Guidelines

Phlebology

Phlebology
2020, Vol. 35(2) 73–83

DOI: 10.1177/0268355519857362
journals.sagepub.com/home/phl
SAGE

European College of Phlebology guideline for truncal ablation

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Abstract

Background: The purpose of the guideline was to achieve consensus in the care and treatment of patients with chronic venous disease, based on current evidence.

Method: A systematic literature search was performed in PubMed, Embase, Cinahl, and the Cochrane library up until 1 February 2019. Additional relevant literature were added through checking of references. Level of evidence was graded through the GRADE scale and recommendations were concluded.

Results: For the treatment of great and small saphenous vein reflux, endovenous ablation with laser or radiofrequency was recommended in preference to surgery or foam sclerotherapy. If tributaries are to be treated it should be done in the same procedure. Treatment with mecanicochemical ablation and glue can be used but we still need long term follow up results.

Conclusion: For the treatment of truncal varicosities, endovenous ablation with laser or radiofrequency combined with phlebectomies is recommended before surgery or foam.

Keywords

Chronic venous disease, chronic venous insufficiency, endovascular treatment, endovenous thermal ablation, foam sclerotherapy

Surgical anatomy and terminology

The superficial veins in the lower extremity drain into the two larger veins: the great saphenous vein (GSV) and the small saphenous vein (SSV). The GSV originates in the medial foot, and travel to the groin inside the "saphenous fascia".[1] Visualization of this fascial envelope is an important way of identifying the GSV with duplex ultrasonography (DUS). The termination point of the GSV into the common femoral vein, is the saphenofemoral junction (SFJ). Just below its junction with the common femoral vein, the GSV receives several tributary veins.[2] The anterior accessory vein (AASV) is the most important site of recurrence after endovenous ablation.[3] The GSV runs intimately along the saphenous nerve below the knee.

The SSV ascends upwards on the posterior aspect of the calf between the two heads of the gastrocnemius muscle. In the popliteal fossa, the main trunk of the SSV usually drains into the popliteal vein. A thigh extension of the SSV may terminate in a thigh, infra-gluteal GSV, or pelvic escape point. The term "vein of Giacomini" denotes the extension of the SSV terminating in the GSV medially via the posterior thigh circumflex vein.[4] The SSV lies in its own saphenous compartment, delineated by the superficial fascia and the muscular fascia.[5] In the distal two-thirds of the

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lower leg, the distance between the vein and the sural nerve is <5 mm in 90% of the legs, making the sural nerve at risk during endovenous thermal ablation (EVTA).[6]

Treatment modalities

The introduction of endovenous techniques almost 20 years ago has radically changed the treatment of varicose veins. Gudmundur Danielsson treated the first patient using radiofrequency in Lund Sweden in 1998.[7] Carlos Boné treated the first patient in 1999 with laser.[8] Subsequently, endovenous techniques have become popular as minimally invasive alternatives to high ligation and stripping (HL&S). Mainly there are two modes of treatment: endovenous thermal ablation (laser, radiofrequency, and steam) and nonthermal ablation (foam, mechanical occlusion chemically assisted (MOCA), and cyanoacrylate ablation (CA)). Different wavelengths of lasers, radial, or covered laser tips have been introduced in the last two decades.[9–13] Segmental radiofrequency ablation (RFA) with Venefit® (Medtronic minimally invasive therapies) is the most widely used RFA technique.[13] Steam ablation is the third thermal ablation technique.[14] Endovenous thermal techniques require injection of tumescent anesthesia. Nonthermal ablation techniques does not.[15,16]

The occlusion rates of EVTA are as good as HL&S in most studies. Foam is less efficient but cheaper. Side effects, complications, and convalescence period are comparable.[17]

Endovenous thermal ablation

Endovenous thermal ablation is performed as an outpatient procedure.[3] Venous access to the GSV is gained at the most distal point of reflux or just below the knee. The SSV is punctured at mid-calf to reduce the risk of sural nerve injury. When treating the GSV, the tip is positioned just after the origin of the superficial epigastric vein or 1.5–2 cm distal to the SFJ, and for SSV, the tip is positioned at the point where the SSV leaves the subfascial space to join the popliteal vein. The tumescent fluid usually is diluted lidocaine and may consists of 25 mL lidocaine 2% with 1 mL adrenaline 0.01% and 12 mL sodium bicarbonate 8.4% in 1000 mL NaCl. The average amount of tumescent fluid is 8–10 mL/cm of vein. Regarding energy for EVLA, Maurins recommended 7 J times the diameter (in mm) per cm/vein when using a radial fiber, and 10 J when using a bare fiber.[17,18] Most clinicians use energy 8–10 W, while some use lower energy.

For RFA with segmental ablation (Venefit) the energy is somewhat higher and controlled by the generator regulated by the thermometer at the tip. The procedure ensures 120°C for 20 seconds per segment of 7 cm.[13]

Post intervention compression for one week is often recommended, but the value and duration of compression is not clearly defined.[19] Accordingly, there is currently little quality of evidence regarding compression, but few studies suggest that postoperative compression after EVLA may reduce postoperative pain for up to one week postoperatively.[20] However, a recent metaanalysis did not reveal any advantage of compression therapy.[21]

Recommendation	Class	Level	References
In order to reduce post ablation pain and edema, compression for one week is considered.	IIa	B	Marsden et al.,[19] Huang et al.,[20] Al Shakarchi et al.,[21] Ye et al.,[22] El-Sheikha et al.[23]

Endovenous laser ablation

There are several wavelengths targeting mainly hemoglobin (810, 940, 980, 1064 nm), or water (1320, 1470, 1500, 1927, and 2100 nm). Hemoglobin-specific laser wavelengths lead to steam bubble formation, which secondarily induces thermal damage to the intima.[24] Traditionally, the hemoglobin-specific laser generators have been used with a bare-tip fiber, which may lead to perforation of the vein wall. Although this mechanism is effective in vein obliteration, it is associated with increased post procedural pain. A radial fiber tip used with a water-specific laser wavelength (1470 nm) appears to reduce postoperative pain, probably due to less perforation of the vein wall.[25,26] All currently available wavelengths are efficient in ablation of varicose veins, but they differ in side effects and patient compliance.[27] Occlusion rates of EVLA vary between 77% and 99% at one year.[28–32] The occlusion is durable, as in most cases the GSV disappears after about a year.[33–35] In a review of all papers concerning different wavelengths, Cavallini[27] found five studies of comparison between different wavelength, 810 vs. 980 nm, 940 vs. 1320 nm, 810 vs. 1320 nm, 980 vs. 1500 nm, and 980 vs. 1470 nm. The report suggested that higher wavelength (1440 nm) in addition to new optical fibers appear to decrease postoperative pain and bruising.

The new fiber tip modifications have been developed in order to reduce the risk of perforating the vein wall. Gold-tip NeverTouch VenaCure laser fiber (AngioDynamics, Queensbury, NY), Radial fiber (Biolitec, Wien, Austria), and Tulip fiber (Tobrix, Waalre, the Netherlands) are safe and efficient.[24,26,36,37]

In a recent paper, Wallace et al.[38] reported five years follow-up data of laser ablation and compared with traditional surgery. Clinical recurrence was more frequent following surgery than EVLA at five years (34.3 vs. 20.9%; $P = 0.010$). Both groups showed significant improvements at five years over baseline in VCSS scores; however, VCSS was better for EVLA than surgery at five years ($P = 0.031$).

Recommendation	Class	Level	References
In order to reduce postoperative pain, longer wavelengths and modified fiber tips, such as jacket-tip and radial fiber may be used.	IIa	B	Kabnick and Sadek,[24] Vuylsteke and Mordon,[37] Stokbroekx et al.,[36] Hirokawa et al.,[39] Dogancı and Demirkilic,[40] Hirokawa and Kurihara[41]

Radiofrequency ablation

The Venefit radiofrequency segmental thermal ablation catheter is the most widely used device (Medtronic, USA). The 7 cm long therapeutic distal end heats up for 20 s. The power is automatically adjusted by the generator in order to maintain the temperature of the heating element at 120°C. In large veins and in the terminal segment of the GSV, a second or a third cycle may be given immediately after the first one. A catheter with 3 cm heating element to treat short vein segments and perforators is also available. Five-year results from the prospective European multicenter cohort study RFA using the Venefit procedure showed GSV occlusion rate of 91.9% with 94.9% reflux free GSVs.[3] Recently, Whitely et al.[42] reported an 88% success with no recurrence in the originally treated truncal veins, 15 years post RFA, as demonstrated by duplex. Other RFA systems are available (RFITT, Olympus, Germany and Venclose, USA), but the long-term efficacy is still less documented.

Steam ablation

Endovenous steam ablation (EVSA) (SVS system; CERMA SA, France) works by heating the vein with steam at a temperature of maximal 120°C. The catheter releases small pulses of steam, which destroys and closes the vein.[43] In the LAST trial, the success after one year rate was similar to EVLA, and the complication profile and convalescence were comparable.[44]

Nonthermal, nontumescent ablation of truncal veins

Infiltration of tumescent fluid cause discomfort. Nonthermal, nontumescent methods are newer techniques believed to reduce pain, because of the absence of tumescence during ablation. Ultrasound-guided foam sclerotherapy is the first nonthermal, nontumescent method and which is widely used, but it is less efficient than EVTA and surgery.[33,34] The other methods are MOCA and CA.

Ultrasound guided foam sclerotherapy

The use of ultrasound guided foam sclerotherapy (UGFS) for the successful abolition of saphenous vein reflux was first reported in 1996, and its relative efficacy and safety is now well established.[45,46] The advantage of foam is its simplicity and low cost. However, foam sclerotherapy for ablation of saphenous veins is less efficient than surgery and endothermal techniques in the short, as well as long term.[17,33,34] Repeated treatment may overcome this problem. In a randomized trial treating 580 legs with GSV ablation and phlebectomies, Rasmussen et al.[17] and Lawaetz et al.[33] found similar complication profile of EVLA, RFA, UGFS, and stripping, but an occlusion rate of the GSV that was 25% lower compared to the other groups after five years. Severe complications are rare; however, neurologic events such as visual disturbances, migraine, and stroke, have been reported and make this method less attractive.[47–50]

Traditional foam has been prepared by mixing liquid sclerosant with room air or gas, using Tessari et al.'s or the double syringe method.[51] This technique is efficient in experienced hands. A commercially available polidocanol endovenous drug/delivery unit, Varithena® (BTG International Ltd), was approved by the FDA to overcome the variability and inconsistencies of physician-compounded foam.

Mechanochemical ablation

Mechanochemical ablation (MOCA, The ClariVein occlusion catheter system – Vascular Insights, Madison, CT, USA) is a nonthermal catheter-based system. The mechanical component includes a rotating wire, which damages the endothelium of the vein and results spasm while liquid sclerosant is administered from the tip of the catheter concomitantly for chemical obliteration.[16] The system allows treatment of only one saphenous vein in a 24-hour period, because of dose limitations of sclerosing agents. Transient phlebitis was the only common minor complication noted (4%).[52]

Witte et al. reported midterm outcome of 85 patients treated with MOCA for the treatment of GSV insufficiency. Anatomic success was found to be 92%, 90%, and 87% after one, two, and three years, respectively.[53] In a systematic review, Vos et al.[54] reported a pool anatomic success of 94.1% at 12 months after the index procedure. However, in a recent single-center cohort study, complete target vein occlusion at one year was found to be 75%, and six patients (21.4%) required secondary procedures.[55]

Cyanoacrylate ablation

Intravenously administered cyanoacrylate glue immediately occludes the vessel. It elicits a granulomatous foreign body reaction and a concomitant inflammatory vein wall reaction, leading to fibrotic degradation.[15]

Cyanoacrylate (Venaseal) embolisation of the GSV in man was first described in 2013.[56] Since then, further follow-up and more studies have shown that the treatment is efficient, safe, and easy to perform.[57,58] The closure rate is comparable to that of RFA at month 36 (94.4% for the cyanoacrylate closure group and 91.9% for the radiofrequency ablation group).[59]

In a systematic review, CA presented an anatomic success of 94.8% and 89% at 6 and at 12 months after the initial procedure, respectively.[54] Another two variants of cyanoacrylate (Variclose and Venablock), have also proven to be efficient and safe.[60–62]

Only minor complications have been reported so far, but phlebitis in the GSV after a week has been reported in 11–20% of cases.[58,63,64]

Summary of the endovenous ablation procedures

Endovenous methods for truncal ablation are now well established and effective though for many of the newly introduced nonthermal procedures, we still need more robust long-term data to firmly establish their place.

Technique	Early occlusion rate (%)	1-year occlusion rate (%)	2-year occlusion rate (%)	3-year occlusion rate (%)	5-year occlusion rate (%)
Radiofrequency ablation	90–100	85–98	85–96	68–95	92 (Proebstle et al.[3]) – 94.2 (Lawaetz et al.[33])
Endovenous laser ablation	93–100	89–100	74–97	79–100	65.7 (Weiss et al.[66]), 77(van der Velden et al.[34]) – 84.7 (Weiss et al.[66]), 93.2 (Lawaetz et al.[33]) 95% (Rasmussen et al.[35])
Endovenous foam	45–96	67–93	53–97	53–79	23 (van der Velden et al.[34]) – 68.5 (Lawaetz et al.[33])
MOCA	87–99	88–97	96–97	87 (Witte 2017[67])	NA
Cyanoacrylate glue	93–99	92–93	92	94.4%[59]	NA

NA: not available; MOCA: mechanochemical ablation.

High ligation with/without stripping

HL&S has been the standard method of removing saphenous veins for at least half a century. It has been reported that surgical treatment of varicose veins is superior to conservative management with compression regarding symptomatic relief, cosmetic results, and quality of life (QoL).[68] Traditional HL&S in general anesthesia has evolved towards a less invasive technique by invagination under tumescent local anesthesia, giving post-operative results as good as endovenous ablation techniques in terms of complications, pain, QoL and recurrence as shown by Rasmussen and Lawaetz in two randomized controlled trials.[17,33,69] Cryostripping and pin stripping are comparable alternatives.[70]

Randomized trials have shown that HL&S is superior to isolated HL, both including phlebectomies with regards to the rate of reoperations, but not to the rate of clinical recurrence.[71–74]

Recommendation	Class	Level	References
For the noncomplicated C2, C3 varicose veins surgical treatment is recommended instead of conservative management.	I	B	Raju and Neglén,[75] Michaels et al.[68]
For surgical treatment high ligation and stripping is recommended instead of high ligation alone.	I	A	Winterborn et al.,[71] Dwerryhouse et al.,[72] Miyazaki et al.,[73] Rutgers and Kitslaar[74]

Safety data

Deep venous thrombosis

In a randomized trial comparing EVLA and surgery in 121 patients with 137 legs, Rasmussen et al.[69] reported

no incidences of deep vein thrombosis (DVT)or endothermal heat induced thrombosis (EHIT). In a trial comparing EVLA, RF, UGFS, and surgery in 500 patients with 580 legs, DVT was seen in one patient treated with UGFS.[17]

Thrombo-prophylaxis can be prescribed for high-risk patients (previous venous thromboembolism, documented thrombophilia, obesity, immobilized patients, patients with neoplasm, and older patients). However, risk factors should be weighted for each individual patient using a specific risk assessment. Guideline of "the First International Consensus Conference on Endovenous Thermal Ablation for Varicose Vein Disease" recommends against routine prescription of prophylactic anticoagulation (GRADE 1C).[76]

Recommendation	Class	Level	References
Thrombo-prophylaxis should be considered for high risk patients.	IIb	C	Pavlović et al.,[76] Korepta et al.,[77] Kurihara et al.,[78] Hicks et al.,[79] Shutze et al.[80]

The current Society for Vascular Surgery/American Venous Forum recommendation is to perform screening DUS after EVA within 72 h postoperatively with a weak level of recommendation (grade 2C). When the current available literature is examined, it is difficult to justify routine DUS screening for all patients undergoing endovenous ablation, and recommendations regarding universal post-EVA screening should be revised in the near future.[81]

Recommendation	Class	Level	References
Routine post-ablation DUS is not recommended.	IIb	C	Suarez et al.[81]

Comparison of different techniques

Surgery vs. EVTA

Five-year results of randomized trials have shown that the efficacy of EVLA and RFA compared to stripping with regard to closure rate, clinical recurrence, and QoL is not different.[33–35,82] Yet, in one study comparing EVLA with HL&S, significantly more clinical recurrence (31% vs. 7%) due to reflux in GSV tributaries was seen in the EVLA group.[83] However, neovascularization in the groin was only seen in the HL&S group.

In the short term, the results are quite conflicting with regards to postoperative pain and recovery.[28,35] Though, when surgery is performed in tumescent local anesthesia the difference in recovery is small.[17,69]

So far, randomized trials have only been continued to five years. In that time span, no difference in clinical recurrence has been found. However, after surgery, more neovascularization in the groin has been found, which might lead to clinical recurrence later on.[33,84]

EVLA vs. RFA

Postoperative pain is lower after RFA compared to EVLA when a bare fiber is used.[17,85,86] After 4–12 weeks the changes in quality of life scores and VCSS were not different.

No significant differences in complication pattern or occlusion rate has been proved. The aim of Varico 2 study was to compare long-term effectiveness of GSV thermal ablation and postprocedural recovery using radiofrequency-powered segmental ablation (RPSA) or 1470-nm EVLA. The closure rate after 36 and 60 months was 96.2% with RPSA and 96.7% with EVLA ($P = 0.81$). Freedom of symptomatic anterior accessory vein recurrence after five years was 85% after RPSA and 87% after EVLA ($P = 050$). VCSS and AVVQ score presented similar improvements up to 60 months. There was no difference in postoperative pain scores after both treatments in the first two weeks.[87]

UGFS vs. EVTA/surgery

In a randomized trial including 500 patients with 580 legs, RFA, EVLA, and UGFS, were compared to pin stripping under tumescent anesthesia.[17] All patients had phlebectomies performed as well. The postoperative pain scores after 10 days were significantly lower in the group treated with RFA and UGFS with a shorter time to resumption of normal activities and work. But the VCSS, the AVVQ scores, and QOL (SF-36) were not different throughout the five years of follow-up. While the occlusion rates were similar in the groups treated with stripping, EVLA and RFA at 94%, the UGFS group demonstrated a significantly lower occlusion rate at 70% ($P < 0.001$). Clinical recurrence was significantly lower in the RFA group ($P < 0.01$). Complications were minor and comparable between the groups, but one DVT with pulmonary embolus was seen in a patient treated with UGFS.[17,33] In the MAGNA trial including 224 legs, EVLA and stripping were found to be more effective than UGFS, with occlusion rates at 77%, 85%, and 22% respectively after five years. The authors also reported CIVIQ sores to be worse in the UGFS group ($P = 0.013$), whereas no difference in the improvement of EQ-5D scores was found.

Complication rate was low and comparable between treatment groups.[34] Also in the class trial involving 798 patients randomized to surgery, EVLA, or UGFS, the UGFS group performed a significant lower occlusion rate than the other groups after six months (78%, 82%, and 43%, respectively). No difference in AVVQ and VCSS, EQ-5D and SF-3 were reported. There were no significant differences between the groups in the number of adverse events.[88] In a randomized trial with 100 patients, Lattimer et al.[89] reported GSV occlusion in 95% of the EVLA and 67% in the UGFS patients ($P < 0.001$) at 15 months with no difference in AVVQ and VCSS. One patient developed a DVT after EVLA.

Venermo et al.[90] randomized 214 patients to receive surgery, EVLA, or UGFS. After one year, the GSV was occluded or absent in 97%, 97%, and 51%, respectively ($P < 0.001$). Preoperative pain was significantly less and sick leave shorter after UGFS. AVVQ improved with no difference between the groups.

MOCA vs. EVLA/RFA

In a multicenter randomized controlled trial comparing RFA and MOCA in 170 patients, those treated with MOCA experienced significantly less pain during the procedure by Visual Analog Scale ($P = 0.003$). Occlusion rates, clinical severity scores, disease specific, and generic quality of life scores were similar between groups at one and six months. The authors concluded that MOCA is less painful than RFA with similar occlusion and quality of life outcomes. Pain in relation to phlebectomies was not taken into consideration.[91]

Cyanoacrylate ablation vs RFA/EVLA

In the VeClose trial, 222 patients were randomized to Cyanoacrylate (Venaseal TM) or RFA (Closure FastTM). After three years, the occlusion rate was similar between the groups, symptoms and quality of life improved similarly, complications were minor and not different between the groups.[63]

In recent trial, 244 patients with incompetent GSVs were treated with RFA and CAE. At the 12-month, complete occlusion of the GSV was observed in 99.5% of the CAE group and 96.6% of the RFA group ($P = 0.072$). Cyanoacrylate ablation was associated with less pain and fewer complications than RFA; it also may yield better patient comfort.[92]

The one-year results of a prospective comparative study of a new cyanoacrylate glue vs. EVLA for the treatment of venous insufficiency was reported by Bozkurt et al.[60] A total of 310 patients were treated with CA or EVLA. Periprocedural pain was less (3.1 ± 1.6 vs. 6.5 ± 2.3, <0.001) in the CA group compared to the EVLA group. Twelve months closure rates were 92.2% for EVLA and 95.8% for CA groups (NS). Venous Clinical Severity Score and AVVQ improved similarly in the groups.

Small saphenous vein

Endovenous laser ablation of the SSV was compared with conventional surgery (saphenopopliteal ligation and invagination stripping) in a randomized trial including 106 patients. After one-year abolition of reflux was accomplished in 96% and 71% respectively ($P < 0.001$). Postoperative pain was significantly lower after EVLA ($P < 0.05$) allowing earlier return to work and normal function ($P < 0.001$). Minor sensory disturbances were lower in the in the EVLA group (7.5% vs. 26.4%) ($P < 0.001$). The groups demonstrated similar improvements in VCSS and quality of life ($P = 0.009$).[93] At two years, the occlusion rate was still superior after EVLA (81% vs. 66%) ($P = 0.002$), but there was no significant difference in clinical recurrence.[94] In a meta-analysis of the various techniques for the treatment of SSV incompetence, endovenous thermal ablation techniques (EVLA and RFA) were found to present higher pooled anatomic success rates (98.5% and 97.1% respectively) as compared to surgery (58%) and UGFS (63.6%). Neurologic complications were also more frequent after surgery than thermal ablation (19.6% vs. 4.8% after EVLA and 9.7% after RFA).[95]

Recommendations for different ablation techniques

Current International guidelines recommend endovenous thermal ablation as first-line treatment for saphenous vein incompetence, but levels of evidence within the different guidelines should be highlighted. The level of evidence used by the American Venous Forum and Society for Vascular Surgery Guidelines is high for early efficacy but low for long-term efficacy.[96] The UK NICE guidelines are based on low and very low levels of evidence.[19]

European College of Phlebology guidelines

Recommendation	Class	Level	References
For the treatment of great saphenous and short saphenous reflux, in patients with symptoms and signs of chronic venous disease, Laser or RF ablation	I	A	Marsden et al.,[19] Lawaetz et al.,[33] van der Velden et al.,[34] Gauw et al.,[83] Venermo et al.,[90] Wittens et al.,[97]

(continued)

Continued.

Recommendation	Class	Level	References
techniques are recommended.			Sydnor et al.,[98] He et al.[99]
For the treatment great saphenous vein reflux, laser or RF ablation techniques are recommended in preference to surgery or foam sclerotherapy.	I	A	Rasmussen et al.,[17] Marsden et al.,[19] van der Velden et al.,[34] Brittenden et al.,[88] Venermo et al.,[90] Wittens et al.,[97]
For the treatment of short saphenous reflux, Laser or RF ablation techniques are recommended in preference to surgery or foam sclerotherapy.	II	A	Carradice et al.,[28] Samuel et al.,[93] Boersma et al.,[95] Tellings et al.,[100] Paravatsu et al.[101]
For the treatment of symptomatic incompetence of the anterior or posterior accessory GSVs, laser, radiofrequency, or UGFS is recommended.	II	C	Schul et al.,[102] Gibson et al.[103]

Recommendation	Class	Level	References
For the treatment of great saphenous reflux, steam ablation technique is recommended.	IIa	B	Milleret et al.,[43] van den Bos et al.,[44] Proebstle and van den Bos[104]

Recommendation	Class	Level	References
For the treatment of great saphenous saphenous reflux, MOCA is recommended.	IIb	A	Elias and Raines,[16] Tang et al.,[52] Witte et al.,[53,67] Proebstle and van den Bos,[104] Kugler and Brown[105]
For the treatment of great saphenous reflux, cyanoacrylate ablation is recommended.	IIa	A	Almeida et al.,[56] Bozkurt and Yılmaz,[60] Morrison et al.,[63] Gibson and Ferris,[64] Proebstle et al.,[65] Proebstle and van den Bos,[104] Whiteley,[106] Kolluri et al.[107]
For the treatment of saphenous reflux	I	A	Lawaetz et al.,[33] Winterborn et al.,[71]

(continued)

Continued.

Recommendation	Class	Level	References
surgery is recommended as an alternative to endovenous ablation.			Dwerryhouse et al.,[72], Miyazaki et al.,[73], Rutgers and Kitslaar[74]

If tributaries are to be treated, it should be done in the same session as the endovenous ablation.	I	A	Carradice et al.,[108] Lane et al.,[109] Hager et al.[110]

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical approval

No ethical approval was needed.

Guarantor

A Kürsat Bozkurt (AKB)

Contributorship

AKB and LR researched literature and conceived the study. AKB, ML, GD, AL, MP, SO, LR were involved in protocol development and data analysis. AKB and LR wrote the first draft of the article. All authors reviewed and edited the article and approved the final version of the article.

Acknowledgements

None

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