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## Strategies and challenges in treatment of varicose veins and venous insufficiency

Rong-Ding Gao, Song-Yi Qian, Hai-Hong Wang, Yong-Sheng Liu, Shi-Yan Ren

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### Abstract

Patients with varicose veins can be treated with conservative or surgical approaches based on the clinical conditions and patient preferences. In the recent decade, the recommendations for managing symptomatic varicose veins have changed dramatically due to the rise of minimally invasive endovascular techniques. The literature was systematically searched on Medline without language restrictions. All papers on the treatment of varicose veins and venous insufficiency with different procedures were included and reviewed. Endovenous laser ablation (EVLA) and radiofrequency ablation (RFA) both are same safe and effective in terms of occlusion rate, and time to return to normal activity. In comparison with RFA or EVLT, Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire (CHIVA) may cause more bruising and make little or no difference to rates of limb infection, superficial vein thrombosis, nerve injury, or hematoma. In terms of recurrence of varicose veins, there is little or no difference between CHIVA and stripping, RFA, or EVLT. Great saphenous vein recanalization is highest in the ultrasound-guided foam sclerotherapy (FS) group (51%) during 1 year of follow-up. The 2013 National Institute for Health and Care Excellence clinical guidelines recommend surgery as a third-line therapeutic option after EVLA or RFA and sclerotherapy. Although the mechanochemical endovenous ablation (MOCA) is a non-thermal, non-tumescent option and appears to be of similar efficacy to stab avulsion with no potential risk of nerve damage, the overall success rate of MOCA is lower than those of other procedures such as EVLA, RFA, or high ligation and stripping. EVLA is the most

cost-effective therapeutic option, with RFA being a close second for the treatment of patients with varicose veins. Endovenous thermal ablation (EVLA or RFA) is recommended as a first-line treatment for varicose veins and has substituted the high ligation of saphenofemoral junctional reflux and stripping of varicose veins. Ultrasound-guided FS is associated with a high recurrence rate and can be used in conjunction with other procedures. MOCA and cyanoacrylate embolization appear promising, but evidence of their effectiveness is required.

**Key Words:** Varicose veins; Venous insufficiency; High ligation and stripping; Endovenous laser ablation; Radiofrequency ablation; Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire

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**Core Tip:** Endovenous laser ablation (EVLA) is the most cost-effective therapeutic option, with radiofrequency ablation (RFA) being a close second for the treatment of patients with varicose veins. Endovenous thermal ablation (EVLA or RFA) is recommended as a first-line treatment for varicose veins and has substituted the high ligation of saphenofemoral junctional reflux and stripping of varicose veins. In terms of recurrence of varicose veins, there is little or no difference between Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire and EVLA, RFA, or stripping. Ultrasound guided foam sclerotherapy is associated with a high recurrence rate and can be used in conjunction with other procedures. Mechanochemical endovenous ablation and cyanoacrylate embolization appear promising, but evidence on their effectiveness is warranted.

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## INTRODUCTION

Varicose veins are tortuous, twisted, or elongated veins dilated to at least 3 mm in diameter evaluated when a patient in standing status with a prevalence of 10% in the population[1], and serious conditions such as deep venous thrombosis (DVT) and pulmonary embolism may occur if untreated[2,3]. Patients with varicose veins can be treated with conservative or surgical options based on the clinical conditions and patient preferences[4-6]. In the recent decade, there has been a dramatic change in the recommendations for managing symptomatic varicose veins due to the rise of minimally invasive endovascular techniques[6,7]. Therefore, we searched the literature and summarize the strategies and challenges in the treatment of varicose veins and venous insufficiency.

## STRATEGIES IN TREATMENT OF VARICOSE VEINS AND VENOUS INSUFFICIENCY

The decision and the choice of treatment for varicose veins are based on the severity of the venous insufficiency, cost, risk of postoperative complications, and patient preferences. Management options for varicose veins include conservative treatment and surgical intervention. Asymptomatic patients with varicose veins are initially managed with conservative treatment options that include medicine, compression therapy, and lifestyle modifications, while symptomatic patients are suggested to consider surgical options[1] that include endovenous laser ablation (EVLA), radiofrequency ablation (RFA), high ligation and stripping (HL/S) of the incompetent great saphenous vein (GSV), Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire (CHIVA), mechanochemical ablation (MOCA), cyanoacrylate embolization (CAE), *etc.* (Table 1)[6-8].

## COMPRESSION THERAPY

Compression therapy is the mainstay of conservative management and is effective in the treatment of varicose veins with venous ulcers[9]. Compression bandaging helps manage ankle edema. However, many patients can barely tolerate bandaging because of itching, pain, and difficulty in putting on shoes. Thus, medical stockings are more welcomed than compression bandaging[10]. Compression stockings

**Table 1 Strategies for management of varicose veins**

Name of treatment	Mechanism
<b>Conservative</b>	
Medicine	Enhancing venous tone and reducing inflammation
Compression	External pressure, bandages, or graduated stockings
<b>Surgery</b>	
HL/S	Ligation of the conjunction of reflux, stripping veins
AP	Removal of veins <i>via</i> small incision
CHIVA	Ligation of the escape point and preserving veins
HIPP	Destroying veins and sucking out with vacuum pressure
<b>Thermal</b>	
EVLA	Sealing the veins by laser energy
RFA	Sealing the veins by radiofrequency
<b>Nonthermal</b>	
Sclerotherapy	Destroying the venous wall by sclerosants or chemical agents and sealing veins by external pressure
MOCA	Rotating the venous wall and sealing veins with a glue
CAE	Sealing veins with a glue

HL/S: High ligation and stripping; EVLA: Endovenous laser ablation; RFA: Radiofrequency ablation; MOCA: Mechanochemical ablation; CAE: Cyanoacrylate embolization; CHIVA: Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire.

with graduated compression produce graded external compression directly to the legs and oppose the venous blood pressure.

When choosing compression stockings, patients are educated to prefer compression stockings with graduated compression to non-graded ones. Patients with varicose veins involving the main axial superficial veins above and below the knee should choose thigh-length graduated compression stockings rather than knee-length ones. Stockings with moderate pressure (20-30 mmHg) are recommended for patients with varicose veins (C2 to C3), stockings with pressure around 30 to 40 mmHg for people with skin change or an ulcer (C4 to C6), and stockings with a pressure between 40 and 50 mmHg for patients with a recurrent ulcer as an adjuvant treatment to prevent ulcer recurrence [10,11].

At least 1-wk compression stocking therapy after EVLA is suggested because a long time (1-2 wk) of using compression therapy is better than a short-term (24-48 h) of application in terms of reducing postoperative pain at 1 wk and recovery for work [11]. Yet, a trial of compression therapy is unnecessary before endovenous thermal ablation [9] as there is no strong evidence to support compression stockings in the cure of varicose veins C1-C4 [9]. Limitations to the use of compression stockings include arterial insufficiency, application difficulty, and patient preferences.

## MEDICAL THERAPY

Venoactive drugs are prescribed for symptomatic patients with varicose veins, ankle swelling, and venous ulcers to improve venous tone and capillary permeability. The commonly used drugs are spooning, *e.g.*, horse chestnut seed extract, the micronized purified flavonoid fraction (MPFF), and flavonoids [12-14]. Pentoxifylline is reported to target inflammatory cytokine release, leukocyte activation, and platelet aggregation at the microcirculatory level. The use of pentoxifylline or MPFF in combination with compression therapy may improve the closure of venous ulcers compared with compression and placebo [13]. A Cochrane meta-analysis shows that vasoactive drugs may relieve pain and swelling caused by chronic venous insufficiency, but their precise mechanism is not clear. Long-term studies of the safety and effectiveness of phlebotomists are warranted [12-15].

## SURGICAL THERAPY

Historically, surgery with high ligation of saphenofemoral junction (SFJ) or saphenopopliteal junction with or without vein stripping (HL/S) has been the gold standard of care for varicose veins[1]. Specifically, following general or lumbar anesthesia, an incision is made at the groin or upper calf, the GSV is located and incised, the proximal end is ligated below the SFJ, a stripping wire with a probe is put into the GSV and advanced distally, and the proximal part of the GSV is tied to the wire and stripped. Recently, a growing number of research data do not consistently favor surgery as the standard treatment option due to postoperative complications, and the 2013 National Institute for Health and Care Excellence clinical guidelines recommend surgery as a third-line therapeutic option after EVLA or RFA and sclerotherapy[8,16-18].

HL/S of the GSV and their respective junctions are indicated when the saphenous veins themselves dilate greater than 1 cm in diameter. In a cohort study, Navarro *et al*[19] evaluated the relationship of GSV diameter measured in the thigh and calf to the clinical severity of reflux in 112 legs of 85 consecutive patients with SFJ and truncal GSV incompetence[19] and found that a GSV diameter of 5.5 mm or less predicted having no abnormal reflux, with a sensitivity of 78%, specificity of 87%, positive and negative predictive values of 78%, and accuracy of 82%[19].

The surgical outcome of HL/S is relatively satisfactory; HL/S is associated with higher anatomic closure rates at 30 d and 5 years than RFA and ultrasound-guided foam sclerotherapy (UGFS)[8,16]. HL/S has similar long-term saphenous vein closure rates with EVLA at 5 years[8,16-18]. However, the postoperative complications are DVT, bleeding, hematoma, ecchymosis, wound infection, nerve injury, pain, and delayed return to normal activity. The injury of femoral arteries, such as ligation and or stripping of the femoral artery, occurred in the hands of inexperienced operators, which is underreported. Ligation alone is usually associated with a high recurrence rate of the varicose vein that may necessitate re-operation[20]. Stripping of the GSV below the knee or the SSV is not usually performed to avoid the risk of nerve injury.

## AMBULATORY PHLEBECTOMY

Ambulatory phlebectomy (AP), also known as hook phlebectomy, mini-phlebectomy, microphlebectomy, or stab phlebectomy, is a minimally invasive procedure operated under local anesthesia as an outpatient procedure, and it can excise most varicose veins except the proximal long saphenous vein [21]. AP has a technically better outcome in terms of recurrence of GSV and SFJ reflux than UGFS in the long term. Specifically, a small stab wound or puncture is made to remove varicose veins. Administering a certain volume of saline around the target veins before making a stab may help retrieve a longer section of unwanted veins. AP is usually performed in conjunction with other procedures.

Notwithstanding, recurrence rates can be high if the junctional reflux is untreated[21]. The junctional reflux should be managed by HL/S or EVLT rather than simple AP[21]. Patients can walk right away after AP. The proportion of complications associated with AP such as localized thrombophlebitis and hemorrhage is much lower than that of HL/S. The postoperative complications are reduced dramatically after the application of broad compression pads over the wounds following AP.

## CHIVA

CHIVA is ambulatory conservative hemodynamic management of varicose veins that preserves deliberately the saphenous vein and collaterals based on venous hemodynamics[22]. CHIVA is an office-based treatment for varicose veins performed under local anesthesia. The main advantages are the preservation of the saphenous vein, local anesthesia, low cost, low pain, and less bruising, nerve damage, and recurrence than stripping saphenectomy[23] (Figure 1). CHIVA seemed to have superior clinical benefits in long-term efficacy for treating varicose veins[24]. Practically, CHIVA procedure is most likely similar to AP. Patients can walk out of the theatre immediately after CHIVA surgery and go home following observing for a while.

However, the recent Cochrane review[25] included six randomized controlled trials (RCTs) with 1160 patients and compared CHIVA with RFA, vein stripping, and EVLT, respectively, for their effects. In terms of recurrence of varicose veins, there is little or no difference between CHIVA and stripping, RFA, or EVLT. In comparison with RFA or EVLT, CHIVA may cause more bruising and make little or no difference to rates of limb infection, superficial vein thrombosis, nerve injury, or hematoma. Three RCTs comparing CHIVA with vein stripping showed that CHIVA may reduce slightly nerve injury and hematoma in the legs, but make little or no difference to the side effects of limb infection, and superficial vein thrombosis or bruising[25]. One RCT comparing CHIVA with compression dressings in patients with venous ulcers shows uncertainty on whether CHIVA can reduce recurrence.



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**Figure 1** A 56-year-old man had varicose veins for 20 years and received day surgery with Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire procedure, and the varicose veins disappeared on day 5 (Figures are provided by Dr. Shi-Yan Ren).

It is necessary to map and find the escape point (EP) of the veins before CHIVA. Most (82.3%) EPs are located below the knee, and 65.8% are located from the knee to midcalf. The diameter of tributary veins (TVs) near the EP is about 90% of that of the GSV. Thermal ablations of the below-knee varicose vein may damage the nerve[26].

## TRANSILLUMINATION POWERED PHLEBECTOMY

Transilluminated powered phlebectomy (TIPP) is reported as a minimally invasive procedure that is often performed under spinal or general anesthesia for the treatment of varicose veins[27], and it was once considered cosmetic for veins less than 2.5 mm in diameter due to few incisions. However, TIPP has been associated with a higher incidence of hematoma, postoperative pain, and paresthesia[28] due to damage to tissue and nerve around the veins; it has not been proven to be superior to other procedures to remove varicose veins[27]. Aremu *et al*[27] compared conventional stab avulsions to TIPP and found that recurrence at 52 wk in the TIPP group is higher than that in the stab avulsion group (21.2% vs 6.2%)[28].

TIPP cannot be performed for all the varicose veins, especially for truncal varicose veins. In combination with RFA, a more satisfactory outcome at a 1-year follow-up[29] can be achieved. Passman *et al*[30] divided their patients into three groups to evaluate the effect of TIPP: Saphenous stripping-stab avulsion phlebectomy (STRIP-AP), combined saphenous vein stripping-TIPP (STRIP-TIPP), and combined EVLT-TIPP. The rate of complications was higher in procedures involving TIPP (STRIP-AP 5.6%, STRIP-TIPP 6.5%, and EVAB-TIPP 2.0%;  $P = \text{NS}$ ), and more hematomas occurred in procedures involving TIPP (STRIP-AP 5.6%, STRIP-TIPP 16.3%, and EVAB-TIPP 6.9%;  $P < 0.05$ )[30].

## ENDOVENOUS THERMAL ABLATION THERAPY

Endovenous thermal ablation (EVLA or RFA) is recommended as a first-line treatment and has substituted the surgical procedure to destroy the veins by heat and occlude the veins for symptomatic varicose veins[9,31,32].

EVLA was initially reported by Dr. Carlos Bone for the treatment of varicose veins at the International Union of Phlebology in 1999. The laser fiber is inserted into the target vein, a heat generator emits laser energy, and the thermal light emitting out of the fiber tip induces local thermal injury to the veins, leading to vein contraction, blood thrombosis, and venous fibrosis. EVTA with or without HL/S appeared to be a safe and effective treatment for patients with incompetent saphenous veins[33].

One systematic evidence review reported that the occlusion rates of the GSV and small saphenous vein within 6 mo after EVLA were all greater than 90%[20]. A study by Wallace *et al*[34] showed that the SFJ anatomical success closure rate detected by DUS 5 years after treatment is similar between HL/S

(85%) and EVLA (93%). A meta-analysis by Kheirleisid *et al*[35] demonstrated no significant differences between HL/S in comparison to EVLA and RFA after 5 years[35].

A range of laser wavelengths can be used to achieve occlusion, and the radial fibers and lasers with high wavelengths (1470–1940 nm) are introduced for homogeneous damage of the vein wall to improve the efficacy and reduce the side effect of procedures[36]. The temperature produced by a 1470-nm laser with a radial probe is 120–140 °C ( $\pm 20$  °C)[36], and less pain is noticed in the first week after the use of a 1470-nm wavelength fiber than a 940-nm fiber. At the 48-mo follow-up, the recurrence rate of treated veins followed by ultrasound was less with the 1470-nm wavelength laser than with 940-nm fibers (8.3% vs 15.9%,  $P = 0.017$ )[37]. Another RCT indicated that patients treated with the 1470-nm catheter had a higher occlusion rate than those with the 1920-nm system (94.7% vs 87.5%;  $P = 0.05$ ) at 1-year follow-up. Patients treated with the 1920-nm EVLA catheter had less ecchymosis, induration, and analgesic use.

However, a systematic review and meta-analysis show that commonly used EVLA parameters do not influence efficacy, no particular wavelength is superior to any other[20], and no statistically significant differences were found for wavelengths [short (810, 940, and 980 nm), long (1470, 1500, and 1920 nm)], high or low administered energy ( $\leq 50$  J/cm and  $> 50$  J/cm), or follow-up ( $\leq 1$  year and  $> 1$  year). The overall success rate of EVLA was 92%[38]. An RCT study by Malskat *et al*[39] showed that treatment success and adverse event rates between a 1470-nm wavelength fiber and a 940-nm fiber for the treatment of varicose veins were similar[39].

The common complications after EVLA are bruising (24%-75%), thrombophlebitis (5%), superficial vein thrombosis, DVT, hematomas and ecchymoses, skin burn, pigmentation, nerve injury, recurrence, and retained fragment of catheter[40,41]. Arteriovenous fistula has been reported after perforator ablation. The risk of nerve lesions increases when the endovenous treatment is carried out on the lower leg. Recurrence can be treated with the second ablation, and the occlusion rate was 93.3% 1 year after the second ablation[42,43].

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## RFA

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RFA is an ultrasonography-guided minimally invasive treatment that ablates the refluxing vein segment using thermal energy delivered through a radiofrequency catheter. RFA can be segmental procedures that induce heat to 120 °C. Ultrasonography is used to guide to insert a guidewire into the target vein, and an introducer sheath is advanced through the guidewire which will be pulled away followed by inserting the RFA catheter into the sheath into the target position.

A tumescent anesthetic solution is injected around GSV to reduce pain, provide good hemostasis, and prevent burn and nerve damage. After injection of a tumescent solution, the RF generator is then activated and the catheter is slowly pulled along the length of the vein. Compression therapy is used to reduce the risk of vein thrombosis, postoperative bruising, and tenderness. Patients are encouraged to walk immediately after RFA[44].

There is a difference among the RFA devices. F-Care (F Care Systems, Antwerp, Belgium) is a relatively new RFA technique for the treatment of venous insufficiency. The 30-d total occlusion rates in the F-Care and Closurefast groups were 96.2% and 98.1%, respectively ( $P = 0.5$ ). The 1-year full occlusion rates in the F-Care and Closurefast groups were 71.7% and 90.6%, respectively ( $P = 0.013$ )[45]. The 3-RF trial is the first RCT of Venefit, radiofrequency induced thermal therapy (RFITT), and endovenous radiofrequency (EVRF) to compare outcomes of RFA devices. At 6 mo, complete GSV closure was significantly better after Venefit and RFITT treatment (100% and 98%, respectively) compared with EVRF treatment (79%,  $P < 0.001$ ). However, clinical outcomes did not differ significantly at 1 year[46].

RFA is associated with a high satisfaction rate and quality of life score. Although operative time in RFA was significantly longer than that in surgery, recovery after RFA was significantly quicker than that after surgery in terms of returning to usual activity and work in 1 wk with fewer major adverse events. Complete obliteration of GSV was obtained in 98.2% of 135 patients (164 limbs) at a median follow-up of 11 mo[47]. RFA was shown to be non-inferior in terms of recurrence of CHIVA and HL/S 2 years after treatment. No differences in postoperative complications or pain were found among HL/S, RFA, and CHIVA[48].

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## COMPARISON OF RFA AND EVLA

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EVLA and RFA seem to be the same safe and effective modalities in clinical efficacy in terms of occlusion rate, time to return to normal activity, and complications such as thrombophlebitis, hematoma, and recanalization[31,49,50]. A 10-year follow-up with duplex ultrasound for 240 patients treated with a 1470-nm diode laser with radial fibers found stable and valuable long-term results[36]. EVLA is the most cost-effective therapeutic option, followed by RFA, in patients with the incompetence of the GSV[8]. EVLA can manage almost all the varicose veins both above and below the knee; in contrast, RFA is used to ablate the truncal varicose vein above the knee, and cannot treat the varicose

veins below the knee that can be managed by EVLA. Thus, RFA is usually performed in conjunction with other procedures such as HIPP to achieve a better outcome[29].

An RCT comparing the endovenous treatment of primary GSV in 159 patients using RFA or 810 nm EVLT showed complete occlusion (100%) by duplex ultrasound in both groups at 1 wk, and 97% for RFA and 96% for EVLT at 3 mo follow-up. No significant adverse event was observed. Even though RFA showed less pain, ecchymosis, and hematomas[50,51], EVLA and RFA demonstrated comparable outcomes in terms of venous occlusion rates and return to normal activities. Both radiofrequency-powered segmental ablation and EVLA using bare-tip fibers have similarly high GSV obliteration rates in the first 5 years, and the treatments are equally effective clinically and have similar minimal postoperative pain scores and short recovery times[52].

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## SCLEROTHERAPY

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Sclerotherapy is a less invasive percutaneous approach to administering sclerosants into the target veins [52] that will be closed subsequently after immediate external pressure. Anesthesia is generally not required during sclerotherapy. Compression stockings or bandages should be applied immediately after sclerotherapy. Patients are encouraged to walk to reduce the complications of sclerotherapy.

Sclerotherapy is recommended to treat varicose tributaries or the incompetent saphenous vein[9] and is considered cosmetic for treatment of veins less than 2.5 mm in diameter and all other indications. As sclerotherapy alone has not been proven to be effective for the treatment of SFJ or saphenopopliteal junctions reflux, patients with reflux should be treated with EVLA or HL/S to reduce the risk of recurrence.

Currently available sclerosants include detergents (*e.g.*, polidocanol and sodium morrhuate), osmotic agents, and chemical agents. No reliable evidence is available to support that one type of sclerosant is better than any other. Instead of using sclerosant as a liquid, foam sclerotherapy (FS) is performed using mixed sclerosant with air (usually 1:4) with or without UGFS, and it is used primarily or in conjunction with other procedures. The closure rate of veins with FS is higher (68%) than that with liquid sclerotherapy (17.5%) at 12 mo of follow-up[53]. UGFS is associated with faster recovery and less postoperative pain compared with EVLA and surgical stripping. The common complications are superficial venous thromboembolism, recurrence, hyperpigmentation, telangiectasia matting, *etc.* Patients often complain of nodular or linear hardness alone in the varicose veins with tenderness. DVT, tissue necrosis, or even arterial thrombosis has been observed after FS, especially with the use of liquid sodium morrhuate.

GSV recanalization was highest in the UGFS group (51%) during 1 year of follow-up[53]. A prospective RCT involving more than 580 legs compared four treatments: EVLA, RFA, UGFS, and surgical stripping for GSVs. UGFS was associated with a higher technical failure (16.3%) compared with other treatments ( $P < 0.001$ ) at the 5-year follow-up. A total of 288 limbs of 233 patients were treated with UGFS, and the mean follow-up interval was 37.8 mo. Occlusion was achieved for 89.6% of the incompetent veins in two sessions of UGFS. The internal diameters of the treated veins were reduced to 66.9% at 3 mo and 32.7% at 12 mo. It is worthy to know that UGFS is unable to seal incompetent GSV segments completely and may be repeated several times in cases of recurrence[54].

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## MECHANOCHEMICAL ENDOVENOUS ABLATION

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MOCA was conducted in 2010 using the ClariVein device. A wire tip is introduced into the targeted veins and rotated to abrade the intimal layer of the venous wall mechanically (3500 rpm), and a liquid sclerosant is simultaneously injected into the damaged venous wall below the catheter tip to seal the veins.

The MOCA is a non-thermal-non-tumescent option (NTNT) and appears to be of similar efficacy with stab avulsion with no potential risk of nerve damage.

A recent multi-center randomized study comparing MOCA with RFA for truncal vein reflux demonstrated that MOCA was significantly less painful than RFA ( $P = 0.003$ ). There were no significant differences between MOCA and RFA for occlusion rates, clinical severity scores, time to return to normal activities, and adverse effects such as DVT and superficial thrombophlebitis[55].

The anatomical closure rate of MOCA is higher with 3% POL liquid than with 2% POL liquid at the 6-mo follow-up. A multicenter RCA study showed that the technical success rate at 6 mo was 69.8% in the 2%-group *vs* 78.0% in the 3%-group ( $P = 0.027$ ). The overall closure rate was higher in GSVs  $< 5.9$  mm than in GSVs  $> 5.9$  mm (84.3% *vs* 59.5%,  $P < 0.001$ ). Regardless of the concentration of sclerosant, the overall success rate of MOCA is lower than that of EVAL, RFA, or HL/S[55].

## CAE

CAE is a novel endovascular NTNT ablation technique for treatment of incompetent truncal veins with *n*-butyl-2-cyanoacrylate (NBCA) glue[56-58]. Multiple studies have shown the effectiveness of CAE since its first use in 2013. Current available two techniques are the VenaSeal™ Closure System and the VariCloseR vein sealing system[56]. A catheter used is pulled back segmentally in a former system or, continuously in the latter technique. NBCA glue is an adhesive that rapidly polymerizes during endovenous treatment to cause rapid occlusion of veins and initiate vein fibrosis.

In a review of 2910 patients (3220 veins) in 17 studies, 1981 patients received NBCA, 445 RF, and 484 EVLA. The mean followed-up was 12.3 mo (1–36 mo). Two-year occlusion rates were 93.7, 90.9, and 91.5% for NBCA, RFA, and EVLA, respectively[58]. CAE had higher anatomic closure rates at 30 d than EVLA[16]. Patients treated with CAE had less postoperative ecchymosis than those with RFA ( $P < 0.01$ ). Pain during the procedure was comparable for both groups. Patients treated with NBCA had the fewest complications, *e.g.*, bruising, phlebitis, and pain. NBCA is simple to administer, safe, and effective even without compression stockings[58].

However, complications of CAE treatment are phlebitis, cellulitis, and DVT. The adhesive is presumably not degraded and remains in the vein over many years. In rare instances, cyanoacrylate glue embolization can extravasate and cause chronic foreign body reactions necessitating surgical intervention[57,58]. A thread-like thrombus extension has been reported with the VenaSeal system, which resolved spontaneously without additional adjunctive treatment after 6 mo of follow-up. Occlusion of the treated vein is incomplete with recanalization in the peripheral region after CAE. In this case, USFS can be used to achieve the complete occlusion of the veins. MOCA and CAE appear promising but evidence of their effectiveness is needed[8].

## CONCLUSION

EVLA is the most cost-effective therapeutic option, with RFA being a close second for the treatment of patients with varicose veins. Endovenous thermal ablation (EVLA or RFA) is recommended as a first-line treatment for varicose veins and has substituted the high ligation of saphenofemoral junctional reflux and stripping of varicose veins. The 2013 National Institute for Health and Care Excellence clinical guidelines recommend surgery as a third-line therapeutic option after EVLA or RFA and sclerotherapy. In terms of recurrence of varicose veins, there is little or no difference between CHIVA and EVLA, RFA, or stripping. Ultrasound-guided FS is associated with a high recurrence rate and can be used in conjunction with other procedures. Currently, no strong evidence is available to show whether MOCA or cyanoacrylate embolization is similar or superior to any other procedures in the treatment of varicose veins.

## FOOTNOTES

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## REFERENCES

- 1 **Medical Advisory Secretariat.** Endovascular radiofrequency ablation for varicose veins: an evidence-based analysis. *Ont Health Technol Assess Ser* 2011; **11**: 1-93 [PMID: 23074413]
- 2 **Raetz J, Wilson M, Collins K.** Varicose Veins: Diagnosis and Treatment. *Am Fam Physician* 2019; **99**: 682-688 [PMID: 31150188]
- 3 **Lin F, Zhang S, Sun Y, Ren S, Liu P.** The management of varicose veins. *Int Surg* 2015; **100**: 185-189 [PMID: 25594661 DOI: 10.9738/INTSURG-D-14-00084.1]
- 4 **Li X, Yang B, Li X, Ren S.** Prospective Comparison of Effect of Ligation and Foam Sclerotherapy with Foam Sclerotherapy Alone for Varicose Veins. *Ann Vasc Surg* 2018; **49**: 75-79 [PMID: 29428536 DOI: 10.1016/j.avsg.2018.01.004]
- 5 **Sun Y, Li X, Chen Z, Ren S.** Feasibility and safety of foam sclerotherapy followed by a multiple subcutaneously interrupt ligation under local anaesthesia for outpatients with varicose veins. *Int J Surg* 2017; **42**: 49-53 [PMID: 28419883 DOI: 10.1016/j.ijvsu.2017.04.023]
- 6 **Li X, Fan L, Ren S, Li X.** Outcomes of Foam Sclerotherapy plus Ligation vs Foam Sclerotherapy Alone for Venous Ulcers in Lower Extremities. *Ann Vasc Surg* 2017; **45**: 160-165 [PMID: 28648655 DOI: 10.1016/j.avsg.2017.06.055]
- 7 **Liu P, Ren S, Yang Y, Liu J, Ye Z, Lin F.** Intravenous catheter-guided laser ablation: a novel alternative for branch varicose veins. *Int Surg* 2011; **96**: 331-336 [PMID: 22808616 DOI: 10.9738/cc44.1]
- 8 **Epstein D, Bootun R, Diop M, Ortega-Ortega M, Lane TRA, Davies AH.** Cost-effectiveness analysis of current varicose veins treatments. *J Vasc Surg Venous Lymphat Disord* 2022; **10**: 504-513.e7 [PMID: 34450353 DOI: 10.1016/j.jvsv.2021.05.014]
- 9 **Gloviczki P, Comerota AJ, Dalsing MC, Eklof BG, Gillespie DL, Gloviczki ML, Lohr JM, McLafferty RB, Meissner MH, Murad MH, Padberg FT, Pappas PJ, Passman MA, Raffetto JD, Vasquez MA, Wakefield TW; Society for Vascular Surgery; American Venous Forum.** The care of patients with varicose veins and associated chronic venous diseases: clinical practice guidelines of the Society for Vascular Surgery and the American Venous Forum. *J Vasc Surg* 2011; **53**: 2S-48S [PMID: 21536172 DOI: 10.1016/j.jvs.2011.01.079]
- 10 **Todd M.** Compression therapy for chronic oedema and venous leg ulcers: CoFlex TLC Calamine. *Br J Nurs* 2019; **28**: S32-S37 [PMID: 31242115 DOI: 10.12968/bjon.2019.28.12.S32]
- 11 **Chou JH, Chen SY, Chen YT, Hsieh CH, Huang TW, Tam KW.** Optimal duration of compression stocking therapy following endovenous thermal ablation for great saphenous vein insufficiency: A meta-analysis. *Int J Surg* 2019; **65**: 113-119 [PMID: 30959134 DOI: 10.1016/j.ijvsu.2019.03.024]
- 12 **Gohel MS, Davies AH.** Pharmacological agents in the treatment of venous disease: an update of the available evidence. *Curr Vasc Pharmacol* 2009; **7**: 303-308 [PMID: 19601855 DOI: 10.2174/157016109788340758]
- 13 **Ulloa JH.** Micronized Purified Flavonoid Fraction (MPFF) for Patients Suffering from Chronic Venous Disease: A Review of New Evidence. *Adv Ther* 2019; **36**: 20-25 [PMID: 30758743 DOI: 10.1007/s12325-019-0884-4]
- 14 **Akhmetzianov RV, Bredikhin RA.** Clinical Efficacy of Conservative Treatment with Micronized Purified Flavonoid Fraction in Female Patients with Pelvic Congestion Syndrome. *Pain Ther* 2021; **10**: 1567-1578 [PMID: 34537951 DOI: 10.1007/s40122-021-00312-6]
- 15 **Krasinski Z, Krasinska A, Markiewicz S, Zieliński M.** Patients with chronic venous insufficiency in the times of COVID-19 and the risk of thrombus formation - suggestions on conservative treatment of such patients based on the principles of pathophysiology. *Pol Przegl Chir* 2021; **93**: 43-52 [PMID: 33949321 DOI: 10.5604/01.3001.0014.8500]
- 16 **Farah MH, Nayfeh T, Urtecho M, Hasan B, Amin M, Sen I, Wang Z, Prokop LJ, Lawrence PF, Gloviczki P, Murad MH.** A systematic review supporting the Society for Vascular Surgery, the American Venous Forum, and the American Vein and Lymphatic Society guidelines on the management of varicose veins. *J Vasc Surg Venous Lymphat Disord* 2021 [PMID: 34450355 DOI: 10.1016/j.jvsv.2021.08.011]
- 17 **Snyder D, Sullivan N, Margolis D, Schoelles K.** Skin Substitutes for Treating Chronic Wounds [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2020-Feb-2 [PMID: 32101391]
- 18 **Mazzei S, Sindoni A, Fama F, Buizon NJ, Shafei MA.** Dehydrated human amnion/chorion membrane treatment of venous leg ulcers. *Indian J Dermatol Venereol Leprol* 2020; **86**: 212-214 [PMID: 31997789 DOI: 10.4103/ijdv.IJDVL\_175\_19]
- 19 **Navarro TP, Delis KT, Ribeiro AP.** Clinical and hemodynamic significance of the greater saphenous vein diameter in chronic venous insufficiency. *Arch Surg* 2002; **137**: 1233-1237 [PMID: 12413308 DOI: 10.1001/archsurg.137.11.1233]
- 20 **MSAC.** Endovenous laser therapy (ELT) for varicose veins. Assessment report. MSAC Application 1113 Canberra, ACT: MSAC; March. 2008
- 21 **MSAC.** Consultation Decision Analytic Protocol (DAP) to guide the assessment of radiofrequency ablation for the treatment of varicose veins due to chronic venous insufficiency. MSAC Application 1166 Canberra, ACT: MSAC; November 11. 2011
- 22 **Faccini FP, Arendt AL, Pereira RQ, de Oliveira AR.** CHIVA to spare the small and great saphenous veins after wrong-site surgery on a normal saphenous vein: a case report. *J Vasc Bras* 2019; **18**: e20180077 [PMID: 31191627 DOI: 10.1590/1677-5449.007718]
- 23 **Faccini FP, Ermini S, Franceschi C.** CHIVA to treat saphenous vein insufficiency in chronic venous disease: characteristics and results. *J Vasc Bras* 2019; **18**: e20180099 [PMID: 31191629 DOI: 10.1590/1677-5449.009918]
- 24 **Guo L, Huang R, Zhao D, Xu G, Liu H, Yang J, Guo T.** Long-term efficacy of different procedures for treatment of varicose veins: A network meta-analysis. *Medicine (Baltimore)* 2019; **98**: e14495 [PMID: 30762775 DOI: 10.1097/MD.00000000000014495]
- 25 **Bellmunt-Montoya S, Escribano JM, Pantoja Bustillos PE, Tello-Diaz C, Martinez-Zapata MJ.** CHIVA method for the treatment of chronic venous insufficiency. *Cochrane Database Syst Rev* 2021; **9**: CD009648 [PMID: 34590305 DOI: 10.1002/14651858.CD009648.pub4]
- 26 **Yun S.** Ultrasound-based topographic analysis of tributary vein connection with the saphenous vein during ambulatory conservative hemodynamic correction of chronic venous insufficiency. *J Vasc Surg Venous Lymphat Disord* 2019; **7**: 356-

- 363 [PMID: 30777672 DOI: 10.1016/j.jvsv.2018.09.011]
- 27 **Aremu MA**, Mahendran B, Butcher W, Khan Z, Colgan MP, Moore DJ, Madhavan P, Shanik DG. Prospective randomized controlled trial: conventional vs powered phlebectomy. *J Vasc Surg* 2004; **39**: 88-94 [PMID: 14718823 DOI: 10.1016/j.jvs.2003.09.044]
- 28 **de Zeeuw R**, Wittens C, Loots M, Neumann M. Transilluminated powered phlebectomy accomplished by local tumescent anaesthesia in the treatment of tributary varicose veins: preliminary clinical results. *Phlebology* 2007; **22**: 90-94 [PMID: 18268858 DOI: 10.1258/026835507780346141]
- 29 **Liao CJ**, Song SH, Li T, Zhang Y, Zhang WD. Randomized clinical trial of radiofrequency-induced thermotherapy combined with transilluminated powered phlebectomy vs high ligation and stripping for the treatment of lower limb varicose veins. *J Vasc Surg Venous Lymphat Disord* 2021; **9**: 95-100 [PMID: 32454239 DOI: 10.1016/j.jvsv.2020.04.028]
- 30 **Passman MA**, Dattilo JB, Guzman RJ, Naslund TC. Combined endovenous ablation and transilluminated powered phlebectomy: is less invasive better? *Vasc Endovascular Surg* 2007; **41**: 41-47 [PMID: 17277242 DOI: 10.1177/1538574406296207]
- 31 **Kabnick LS**, Sadek M, Bjarnason H, Coleman DM, Dillavou ED, Hingorani AP, Lal BK, Lawrence PF, Malgor R, Puggioni A. Classification and treatment of endothermal heat-induced thrombosis: Recommendations from the American Venous Forum and the Society for Vascular Surgery This Practice Guidelines document has been co-published in *Phlebology* [DOI: 10.1177/0268355520953759] and *Journal of Vascular Surgery: Venous and Lymphatic Disorders* [DOI: 10.1016/j.jvsv.2020.06.008]. The publications are identical except for minor stylistic and spelling differences in keeping with each journal's style. The contribution has been published under a Attribution-Non Commercial-No Derivatives 4.0 International (CC BY-NC-ND 4.0), (<https://creativecommons.org/licenses/by-nc-nd/4.0/>). *Phlebology* 2021; **36**: 8-25 [PMID: 32998622 DOI: 10.1177/0268355520953759]
- 32 **Mohammadi Tofigh A**, Tahmasebi H, Zebarjadi J. Comparing the Success Rate and Side Effects of Endovenous Laser Ablation and Radiofrequency Ablation to Treat Varicose Veins in the Lower Limbs: A Randomized Clinical Trial. *J Lasers Med Sci* 2020; **11**: S43-S48 [PMID: 33995968 DOI: 10.34172/jlms.2020.S7]
- 33 **Hamann SAS**, van der Velden SK, De Maeseneer MGR. Safety and Effectiveness of Endovenous Thermal Ablation for Incompetent Saphenous Veins with an Aneurysm Close to the Junction. *Eur J Vasc Endovasc Surg* 2019; **58**: 244-248 [PMID: 31153734 DOI: 10.1016/j.ejvs.2018.12.007]
- 34 **Wallace T**, El-Sheikha J, Nandhra S, Leung C, Mohamed A, Harwood A, Smith G, Carradice D, Chetter I. Long-term outcomes of endovenous laser ablation and conventional surgery for great saphenous varicose veins. *Br J Surg* 2018; **105**: 1759-1767 [PMID: 30132797 DOI: 10.1002/bjs.10961]
- 35 **Kheirelseid EAH**, Crowe G, Sehgal R, Liakopoulos D, Bela H, Mulkern E, McDonnell C, O'Donohoe M. Systematic review and meta-analysis of randomized controlled trials evaluating long-term outcomes of endovenous management of lower extremity varicose veins. *J Vasc Surg Venous Lymphat Disord* 2018; **6**: 256-270 [PMID: 29292115 DOI: 10.1016/j.jvsv.2017.10.012]
- 36 **Pavei P**, Spreafico G, Bernardi E, Giraldi E, Ferrini M. Favorable long-term results of endovenous laser ablation of great and small saphenous vein incompetence with a 1470-nm laser and radial fiber. *J Vasc Surg Venous Lymphat Disord* 2021; **9**: 352-360 [PMID: 32599308 DOI: 10.1016/j.jvsv.2020.06.015]
- 37 **Arslan Ü**, Çalık E, Tort M, Yıldız Z, Tekin AI, Limandal HK, Kaygın MA, Dağ Ö, Erkut B. More Successful Results with Less Energy in Endovenous Laser Ablation Treatment: Long-term Comparison of Bare-tip Fiber 980 nm Laser and Radial-tip Fiber 1470 nm Laser Application. *Ann Vasc Surg* 2017; **45**: 166-172 [PMID: 28647634 DOI: 10.1016/j.avsg.2017.06.042]
- 38 **Malskat WSJ**, Engels LK, Hollestein LM, Nijsten T, van den Bos RR. Commonly Used Endovenous Laser Ablation (EVLA) Parameters Do Not Influence Efficacy: Results of a Systematic Review and Meta-Analysis. *Eur J Vasc Endovasc Surg* 2019; **58**: 230-242 [PMID: 31230868 DOI: 10.1016/j.ejvs.2018.10.036]
- 39 **Malskat WS**, Giang J, De Maeseneer MG, Nijsten TE, van den Bos RR. Randomized clinical trial of 940- vs 1470-nm endovenous laser ablation for great saphenous vein incompetence. *Br J Surg* 2016; **103**: 192-198 [PMID: 26661521 DOI: 10.1002/bjs.10035]
- 40 **Nemoto H**, Mo M, Ito T, Inoue Y, Obitsu Y, Kichikawa K, Yamaki T, Ogawa T; Japanese Endovenous Ablation Committee for Varicose Veins. Venous thromboembolism complications after endovenous laser ablation for varicose veins and role of duplex ultrasound scan. *J Vasc Surg Venous Lymphat Disord* 2019; **7**: 817-823 [PMID: 31540837 DOI: 10.1016/j.jvsv.2019.06.014]
- 41 **Ren S**, Liu P, Wang W, Yang Y. Retained foreign body after laser ablation. *Int Surg* 2012; **97**: 293-295 [PMID: 23294067 DOI: 10.9738/CC155.1]
- 42 **Rodriguez Santos F**, Loson V, Coria A, Marquez Fossier C, Dotta M, Katsini R, Pared C, Bauzá Moreno H, Martínez H. Secondary Ablation of Recanalized Saphenous Vein after Endovenous Thermal Ablation. *Ann Vasc Surg* 2020; **68**: 172-178 [PMID: 32339689 DOI: 10.1016/j.avsg.2020.04.017]
- 43 **Müller L**, Alm J. Feasibility and technique of endovenous laser ablation (EVLA) of recurrent varicose veins deriving from the sapheno-femoral junction-A case series of 35 consecutive procedures. *PLoS One* 2020; **15**: e0235656 [PMID: 32628724 DOI: 10.1371/journal.pone.0235656]
- 44 **Somasundaram SK**, Weerasekera A, Worku D, Balasubramanian RK, Lister D, Valenti D, Rashid H, Singh Gambhir RP. Office Based Endovenous Radiofrequency Ablation of Truncal Veins: A Case for Moving Varicose Vein Treatment out of Operating Theatres. *Eur J Vasc Endovasc Surg* 2019; **58**: 410-414 [PMID: 31351830 DOI: 10.1016/j.ejvs.2019.05.020]
- 45 **Bitargil M**, Kılıç HE. Ablation of the great saphenous vein with F-care vs Closurefast endovenous radiofrequency therapy: Double-blinded prospective study. *Phlebology* 2020; **35**: 561-565 [PMID: 32192407 DOI: 10.1177/0268355520913389]
- 46 **Nyamekye IK**, Dattani N, Hayes W, Harding D, Holloway S, Newman J. A Randomised Controlled Trial Comparing Three Different Radiofrequency Technologies: Short-Term Results of the 3-RF Trial. *Eur J Vasc Endovasc Surg* 2019; **58**: 401-408 [PMID: 31351832 DOI: 10.1016/j.ejvs.2019.01.033]
- 47 **Borghese O**, Pisani A, Di Centa I. Endovenous radiofrequency for chronic superficial venous insufficiency: Clinical outcomes and impact in quality of life. *J Med Vasc* 2021; **46**: 3-8 [PMID: 33546819 DOI: 10.1016/j.jdmv.2020.11.003]

- 48 **González Cañas E**, Florit López S, Vilagut RV, Guevara-Noriega KA, Santos Espí M, Rios J, Soto SN, Giménez Gaibar A. A randomized controlled noninferiority trial comparing radiofrequency with stripping and conservative hemodynamic cure for venous insufficiency technique for insufficiency of the great saphenous vein. *J Vasc Surg Venous Lymphat Disord* 2021; **9**: 101-112 [PMID: [32353592](#) DOI: [10.1016/j.jvsv.2020.04.019](#)]
- 49 **He G**, Zheng C, Yu MA, Zhang H. Comparison of ultrasound-guided endovenous laser ablation and radiofrequency for the varicose veins treatment: An updated meta-analysis. *Int J Surg* 2017; **39**: 267-275 [PMID: [28119106](#) DOI: [10.1016/j.ijsu.2017.01.080](#)]
- 50 **Izzo L**, Pugliese F, Pieretti G, Izzo S, Izzo P, Florio G, Del Papa M, Messineo D. High ligation of sapheno-femoral junction and thermal ablation for lower limb primary varicosity in day hospital setting. *Ann Ital Chir* 2020; **91**: 61-64 [PMID: [32180575](#)]
- 51 **Florio G**, Carni P, D'Amata G, Crovaro M, Musmeci L, Manzi L, Del Papa M. Thermal ablation combined with high ligation of sapheno-femoral junction for lower limb primary varicosity. *G Chir* 2019; **40**: 413-416 [PMID: [32003720](#)]
- 52 **Lawson JA**, Gauw SA, van Vlijmen CJ, Pronk P, Gaastra MTW, Tangelder MJ, Mooij MC. Prospective comparative cohort study evaluating incompetent great saphenous vein closure using radiofrequency-powered segmental ablation or 1470-nm endovenous laser ablation with radial-tip fibers (Varico 2 study). *J Vasc Surg Venous Lymphat Disord* 2018; **6**: 31-40 [PMID: [29248107](#) DOI: [10.1016/j.jvsv.2017.06.016](#)]
- 53 **Epstein D**, Onida S, Bootun R, Ortega-Ortega M, Davies AH. Cost-Effectiveness of Current and Emerging Treatments of Varicose Veins. *Value Health* 2018; **21**: 911-920 [PMID: [30098668](#) DOI: [10.1016/j.jval.2018.01.012](#)]
- 54 **Chen CH**, Chiu CS, Yang CH. Ultrasound-guided foam sclerotherapy for treating incompetent great saphenous veins--results of 5 years of analysis and morphologic evolution study. *Dermatol Surg* 2012; **38**: 851-857 [PMID: [22540961](#) DOI: [10.1111/j.1524-4725.2012.02408.x](#)]
- 55 **Lam YL**, Alozai T, Schreve MA, de Smet AAEA, Vahl AC, Nagtzaam I, Lawson JA, Nieman FHM, Wittens CHA. A multicenter, randomized, dose-finding study of mechanochemical ablation using ClariVein and liquid polidocanol for great saphenous vein incompetence. *J Vasc Surg Venous Lymphat Disord* 2021 [PMID: [34781008](#) DOI: [10.1016/j.jvsv.2021.10.016](#)]
- 56 **Chan SS**, Tang TY, Chong TT, Choke EC, Tay HT. Retrograde technique for great saphenous vein ablation using the VenaSeal™ closure system - Ideal approach for deep seated or small below the knee refluxing truncal veins. *Phlebology* 2020; **35**: 102-109 [PMID: [31132940](#) DOI: [10.1177/0268355519853412](#)]
- 57 **Langridge BJ**, Onida S, Weir J, Moore H, Lane TR, Davies AH. Cyanoacrylate glue embolisation for varicose veins - A novel complication. *Phlebology* 2020; **35**: 520-523 [PMID: [31992129](#) DOI: [10.1177/0268355520901662](#)]
- 58 **Dimech AP**, Cassar K. Efficacy of Cyanoacrylate Glue Ablation of Primary Truncal Varicose Veins Compared to Existing Endovenous Techniques: A Systematic Review of the Literature. *Surg J (N Y)* 2020; **6**: e77-e86 [PMID: [32577526](#) DOI: [10.1055/s-0040-1708866](#)]



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