the median time to healing in other reports was 3 to 5 months.

A Cochrane review on compression stockings for the initial treatment of varicose veins in patients without venous ulceration was published in 2011. Included in the review were 7 studies involving 356 participants with varicose veins without healed or active venous ulceration (CEAP classification C2 to C4). Six of the 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 included trials was unclear. Meta-analyses were not performed due to inadequate reporting and suspected heterogeneity. The authors concluded that there is insufficient high-quality evidence to determine whether or not compression stockings are effective as the sole and initial treatment of varicose veins in patients without venous ulceration, or whether any type of stocking is superior to any other type.

Ligation and Stripping  
Systematic literature reviews published in 2008 indicate a similar healing rate of venous ulcers with superficial vein surgery and conservative compression treatments but a reduction in ulcer recurrence rate with surgery. In general, recurrence rates after ligation and stripping are estimated at around 20%. Jones et al reported on the results of a study that randomized 100 patients with varicose veins to undergo either ligation alone or ligation in conjunction with stripping. At 1 year, reflux was detected in 9% of patients, rising to 26% at 2 years. Rutgers and Kitslaar reported on the results of a trial that randomized 181 limbs to undergo either ligation and stripping or ligation combined with sclerotherapy. At 2 years, Doppler ultrasound demonstrated reflux in approximately 10% of patients after ligation and stripping, increasing to 15% at 3 years.

Comparison of Endovenous Ablation with Ligation and Stripping  
An updated Cochrane review from 2014 compared endovenous ablation (radiofrequency and laser) and foam sclerotherapy versus ligation/stripping for saphenous vein varices. Included in the review were 13
randomized studies with a combined total of 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 (EVLA) versus surgery, there were no significant differences between the treatment groups for clinician noted or symptomatic recurrence, or for recanalization. Neovascularization and technical failure were reduced in the laser group (OR=0.05, p<0.001; and OR=0.29, p<0.001, respectively). For endovenous RFA versus surgery, there were no significant differences between the groups in clinician noted recurrence, recanalization, neovascularization, or technical failure. The authors concluded that sclerotherapy, EVLA, and RFA are at least as effective as surgery in the treatment of great saphenous varicose veins.

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

**Endovenous RFA**

In 2008, Luebke et al reported a meta-analysis of 8 studies that included a total of 224 patients who underwent RFA and 204 patients who underwent stripping. There was no significant difference between RFA and surgery in immediate or complete greater saphenous vein occlusion, incomplete greater saphenous vein closure, freedom from reflux, recurrent varicose veins, recanalization, or neovascularization between the 2 treatments. There were significant reductions in tenderness and ecchymosis at 1 week and fewer hematomas at 72 hours, 1 week, and 3 weeks with RFA. Quality-of-life results, including return to normal activity and return to work, favored RFA over surgery. The authors noted that rates of recanalization, retreatment, occlusion, and reflux may alter with longer follow-up and that further RCTs with longer follow-up are needed.

Long-term outcomes of endovenous RFA were reported from the Closure Study Group clinical registry in 2005. Thirty-four centers (1006 patients, 1222 limbs) participated in the registry, with 12 centers contributing 5-year data (406 limbs). The registry included data on the treatment of 52 lesser saphenous veins and 16 accessory saphenous veins. Follow-up at 1 week showed a 97% anatomic success rate and a decrease in pain in 50% (from 85% to 30%) of patients. An additional 162 failures were identified over the 5 years of follow-up; 129 veins were found to have recanalization, and 33 limbs had reflux in the groin. Logistic regression analysis (risk factors of sex, age, body mass index [BMI]), vein diameter, and catheter pullback
speed) showed that BMI was associated with long-term failure. The rate of pull-back speed of the catheter during treatment was associated with failure to occlude or recanalization.

**Endovenous Laser Ablation**

The largest trial on EVLA is the 2012 RELACS study, which was a practical design that randomized 400 patients to EVLA performed by a surgeon at 1 site or to ligation and stripping performed by a different surgeon at a second location. At 2-year follow-up, there was no significant difference between the groups for clinically recurrent varicose veins, medical condition on the Homburg Varicose Vein Severity Score, or disease-related quality of life. Saphenofemoral reflux was detected by ultrasonography more frequently after EVLT (17.8% vs 1.3%). This study will follow patients for 5 years. Another trial compared EVLA with ligation and stripping in 200 limbs (100 in each group). At 1-year follow-up, 98% of the limbs were reported to be free of symptoms. At 2-year follow-up, the EVLA group had 2 veins completely reopened and 5 partially reopened, which was significantly greater than in the ligation and stripping group. In the 2013 MAGNA trial, 223 consecutive patients (240 legs) with great saphenous vein reflux were randomized to EVLA, ligation and stripping, or foam sclerotherapy. At 1-year follow-up, the anatomic success rates were similar between EVLA and stripping (88.5% and 88.2%, respectively), which were superior to foam sclerotherapy (72.2%). Ten percent of the stripping group showed neovascularization. Health-related quality of life improved in all groups. The CEAP classification improved in all groups with no significant difference between the groups. Transient adverse events were reported in 11 patients after stripping, 7 after EVLA, and 5 after sclerotherapy. At 5-year follow-up, Kaplan-Meier analysis showed obliteration or absence of the great saphenous vein in 85% of patients who underwent conventional surgery and 77% of patients who underwent EVLA (not significantly different). Grade I neovascularization was higher in the conventional surgery group (27% vs 3%, p<0.001), while grade II neovascularization was similar in the 2 groups (17% vs 13%).

Literature on isolated treatment of the anterior accessory saphenous vein is limited. In a 2009 study, outcomes from a cohort of 33 patients who underwent EVLA of the anterior accessory saphenous vein were compared with 33 matched controls undergoing EVLA of the greater saphenous vein. In 21 of the patients (64%) in the accessory saphenous vein group, there had been no previous treatment of the greater saphenous vein. At 12-month follow-up, there was no evidence of reflux in these patients, and the treated accessory saphenous vein was not visible with ultrasound. The Aberdeen Varicose Vein Symptom Severity Score had improved in both groups, with no significant difference between the 2 groups. Patient satisfaction scores were also similar.

**Sclerotherapy**

In the 2013 MAGNA trial (previously described), 223 consecutive patients (240 legs) with great saphenous vein reflux were randomized to EVLA, ligation and stripping, or physician compounded foam sclerotherapy (1 cc aethoxysclerol 3%; 3 cc air). At 1-year follow-up, the anatomic success rate of foam sclerotherapy (72.2%) was inferior to both EVLA and stripping (88.5% and 88.2%, respectively). 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.
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and 77% of patients who underwent EVLA. Thirty-two percent of legs treated initially with sclerotherapy required 1 or more reinterventions during follow-up compared with 10% in the conventional surgery and EVLA groups. However, clinically relevant grade II neovascularization was higher in the conventional surgery and EVLA groups (17% and 13%, respectively) compared with the sclerotherapy group (4%). EuroQol-5D scores improved equally in all groups. A 2012 study was a noninferiority trial of foam sclerotherapy versus ligation and stripping in 430 patients. Analysis was per protocol. Forty patients (17%) had repeat sclerotherapy. At 2 years, the probability of clinical recurrence was similar in the 2 groups (11.3% sclerotherapy vs 9.0% ligation and stripping), although reflux was significantly more frequent in the sclerotherapy group (35% vs 21%). Thrombophlebitis occurred in 7.4% of patients after sclerotherapy. There were 2 serious adverse events in the sclerotherapy group (deep venous thrombosis and pulmonary emboli) that occurred within 1 week of treatment.

In 2013, Varithena microfoam was approved under a new drug application for the treatment of varicose veins. Efficacy data were from 2 randomized, blinded, multicenter studies. One evaluated Varithena at 0.5%, 1.0%, and 2.0% polidocanol and the second evaluated Varithena at 0.5% and 1.0% polidocanol compared with endovenous placebo or a subtherapeutic dose of polidocanol foam. The primary end point was improvement in symptoms at week 8, as measured by the Varicose Vein Symptoms Questionnaire. The improvement in symptoms was greater in the pooled Varithena treatment group (p<0.001) and in each of the individual dose-concentration groups compared with vehicle alone. Secondary and tertiary end points (appearance, duplex ultrasound response, quality of life) were also significantly better for the Varithena groups compared with controls. This second study, called VANISH-2, was published in 2014. 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 1.0% dose of Varithena was selected for the FDA approval. Safety analysis found deep vein thrombosis detected by ultrasound in 2.8% of Varithena-treated patients with 1% of patients having proximal symptomatic thrombi; these were treated with anticoagulants. There was no signal of an increase in neurological adverse events, and there were no adverse cardiac or cardiopulmonary effects following treatment with Varithena injectable foam. Rates of occlusion with Varithena are similar to those reported for EVLA or stripping. A randomized trial comparing EVLA and stripping with this new preparation of foam sclerotherapy is needed to evaluate its comparative effectiveness. Evaluation out to 5 years is continuing.

Mechanochemical Ablation
Several prospective series and cohort studies have been reported. One prospective multicenter series evaluated the efficacy of mechanochemical ablation (MCA) of the great saphenous vein in 126 patients in a community setting. Veins were selected that were greater than 4 mm and less than 12 mm in diameter, with an average diameter of 7.3 mm. Closure rates were 100% at 1 week, 98% at 3 months, and 94% at 6 months. The venous clinical severity score decreased from a score of approximately 9 pretreatment to about 3 at 6 months. In 2012, Elias and Raines reported an industry-sponsored safety and efficacy study of MCA with the ClariVein system. Thirty greater saphenous veins in 29 patients were treated with this device. Greater saphenous veins with diameters greater than 12 mm were excluded. At 6-month follow-up, 1 vein had recanalized, for a primary closure rate of 96.7%. No pain during the procedure or adverse events were
reported. Another prospective series evaluated MCA of the small saphenous vein in 50 consecutive patients. Only patients with a vein diameter of 2.5 to 11 mm were included. The dose of sclerosant was increased after the first 15 patients. At the 6-week assessment, all treated veins were occluded and at 1-year follow-up, 94% remained occluded. The median visual analog scale score for pain during the procedure was 2 of 10. There were no major complications. Controlled studies with a greater number of subjects and longer follow-up are needed.

A 2013 review of MCA notes that a 5-year 840 patient randomized trial comparing ClariVein with RFA began in 2012 in Europe. This trial will provide needed data on the comparative effectiveness of MCA, measured at a longer duration and in a larger population. Early results from this trial (119 patients) indicate that intra-procedural pain is slightly lower with MCA (13.4 mm on a 100-mm scale) compared with RFA (24.4, p=0.001).

Cyanoacrylate Adhesion
The VenaSeal pivotal study (VeClose) was a multicenter noninferiority trial with 222 patients that compared VenaSeal versus RFA for the treatment of venous reflux. The primary end point, the proportion of patients with complete closure of the target great saphenous vein at 3 months measured by ultrasound, was noninferior to RFA, with a 99% closure rate for VenaSeal compared with 96% for RFA. The secondary end point of intraoperative pain was similar for the 2 groups (2.2 on a 10-point scale for VenaSeal and 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 Aberdeen Varicose Veins Questionnaire (AVVQ) and Venous Clinical Severity Score improved to a similar extent in the 2 groups. Longer term follow-up is needed to permit conclusions on the durability of this procedure.

Twenty-four-month follow-up was reported for 24 of 38 patients enrolled in a study by Almeida et al. Thirty-three-month follow-up was reported in 467 veins out of a series of 795 veins (58.7%) treated at 1 institution in Germany. An inflammatory reddening of the skin was observed at approximately 1 week after treatment in 11.7% of cases. No permanent skin responses were observed. Of the 467 veins reexamined, the sealing rate was 97.7%. This series is limited by the high loss to follow-up.

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

Disselhoff et al reported 2 and 5 year outcomes from a randomized trial that compared cryostripping with EVLA. Included were 120 patients with symptomatic uncomplicated varicose veins (CEAP C2) with saphenofemoral incompetence and greater saphenous vein reflux. At 10 days after treatment, EVLA had better results than cryostripping with respect to pain score over the first 10 days (2.9 vs 4.4), resumption of
normal activity (75% vs 45%) and induration (15% vs 52%). At 2-year follow-up, freedom from recurrent incompetence was observed in 77% of patients after EVLA and 66% of patients after cryostripping (not significantly different). At 5 years, 36.7% of patients were lost to follow-up; freedom from incompetence and neovascularization was found in 62% of patients treated with EVLA and 51% of patients treated with cryostripping (not significantly different). Neovascularization was more common after cryostripping, but incompetent tributaries were more common after EVLA. There was no significant difference between groups in the Venous Clinical Severity Score or Aberdeen Varicose Vein Severity Score at either 2 or 5 years.

Other Treatments
Both steam injection and microwave ablation for endovenous treatment of varicose veins were reported outside of the United States. These procedures have not been approved or cleared for marketing by FDA.

Section Summary
There are a number of large randomized trials on endovenous ablation of the saphenous veins. Comparison with ligation and stripping at 2-year follow-up supports use of both RFA and EVLA. Evidence suggests that ligation and stripping may lead to neovascularization, while thermal ablation may lead to recanalization. Controlled studies with longer follow-up are needed to determine the long-term efficacy of these treatments with greater certainty. Two RCTs suggest that cryotherapy is not as effective as available alternatives. For physician-compounded sclerotherapy, there is high variability in success rates of the procedure and reports of serious adverse events. Rates of occlusion with the FDA-approved microfoam sclerotherapy are similar to those reported for EVLA or stripping. MCA is a combination of liquid sclerotherapy with mechanical abrasion. A potential advantage of this procedure compared with thermal ablation techniques is that it does not require tumescent anesthesia and may result in less postoperative pain. To date, the ClariVein procedure has been assessed in relatively few patients and for short durations. Thus, there is insufficient evidence to permit conclusions regarding the safety and efficacy of MCA. Short-term efficacy of cyanoacrylate adhesion has been shown to be noninferior to RF in a large multicenter RCT at 3 months. Longer term follow-up is needed to determine durability of this treatment.

Treatment of Tributary Varicosities
Sclerotherapy and Phlebectomy
Early studies established ligation and stripping as the criterion standard for the treatment of saphenofemoral incompetence based on improved long-term recurrence rates, with sclerotherapy used primarily as an adjunct to treat varicose tributaries. A 2006 Cochrane Review, 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.” Sclerotherapy and phlebectomy are considered appropriate in the absence of reflux of the saphenous system, eg, post- or adjunctive treatment to other procedures such as surgery. In 2014, El-Sheikh et al reported a small randomized trial of concomitant or sequential (if needed) phlebectomy following EVLA for varicose veins. Quality of life and clinical severity scores were similar between the groups by 1 year, with 16 of 24 patients (67%) in the sequential phlebectomy group receiving a secondary intervention.
A small proportion of patients may present with tributary varicosities in the absence of saphenous reflux. For example, of 1009 patients recruited for an RCT, 64 patients were found to have minor varicose veins without reflux, 34 of whom agreed to be randomized to sclerotherapy or conservative treatment. At baseline, 92% had symptoms of heaviness, 69% had cosmetic concerns, 53% reported itching, and 30% reported relief of symptoms through the use of 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 improved compared with 29% of patients in the conservative-therapy group. Symptoms of aching were better or eliminated in 69% of the sclerotherapy group and 28% of the group treated with conservative therapy. Cosmetic concerns were improved in 85% of the sclerotherapy patients and 14% of controls.

The bulk of the literature discussing the role of ultrasound guidance refers to sclerotherapy of the saphenous vein, as opposed to the varicose tributaries. In 2012, Yamaki et al reported a prospective RCT that compared visual foam sclerotherapy versus ultrasound-guided foam sclerotherapy of the greater saphenous vein together with visual foam sclerotherapy for varicose tributary veins. A total of 51 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 limbs (45.1%) treated with ultrasound-guided and visual-guided foam sclerotherapy and in 22 limbs (42.3%) treated with visual sclerotherapy alone. Reflux was absent in 30 limbs (58.8%) treated with ultrasound and visual guidance and in 37 (71.2%) treated with visual guidance alone (not significantly different). The authors note that for the treatment of tributary veins in clinical practice, most patients receive direct injection of foam without ultrasound guidance.

Transilluminated Powered Phlebectomy
A 2008 meta-analysis included 5 studies that compared TIPP with conventional surgery. Results showed a significant advantage of TIPP over the conventional treatment for 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 that compared TIPP (n=29) with a multiple stab incision procedure (n=33). A single surgeon performed all but 2 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, blinded evaluation revealed that bruising or discoloration was higher for the TIPP group at both 1 and 6 weeks after surgery. At 6 weeks after surgery, patients in the TIPP group showed no improvement in pain (-2 points on the Burford pain scale), while patients in the multiple stab incision group had a significant improvement in pain score compared with presurgical baseline (-20 points). Six weeks after surgery, quality-of-life measures had improved in the multiple-stab incision group but not in the TIPP group. Thus, although TIPP had the advantage of fewer surgical incisions, in this single-center study, it was associated with a more prolonged recovery due to more extensive bruising, prolonged pain, and reduced early postoperative quality of life. The current literature does not show an advantage of TIPP over conventional treatment.
Section Summary: Treatment of Tributary Varicosities
The literature indicates that sclerotherapy of tributaries following occlusion of the saphenofemoral or saphenopopliteal junction and saphenous veins may be considered medically necessary. Evidence is insufficient to evaluate the health benefit of sclerotherapy as a sole treatment of varicose tributaries without prior or concurrent treatment of the saphenous veins. No studies have been identified that compare RF or laser ablation of tributary veins with standard procedures (microphlebectomy and/or sclerotherapy). Transilluminated powered phlebectomy 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.

Treatment of Perforator Reflux
A systematic literature review published in 2008 indicates insufficient evidence for the role of incompetent perforator vein surgery. These conclusions were based on 4 RCTs published since 2000 that compared superficial vein surgery with conservative therapy in advanced chronic venous insufficiency (CEAP category C5 to C6). The 4 trials included 2 level I (large subject population) and 2 level II (small subject population) studies. Two of the trials combined surgical treatment of the incompetent perforator veins with concurrent or prior treatment of the superficial saphenous veins; the other 2 treated the greater saphenous vein alone. The 2 randomized studies in which the greater saphenous vein alone was treated (including the ESCHAR trial) showed a significant reduction in ulcer recurrence in comparison with conservative therapy. A 2011 community hospital-based multicenter, double-blind, randomized trial found no clinical benefit (self-reported symptoms) from adding subfascial endoscopic perforator surgery (SEPS) to saphenous surgery in 75 patients with varicose ulcers (CEAP C5 or C6) and incompetent perforators.

Treatment of the great saphenous vein alone has been reported to improve perforator function. For example, 1 study showed that reversal of perforator vein incompetence (41% of 68 previously incompetent perforators) was more common than new perforator vein incompetence (22% of 183 previously competent perforators) following superficial vein surgery. O’Donnell discusses additional (lower quality) evidence to suggest deep venous valvular involvement rather than incompetent perforators in venous insufficiency. 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
In 2004, Tenbrook et al published a review of the literature of SEPS, which included 19 case series and 1 randomized trial. In total, the reviewed studies included 1031 patients with 1140 treated limbs. The authors concluded that SEPS was associated with excellent results in terms of ulcer healing and prevention of recurrence. However, the authors also noted that randomized trials are required to define the relative contributions of compression therapy, superficial venous surgery, and SEPS in the management of severe venous disease. In 2015, Van Gent et al reported 10-year follow-up of a randomized trial that compared conservative treatment versus SEPS for venous leg ulcers. Patients (196 legs) returned to the clinic on an annual basis and analysis was conducted with the last-observation-carried-forward. The primary outcome, incidence ulcer-free, was significantly higher in the surgical group than in the conservative treatment group.
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(58.9% vs 39.6%, p=0.007). The number of incompetent perforator veins at follow-up was a risk factor for not being ulcer free (OR=18.5, p<0.001). The relatively high rate of recurrence of the surgically treated group may be due to limited/no stripping of the superficial veins at the time of SEPS.

A 2009 meta-analysis of SEPS for chronic venous insufficiency concludes that “Its [SEPS] 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.” The authors also state that “introduction of less invasive techniques for perforator vein ablation, such as ultrasound-guided sclerotherapy or radiofrequency ablation, may diminish the role of SEPS in the future.”

Other Treatments
A 2008 review of procedures for management of varicose veins recommends duplex-guided foam sclerotherapy, microincision phlebectomy, or thermal ablation using a new short RFA catheter for the treatment of symptomatic residual perforator vein incompetence. Ablation of incompetent perforator veins with laser or RFA had been shown to be technically feasible, although no studies had been identified that showed an improvement in clinical outcomes (eg, ulcer healing or recurrence). The 2011 literature update identified 1 study of EVLA for perforating veins in 33 patients with a CEAP classification of 4 (skin changes), 5 (healed ulcer), or 6 (active ulcer). All incompetent saphenous trunks were treated simultaneously (63% of limbs). At 3-month follow-up, occlusion was achieved in 78% of the perforating veins. Five patients (15%) had active ulcers at baseline; 4 of the 5 ulcers had healed by 6 weeks after EVLA. Evidence regarding the treatment of perforator veins with ultrasound-guided sclerotherapy is limited, and there is a risk of deep venous occlusion.

Section Summary: Treatment of Perforator Reflux
The literature indicates that the routine ligation/ablation of incompetent perforator veins is not medically 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 (ie, ulcers), treatment of perforator vein reflux may be as beneficial as any alternative (eg, deep vein valve replacement). Therefore, treatment of incompetent perforator veins may be considered medically necessary in this specific situation.

Comparative studies are needed to determine the most effective method of ligating/ablating incompetent perforator veins. SEPS has been shown to be as effective as the Linton procedure with a reduction in adverse events. Although only 1 case series has been identified showing an improvement in health outcomes, endovenous ablation with specialized laser or RF probes has been shown to effectively ablate incompetent perforator veins with a potential decrease in morbidity in comparison with surgical interventions. For sclerotherapy, concerns have been raised about the risk of deep vein occlusion, and evidence is currently insufficient to evaluate the safety or efficacy of this treatment for incompetent perforator veins.
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Ongoing and Unpublished Clinical Trials
Some currently unpublished trials that might influence this review are listed in Table 1.

Table 1. Summary of Key Trials

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<td>NCT 01459263</td>
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<td>NTR4613a</td>
<td>Mechanochemical endovenous ablation versus radiofrequency ablation in the treatment of primary small saphenous vein insufficiency (MESSI trial)</td>
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<td>Apr 2020</td>
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NCT: national clinical trial. NTR: Nederlands Trial Registry.

Denotes industry-sponsored or cosponsored trial.

Summary of Evidence
The evidence on mechanochemical ablation, cyanoacrylate adhesive, and cryoaablation in patients with varicose veins/venous insufficiency includes RCTs and multicenter series. Relevant outcomes are symptoms, morbidity events, functional outcomes, and change in disease status. Several series have been reported on MCA, and a large RCT comparing MCA with RF ablation is ongoing. Efficacy of cyanoacrylate adhesion at 3 months has been shown to be noninferior to RF in a multicenter RCT. Longer term follow-up is needed to determine durability of this treatment. Results from a recent RCT of cryoaablation indicate that this therapy is inferior to conventional stripping. The evidence is insufficient to determine the effects of the technology on health outcomes.

References
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20. Todd KL, 3rd, Wright D, for the V-IG. The VANISH-2 study: a randomized, blinded, multicenter study to evaluate the efficacy and safety of polidocanol endovenous microfoam 0.5% and 1.0% compared with placebo for the treatment of saphenofemoral junction incompetence. Phlebology. Oct 2014;29(9):608-618. PMID 23864935


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Policy History
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08/15/2002 Medical Policy Committee review
08/26/2002 Managed Care Advisory Council approval
10/05/2004 Medical Director review
11/29/2004 Managed Care Advisory Council approval
10/05/2005 Medical Director review
10/18/2005 Medical Policy Committee review. Format revision. No substance change to policy.
10/27/2005 Quality Care Advisory Council approval
07/07/2006 Format revision including addition of FDA and or other governmental regulatory approval and rationale/source. Coverage eligibility unchanged.
11/01/2006 Medical Director review
11/15/2006 Medical Policy Committee approval. Patient selection criteria changed to include all saphenous varicose veins as eligible for coverage with criteria.
06/13/2007 Medical Director review
06/20/2007 Medical Policy Committee approval. Policy revised to include small saphenous and great saphenous vein greater than 12mm. Rationale/Source updated.
06/04/2008 Medical Director review
06/18/2008 Medical Policy Committee approval. No change to coverage eligibility.
06/04/2009 Medical Director review
06/17/2009 Medical Policy Committee approval. No change to coverage eligibility.
06/03/2010 Medical Policy Committee review
06/16/2010 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
06/02/2011 Medical Policy Committee review
06/14/2012 Medical Policy Committee review
06/20/2012 Medical Policy Implementation Committee approval. Policy extensively rewritten. Title changed. Added "echosclerotherapy, also known as deep ultrasound-guided sclerotherapy (DUGS), usually
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with a catheter infusion of a foam sclerosant, and other protocols for sclerotherapy, including the COMPASS protocol* to list of investigational indications.

06/04/2013 The "not medically necessary" statement for treatment of greater or lesser saphenous veins clarified by removal of the term "cosmetic".
06/06/2013 Medical Policy Committee review
06/25/2013 Medical Policy Implementation Committee approval. Mechanochemical ablation of any vein added as investigational. “The Company considers treatment of telangiectasia such as spider veins, angiomata, and hemangiomata cosmetic and is not a covered benefit” was changed from not medically necessary.
06/05/2014 Medical Policy Committee review
06/18/2014 Medical Policy Implementation Committee approval. No change to coverage.
03/05/2015 Medical Policy Committee review
03/20/2015 Medical Policy Implementation Committee approval. Microfoam sclerotherapy considered medically necessary. Added “or microfoam sclerotherapy” to the not medically necessary policy statement under accessory saphenous veins.
08/03/2015 Coding update: ICD10 Diagnosis code section added; ICD9 Procedure code section removed.
01/07/2016 Medical Policy Committee review
01/22/2016 Medical Policy Implementation Committee approval. The requirement of failure of compression therapy was removed from the policy statements on ulceration secondary to venous stasis and recurrent superficial thrombophlebitis; terminology was changed from greater and lesser to great and small saphenous veins. Cyanoacrylate adhesive of any vein added to INV statement. CEAP clinical classification info added.
01/01/2017 Coding update: Removal of ICD-9 Diagnosis Codes and CPT coding update
01/05/2017 Medical Policy Committee review
01/18/2017 Medical Policy Implementation Committee approval. Added coverage for ultrasound-guided microfoam sclerotherapy.

Next Scheduled Review Date: 01/2018

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B. Clinically appropriate, in terms of type, frequency, extent, level of care, site and duration, and considered effective for the patient's illness, injury or disease; and

C. Not primarily for the personal comfort or convenience of the patient, physician or other health care provider, and 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 that patient's illness, injury or disease.

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