
Varicose veins management: when recurrences become an issue

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Professor Andre van Rij

Editorial

In the modern treatment of primary varicose veins, there are many options, but they are only acceptable if they provide immediate and excellent control of reflux, and subsequently, result in extremely infrequent complications. High patient satisfaction is required, and the option is better if it is achieved with a lower cost and minimal time away from work. Unfortunately, the absence of new visible varicose veins and recurrence cannot be promised, it is a matter of how soon after the procedure and how visible.

This publication by Michel Perrin is a welcome presentation of the evidence regarding recurrent varicose veins. The complexity of the venous system, its networks and interconnections, along with the ingenuity and passion of surgeons to thwart venous reflux has generated an array of procedures that are, without exception, frustrated by recurrence.

Varicose vein surgery has been carried out for many years now and much has been written about the procedure. By now, more answers to the big question of recurrence were expected; however, this is patently not the case.

Consequently, Perrin, with his vast experience, along with that of his collaborators, addressed the issue of recurrence several years ago with REVAS (Recurrent Varices After Surgery) to obtain some consensus on what drove recurrence. That was about recurrence after surgery and has now been extended to capture what happens after all other invasive treatments. This is now referred to as PREVAIT (PREsence of Varices After operative Treatment).

Perrin has chosen to review publications from 1990-2013 to reflect this change and to acknowledge that venous research has matured and that more sophisticated well-designed trials have been, or are being, completed to adequately describe the outcome of PREVAIT. It is not an easy task to distill the essence of these studies, especially with the huge heterogeneity still present within them. Different outcome measures, definitions, and times following treatment make interpretation difficult.

Recurrence is, of course, a mixed affair. If it is due to bad technical procedure or poor decision-making, then there is hope for improving on this with better imaging and training across all treatment modalities. Recurrence is more the result of new vessel formation, vascular remodeling, the remarkable reconnecting of venule to venule, and vessel enlargement with reflux. These fascinating mechanisms are not only of great interest to the molecular and developmental biologist, but to the venous physiologist and maybe also the

phlebologist. Understanding these mechanisms may provide the best clues on how to minimize and treat recurrence.

If continuation of the underlying disease is critical to recurrence, and it seems that it is, then we need to understand this much better and understand what controls the degenerative changes in vein walls and the adjacent supporting tissue. For some, these considerations may seem too far removed from the clinic and the patient. For others, these new vessels are just a surgeon's problem and go away with surgery! These are not the reasons for the dramatic reductions in surgical procedures for varicose veins, in many parts of the world, in favor of newer modalities. Recurrence is not just a surgical story, but also the story of the biological response to vein injury, alongside the continued underlying propensity for venous disease.

We cannot cut and tie, burn, freeze, chemically destroy, glue, or use any mode of venous ablation without some consequences, including changes in venous hemodynamics and vein tissue responses, all of which may influence outcomes.

One thing we can be sure of is that all of these factors leading to recurrence are relevant to every type of treatment—every time we damage the vein wall and obliterate a lumen, recurrence will come into play. There might even be genetic predispositions to account for how likely this will happen.

Once recurrence has occurred with the reappearance of visible varicose veins, the question of how they should be treated remains. The best treatment would reasonably reflect what is known to be the cause of the recurrence and its configuration. For example, the complex clustering and tortuosity of neovascular vessels are well suited to spreading the foam sclerosing solution in order to ablate these vessels at a recurrent saphenofemoral junction.

At present, data are insufficient to provide clarity on what is the best treatment for recurrence; therefore, large, prospective, and comparative clinical studies are needed.

Are they going to happen? They will not be easy. However, there is hope for other helpful data to come about. The increasing diligence being taken in clinical follow-up, with the wide availability of ultrasound imaging equipment and greater skill development, has prompted better documentation and outcome data. Add to this, the tool to gather and elucidate patient-based outcomes, such as the new PREVAIT questionnaire suggested in this book, then physicians in busy clinical practices may consistently contribute to addressing the conundrum of what is the best practice for treating recurrence.

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Presence of varices after operative treatment: a review



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Summary

PREsence of Varices After operative Treatment (PREVAIT) occurs in 13% to 77% of patients and remains a debilitating and costly problem.

A PubMed search was conducted in English and French for the years 2000-2013 by using keywords (ie, duplex scanning, endothermal ablation, neovaricoses, recurrent varicose veins after surgery (REVAS), sclerotherapy, varices recurrence, varicose veins, varicose vein surgery).

Epidemiology and socioeconomic consequences were analyzed according to the initial operative treatment, then the possible mechanisms and causes for PREVAIT were classified in terms of tactical and technical errors, and evolution of the disease, considering that the systematic use of ultrasound investigation has minimized the former.

Diagnostic and operative treatment methods for managing PREVAIT were identified and their results analyzed. Indications for PREVAIT treatment are suggested according to clinical status and ultrasound information. According to published data, ultrasound-guided foam sclerotherapy (UGFS) is used as a first-line treatment, yet the grade of recommendation for such a procedure is only 1B according to the European guide for sclerotherapy. To improve the UGFS grade of recommendation for UGFS, we suggest that larger prospective studies with a randomized controlled design be performed and supervised by an international group of experts. Lastly guidelines for prospective studies on PREVAIT are recommended.

The cause and underlying mechanisms for recurrences of varicose veins are poorly understood. Large prospective studies should be performed to clear up the picture.

Background

The presence of varicose veins after operative treatment is a common, complex, and costly problem for both the patients and the physicians who cope with venous diseases. An international consensus meeting was held in Paris in 1998 and guidelines were proposed for the definition and description of REcurrent Varices After Surgery (REVAS).¹ In a related article from 2000, 94 references dealing with recurrence after operative treatment or including information on its presence or absence after operative treatment were listed. Since then, 140 additional publications in English and French have been identified.²⁻¹⁴¹

Classical surgery, which used to be the most frequent operative procedure for treating varicose veins in the last decade, has been progressively replaced by chemical and thermal ablation procedures,

and to a slight extent, by mini-invasive surgeries, including CHIVA (French acronym for ambulatory conservative hemodynamic management of varicose veins)¹⁴² and ASVAL (French acronym for tributary varices phlebectomy under local anesthesia).^{143,144} Therefore, the experts of the VEIN-TERM transatlantic interdisciplinary consensus meeting suggested replacing the classical surgery-related acronym REVAS with PREVAIT (PREsence of Varices After operative Treatment).¹⁴⁵

During the same meeting, the following terms were defined:

1. recurrent varices: reappearance of varicose veins in an area previously treated successfully.
2. residual varices: varicose veins remaining after treatment.
3. PREVAIT: PREsence of Varices (residual or recurrent) After operative Treatment.

The concept of PREVAIT was developed for two reasons: (i) it is often difficult to correctly classify the results of initial procedures done by others and consequently to differentiate recurrent varices from residual varices; and (ii) the term REVAS was limited to patients previously treated by surgery as previously mentioned. The term PREVAIT encompasses both recurrent and residual varicose veins after any kind of operative treatment including open surgery and endovenous procedures, either thermal or chemical.

REVAS Classification sheet							
Date of examination	<table border="1"> <tr> <td>Day</td> <td>Month</td> <td>Year</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table>	Day	Month	Year			
Day	Month	Year					
Patient's name First name or given name Last name or family name	* N Ds is for different (new) site Only one box can be ticked						
✓ Topographical sites of REVAS Since more than one territory may be involved, several boxes may be ticked	Persistent <input type="checkbox"/> 1 (Known to have been present at the time of previous surgery) New <input type="checkbox"/> 2 (Known to have been present at the time of previous surgery) Uncertain/not known <input type="checkbox"/> 3 (Insufficient information at the time of previous surgery)						
Grain <input type="checkbox"/> 1 Thigh <input type="checkbox"/> 2 Popliteal fossa <input type="checkbox"/> 3 Lower leg including ankle and foot <input type="checkbox"/> 4 Other <input type="checkbox"/> 5	✓ Contribution from persistent incompetent saphenous trunks Since more than one territory may be involved, several boxes may be ticked						
✓ Source(s) of recurrence Since more than one source may be involved, several boxes may be ticked	AF great saphenous (above knee) <input type="checkbox"/> 1 BK great saphenous (below knee) <input type="checkbox"/> 2 SSV short saphenous <input type="checkbox"/> 3 0 neither/other <input type="checkbox"/> 4 Comment: _____ _____ _____ _____						
✓ Reflux Only one box can be ticked	✓ Possible contributory factors Several boxes may be ticked						
PROBABLE Clinical significance: R+ <input type="checkbox"/> 1 UNLIKE Clinical significance: R- <input type="checkbox"/> 2 UNCERTAIN Clinical significance: R? <input type="checkbox"/> 3	General factors Family history <input type="checkbox"/> 1 Obesity <input type="checkbox"/> 2 Pregnancy* <input type="checkbox"/> 3 Oral contraceptive <input type="checkbox"/> 4 Lifestyle factors** <input type="checkbox"/> 5 *Pregnancy since the initial operation **Prolonged standing, lack of exercise, chair setting						
✓ Nature of sources Only one box can be ticked	✓ Specific factors Several boxes may be ticked						
* N Ss is for same site Only one box can be ticked	Primary deep vein reflux <input type="checkbox"/> 1 Post-thrombotic syndrome <input type="checkbox"/> 2 Iliac-vein compression <input type="checkbox"/> 3 Angiodysplasia <input type="checkbox"/> 4 Lymphatic insufficiency <input type="checkbox"/> 5 Calf pump dysfunction <input type="checkbox"/> 6						
Technical failures <input type="checkbox"/> 1 Technical failures <input type="checkbox"/> 2 Neovascularization <input type="checkbox"/> 3 Uncertain <input type="checkbox"/> 4 Mixed <input type="checkbox"/> 5							

Table I. REVAS Classification sheet.

Modified after reference 98: Perrin et al. *Eur J Vasc Endovasc Surg.* 2006;32:326-333.

It was also argued that the term "interventional treatment" was not equivalent to the term "operative treatment," because even noninvasive therapies, such as venoactive drugs or compression therapy, may modify the natural history of varicose veins and be considered interventional.

In 2000, a REVAS classification form was elaborated for future studies (Table I). The REVAS classification was then subject to intraobserver and interobserver reproducibility,⁹⁸ and was used in an international survey.^{95,97} A form similar of this should be adapted to PREVAIT for possible future studies.

Aim

The purpose of this review is to analyze all available data on PREVAIT in order to help physicians identify the best operative treatment, if any, likely to prevent PREVAIT. Such analysis might help build a revised classification, as mentioned above.

Material and methods

A PubMed search was conducted to retrieve published articles in English and French for the years 2000-2013 using the keywords: varices recurrence, REVAS, endothermal ablation, sclerotherapy, varicose vein surgery, varicose veins, duplex scanning, neovaricose, and their counterparts in French. Abstracts were not selected. Only publications dealing with PREVAIT were chosen, some of them focused on PREVAIT patients, others concerned patients presenting with varices and operatively treated whose follow-up specified the absence or presence of varices.

Results

Since the REVAS publication,¹ 140 articles on recurrent varices have been published.²⁻¹⁴¹ Additional randomized trials were added to the references from the REVAS articles list, taking the total papers regarding randomized trials to 34.^{6,7,13,16,17,42,52,61,62,66,69,80,83,90,92,103,107-111,117,118,120,122,124,136,137,140,146-150,153}

Epidemiologic data and socioeconomic consequences will be analyzed according to the initial procedures, which will be followed by a discussion of the possible mechanisms for PREVAIT occurrence.

Magnitude of PREVAIT occurrence

With open surgery

The most documented outcomes are provided by classic surgery, but most studies are retrospective. In a 34-year follow-up study, varicose veins were present in 77% of the lower limbs examined and were mostly symptomatic: 58% were painful, 83% had a tired feeling, and 93% showed a reappearance of edema.⁵⁰

Two prospective studies concerning classic surgery are available with a follow-up of 5 years.^{72,133} In both studies, patients were preoperatively investigated with duplex scanning (DS) and treated by high ligation, saphenous trunk stripping, and stab avulsion. In the Kostas et al series, 28 out of 100 patients had PREVAIT after 5 years: recurrent varices mainly resulting from neovascularization in eight limbs (8/28, 29%), new varicose veins as a consequence of disease progression in seven limbs (7/28, 25%), residual veins due to tactical errors (eg, failure to strip the great saphenous vein) in three limbs (3/28, 11%), and complex patterns in ten limbs (10/28, 36%).⁷² In the van Rij et al series, 127 limbs (CEAP class C2–C6) were evaluated postoperatively by clinical examination, DS, and air plethysmography (APG). At the clinical evaluation, recurrence of varicose veins was progressive from 3 months (13.7%) to 5 years (51.7%). In line with clinical changes, a progressive deterioration in venous function was measured by APG and a recurrence of reflux was assessed by DS.¹³³

These two studies showed that recurrence of varicose veins after surgery is common, even in highly skilled centers, and even if the clinical condition of most affected limbs after surgery improved compared with "before surgery." Progression of the disease and neovascularization are responsible for more than half of the recurrences. Rigorous evaluation of patients and assiduous surgical techniques might reduce the recurrence resulting from technical and tactical failures.

In a four arm, randomized controlled trial (RCT) by Rasmussen et al, endovenous laser ablation (EVLA), radiofrequency ablation (RFA), ultrasound-guided foam sclerotherapy (UGFS), and surgical

stripping for great saphenous varicose veins (GSV) were compared with a 3-year follow-up. The rate of PREVAIT was reported in each arm (Table II).¹¹¹ There were no significant differences between the 4 procedures ($P=0.29$) in terms of clinical recurrence, but the presence of persisting reflux in the GSV was significantly higher with UGFS compared with the other 3 methods ($P<0.0001$) as was the reoperation rate ($P<0.0001$).

Operative treatment	PREVAIT	P	Open, refluxing GSV	P	Reoperation	P
Surgery	20.2%	0.29	6.5%	NS	15.5%	NS
RFA	14.9%		7%		11.1%	
EVLA	20 %		6.8%		12.5%	
UGFS	19.1%		26.4%	<0.0001	31.6%	<0.0001

Table II. Rasmussen 3-year clinical and DS outcome and reoperation percentages.

Abbreviations: EVLA, endovenous laser ablation; GSV, great saphenous vein; PREVAIT, presence of varices after operative treatment; RFA, radiofrequency ablation; UGFS, ultrasound-guided foam sclerotherapy.

Modified after reference 111: Rasmussen et al. J Vasc Surg: Venous and Lym Dis. 2013;1:349-356.

Regardless of the procedure used, the severity of varicose disease as assessed with the Venous Clinical Severity Score (VCSS) was significantly reduced, and the quality of life using the Aberdeen Varicose Veins Severity Score (AVVSS) was significantly improved after all operative treatments ($P<0.0001$; Table III).

Operative treatment	VCSS (mean score)	P	AVVSS (mean score)	P
Surgery	Preoperative	2.75	Preoperative	19.3
	Postoperative	0.50		Postoperative
RFA	Preoperative	2.95	Preoperative	18.74
	Postoperative	0.44		Postoperative
EVLA	Preoperative	2.68	Preoperative	17.97
	Postoperative	0.34		Postoperative
UGFS	Preoperative	2.25	Preoperative	18.38
	Postoperative	0.30		Postoperative

Table III. Pre- and postoperative VCSS and AVVSS according to operative treatment.

Abbreviations: AVVSS, Aberdeen Varicose Veins Severity Score; EVLA, endovenous laser ablation; RFA, radiofrequency ablation; UGFS, ultrasound-guided foam sclerotherapy; VCSS, venous clinical severity score.

Modified after reference 111: Rasmussen et al. J Vasc Surg: Venous and Lym Dis. 2013;1:349-356.

With radiofrequency ablation

From a multicenter prospective study, recurrence rates after RFA with ClosurePlus® were reported. At the 5-year follow-up, PREVAIT was estimated at 27.4%.⁸⁴ A 3-year follow-up RCT comparing ClosureFast -RFA of the GSV with or without treatment of calf varicosities did not document the

PREVAIT rate, it only documented the obliteration rate on DS investigation, VCSS, and the presence of symptoms.¹⁰² In the four arm study by Rassmussen et al,¹¹¹ there was no statistical difference regarding PREVAIT rates between RFA and the other operative procedures ($P=0.29$; *Table II*).

With endovenous laser ablation

At the 2-year follow-up, a RCT by Rass et al found no significant difference ($P=0.15$) when comparing EVLA with classic surgery (EVLA 16.2% vs 23.1%).¹⁰⁷ An Italian group reported a PREVAIT rate of 6% at month 36.2 in a RCT comparing EVLA with GSV stripping, with a 5-year follow-up. PREVAIT was reported in 36% and 37% of patients, respectively, with no statistical difference between groups ($P=0.9$). In this study, reoperative treatment was performed in 38.6% and 37.7%, respectively, mainly by UGFS.¹¹⁰ Again in the four arm study by Rassmussen et al,¹¹¹ there was no statistical difference regarding PREVAIT rates between EVLA and the other operative procedures ($P=0.29$; *Table II*).

Ultrasound-guided foam sclerotherapy

Hamel-Desnos et al reported a 36% and 37% recanalization rate at a 2-year follow-up with UGFS, one injection with 1% and 3% polidocanol foam, respectively.⁶² In a RCT of UGFS vs surgery for the incompetent GSV with a follow-up of 2 years, PREVAIT was identified in 9% vs 11.3%, respectively $P=0.407$, which was not significant. Conversely, reflux was significantly higher in UGFS ($P=0.003$).¹¹⁸

In a British long-term RCT by Kalodiki et al of UGFS combined with sapheno-femoral ligation vs standard surgery for GSV, clinical severity of venous disease assessed by VCSS and Venous Segmental Disease Score (VSDS) were equally reduced in both groups, and the quality of life equally improved as well (using the AVVQ and 36-item Short Form Survey).⁶⁹ Unfortunately, PREVAIT was not reported in this study.

With procedures saving the saphenous trunk

CHIVA

PREVAIT was assessed when using the CHIVA method vs classical surgery in 2 RCT's with a follow-up of 5 and 10 years.^{16,90} In both studies, the Hobbs classification was used to assess PREVAIT.^{148,149}

If we add failure (presence of VV>0.5 cm) and slightly improved patients in terms of cosmetic appearance (presence of VV<0.5 cm), the outcomes were as follows: (i) at 5 years postsurgery, the PREVAIT rate in the group operated by stripping was 70.7% vs 55.6% in the CHIVA group ($P>0.001$);⁹⁰ in the 10-year follow-up RCT by Carandina, the recurrence rate of varicose veins was significantly higher in the stripping group compared with the CHIVA group (CHIVA, 18%; stripping, 35%; $P<0.04$ Fisher's exact test). The associated risk of recurrence at 10 years was doubled in the stripping group (odds ratio [OR], 2.2; 95% confidence interval [CI], 1-5; $P=0.04$).¹⁶ In both RCTs, the recurrence rate was lower with CHIVA.^{90,16} Yet there is a great discrepancy between the studies: PREVAIT was unexpectedly higher in the 5-year follow-up RCT,⁹⁰ compared with the 10-year follow-up.¹⁶

ASVAL

No published data is available regarding the mid-term results.

Socioeconomic consequences

No socioeconomic data on PREVAIT has been published. When a redo surgery is performed, the cost is higher than the first surgery because of the number of peri- and postoperative complications. In one observational study, 40% of patients had complications after classic surgery for PREVAIT.⁶⁴

Possible mechanisms leading to PREVAIT

They must be classified in 2 groups: tactical errors and technical problems.

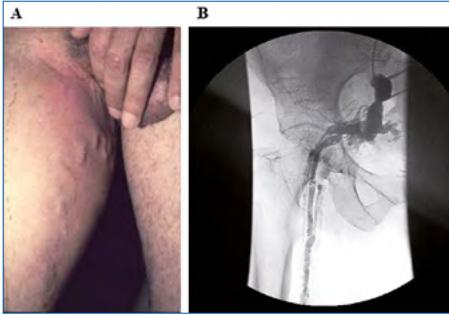


Figure 1. PREVAIT clinical aspect.

Panel A. Pelvic vein leak. Panel B. Selective pelvic venography from the same patient as A. (Image courtesy of Dr J. Leal Monedero and Dr S. Zubicoa Espeleta).



Figure 2. Selective pelvic venography after a Valsalva maneuver.

Reflux through the obturator vein feeding the nonsaphenous vein network. (Image courtesy of Dr J. Leal Monedero and Dr S. Zubicoa Espeleta).

Tactical errors

Tactical errors are common to all operative treatments. It includes wrong or incomplete diagnoses of the extent and/or location of varices, source of reflux, nonidentification of deep venous anomalies including pelvic reflux (Figures 1, Figure 2, Figure 3), primary vein compression or reflux, and postthrombotic syndrome. Fortunately, the systematic use of DS before any operative treatment has minimized this cause of error. In most of the articles published before systematic use of preoperative DS, tactical error was the most frequent mechanism leading to PREVAIT.

There is a consensus on the fact that saphenous ablation provides a better outcome when saphenous trunk incompetence is present and when classic surgery, thermal or chemical, is

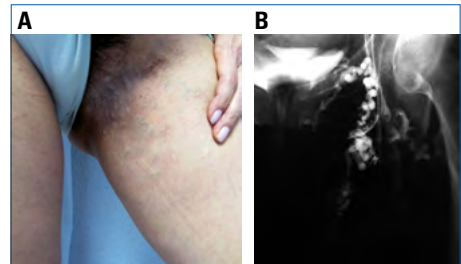


Figure 3. PREVAIT clinical aspect.

Panel A. PREVAIT After high ligation and great saphenous vein stripping massive recurrence at the medial upper part of the thigh.

Panel B. Same patient. Selective phlebography: incompetent round ligament vein feeding the varicose network. (Image courtesy of Dr J. Leal Monedero and Dr S. Zubicoa Espeleta).

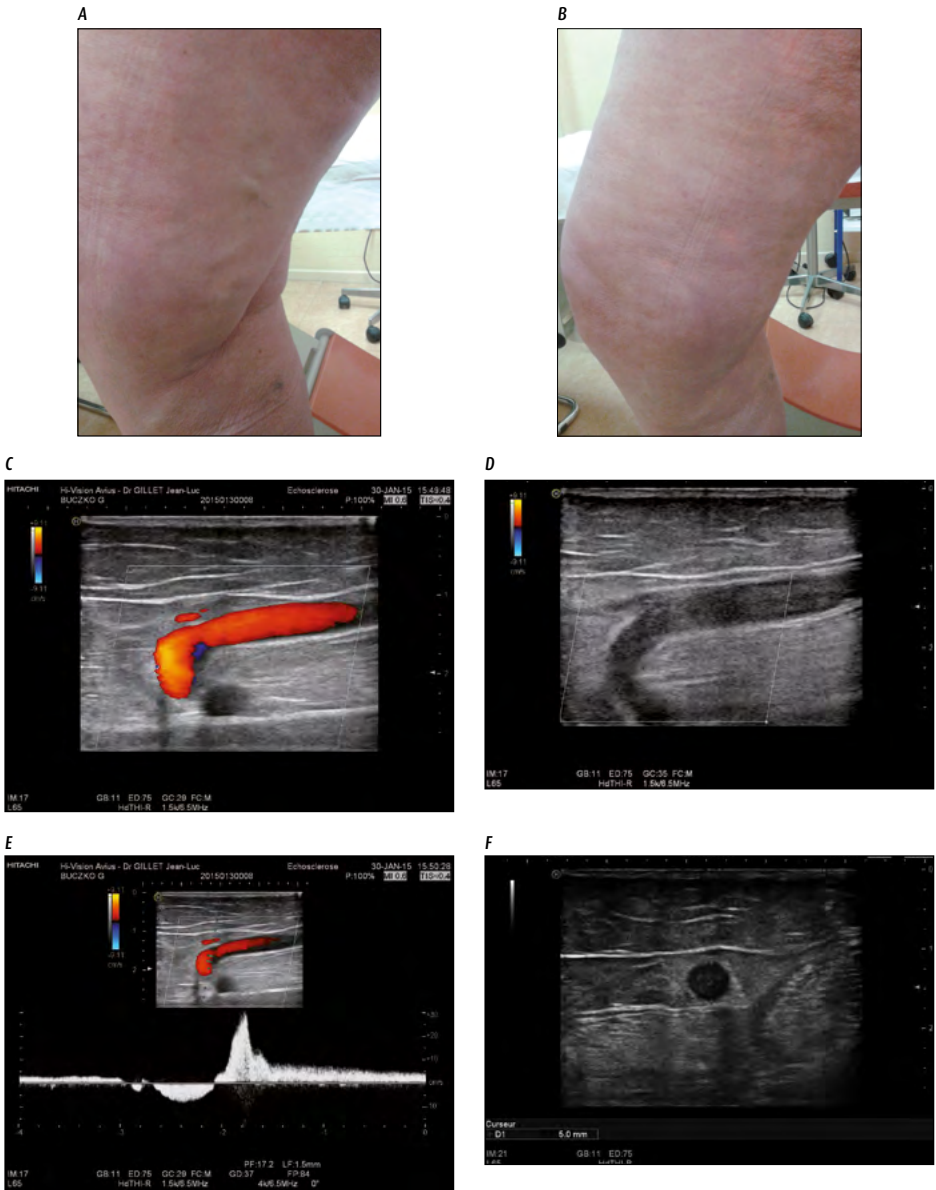


Figure 4. Visualization of PREVAIT

Panel A. PREVAIT in the medical aspect of the thigh after GSV stripping. Panels C and E. Color ultrasound investigation in the same patient. Refluxive perforator is clearly visualized. Panels B, D, and F. Same patient 6 weeks after ultrasound-guided foam sclerotherapy. Varices have disappeared and the perforator is completely occluded at ultrasound investigation. Image courtesy of Dr J.L. Gillet.

performed. Yet, the proponents of the CHIVA and ASVAL procedures contest this point by arguing that trunk conservation would provide good results. In the CHIVA procedure, the argument is that the preservation of the saphenous trunks together with sparing of their functions (cutaneous and subcutaneous drainage) is allowed thanks to appropriate shunt disconnections that break the higher than normal hydrostatic pressure and subsequently improves hemodynamics.^{16,90,142} In the ASVAL method, the ablation of the reservoir incompetent tributaries leads to a reduction in the reflux in the saphenous trunk.^{143,144}

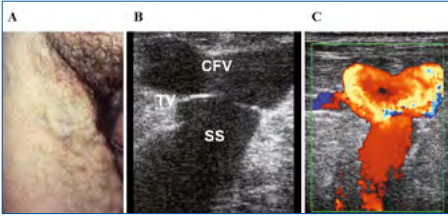


Figure 5. PREVAIT clinical aspect.

Panel A. Massive groin recurrence related to non flush high ligation in a patient with an incompetent GSV terminal valve. Panel B. Same patient with a B mode ultrasound. The terminal valve is identified at the saphenofemoral junction. (Courtesy of Dr Gillet). Panel C. Same patient with a color duplex ultrasound. Massive reflux induced by a Valsalva maneuver. (Image courtesy of Dr J.L. Gillet).

Abbreviations: CFV, common femoral vein; SS, saphenous stump; TV, terminal valve.

Selective treatment of incompetent perforators at the initial operative procedure remains debated knowing that most of the incompetent perforators are no longer identified by DS after saphenous and tributaries ablation, but persistent incompetent perforators, particularly those not connected with the saphenous trunk, can be responsible for PREVAIT. (Figure 4).

Technical problems related to the first operative treatment (surgery, thermal, or chemical ablation)

Such problems can overlap in the same patient, and some are specific and related to the procedure used, while others are identified no matter what procedure was used.

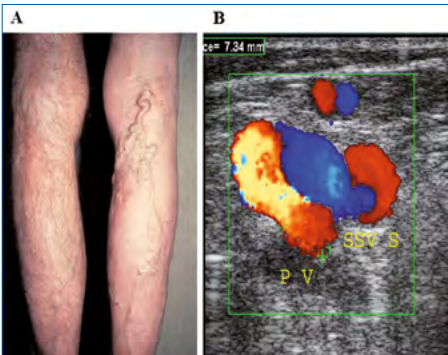


Figure 6. PREVAIT clinical aspect.

Panel A. Popliteal fossa massive recurrence related to non-flush high ligation in a patient with an incompetent SSV terminal valve. Panel B. Postoperative duplex scanning identified reflux in the SSVs, which feeds the varicose network after the compression-decompression maneuver. (Image courtesy of Dr J.L. Gillet).

Abbreviations: SSVs, short saphenous vein stump; PV, popliteal vein.

Surgery

The most frequent technical error quoted in classic surgery was nonflush ligation at the saphenofemoral junction (SFJ; Figure 5) or at the saphenopopliteal junction (SPJ; Figure 6). This point is now controversial as some series with conservation of the SFJ claim to achieve excellent results including patients with incompetent terminal valves.¹⁵² Several authors continue to state that nonflush ligation of the saphenous termination is responsible for frequent recurrence,^{41,52} particularly over the long -term.⁵⁵⁻⁵⁷ In the CHIVA technique, PREVAIT would be mainly related to wrong preoperative marking and inappropriate techniques.⁹⁰

Thermal ablation

Inadequate techniques, consisting mainly of delivering insufficient energy, irradiance, or fluence in laser or radiofrequency procedures,

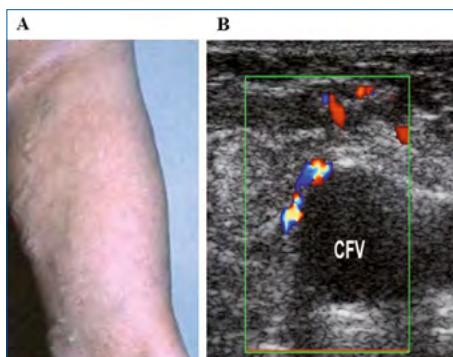


Figure 7. PREVAIT clinical aspect.

Panel A. A varicose network at the thigh just below a previous groin incision related to neovascularization. **Panel B.** Same patient with a duplex scan. Small refluxive veins identified above the CFV after a Valsalva maneuver. (Image courtesy of Dr J.L. Gillet).

Abbreviations: CFV, common femoral vein.

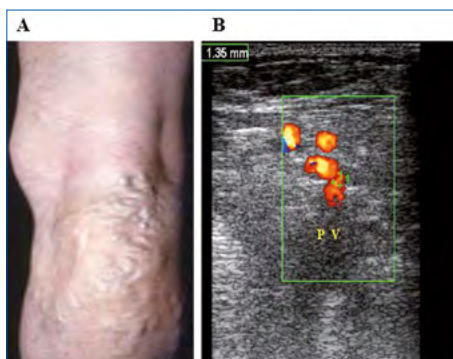


Figure 8. PREVAIT clinical aspect.

Panel A. A varicose network at the popliteal related to neovascularization. **Panel B.** Same patient with a duplex scan. Varicose network above a refluxive popliteal vein (Image courtesy of Dr J.L. Gillet).

perforators may become incompetent. Varices may develop in the same territory initially treated including saphenous tributaries that were not incompetent at the time of the operative treatment or in another superficial vein territory.

Risks factors for chronic venous disease progression and, in particular, varices have been investigated in prospective studies.¹⁵⁵ However, underpinnings and constitution risk factors for disease progression are still poorly understood. It is generally accepted that there is a strong family predisposition not only for presenting with varicose veins, but also for developing recurrence related

might be responsible for short- or long-term recanalization of the treated vein.

Chemical ablation

Inadequate techniques as well as using an inappropriate dose of the sclerosing agent might be responsible for short- or long-term recanalization of the treated vein.

Technical problems not related to initial treatment

The neovascularization phenomenon was discovered 25 years ago, but remains to be fully elucidated.¹⁵² It occurs mainly at the SFJ (Figure 7) and less frequently at the SPJ (Figure 8), and is considered, in many articles, as the main cause of PREVAIT after correct classic surgery.^{28,29,134,153,154} El Wajeh et al contest the term neovascularization and favor adaptive dilatation of preexisting venous channels (vascular remodeling), probably in response to abnormal hemodynamic forces.⁴³ According to Lemasle et al, this phenomenon is related to preexisting anatomical anomalies.⁷⁹ Egan minimizes its frequency as well as its importance in groin recurrence.⁴¹ However, neovascularization has been reported not only in procedures including SFJ or SPJ ligation, but also after thermal ablation,⁷⁶ albeit at a lower frequency.^{71,124}

Evolution of the disease

It should never be forgotten that superficial venous disease is a chronic condition that tends to progress over time.¹⁰⁴ In other words, previously unaffected superficial veins or

to disease evolution. The precise nature of the genetic basis for this family predisposition is far from clear. To shed more light on this issue, it will not be sufficient to study single genes, potentially implicated in varices. Instead, genome wide association studies will be needed using very large sample sizes to further unravel the genetic basis of varices and chronic venous insufficiency.¹⁵⁶

Management of PREVAIT

Diagnostic

Medical history and physical examination must be completed by full duplex scanning of the three venous systems every time there is a PREVAIT. This investigation provides anatomic and hemodynamic data including: (i) topographical sites of recurrence that can be mapped; (ii) possible sources of reflux from the deep to the superficial venous system (*Figures 9 and 10*); (iii) intensity or degree of reflux; and (iv) nature of sources, keeping in mind that causes have to be classified differently if recurrence occurs in a site previously treated or not. In addition, DS gives information on perforator and deep venous systems.

One problem remains: a standardized DS investigation protocol was not universally used by the different investigators. Recently, a consensus document has been published on postoperative DS that provides a precise investigation methodology and a better and more precise description of

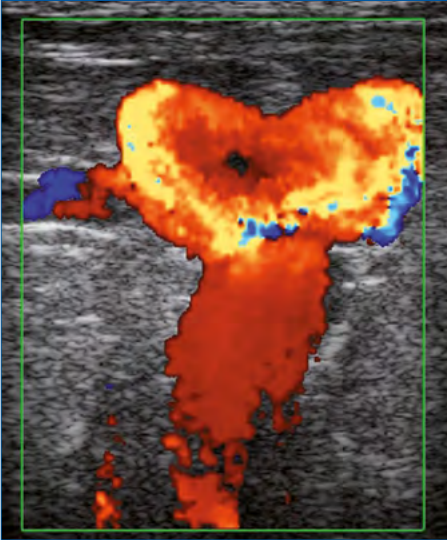


Figure 9. Presence of varices at the groin in a patient previously treated by saphenofemoral ligation.

Color duplex ultrasound. Massive reflux induced by a Valsalva maneuver.

(Image courtesy of Dr J.L. Gillet).

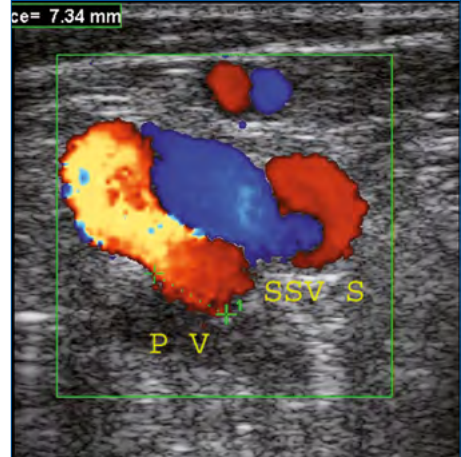


Figure 10. Presence of varices in the popliteal fossa in a patient previously treated by saphenopopliteal ligation.

Postoperative duplex scanning identified reflux in the SSVS that feeds the varicose network after the compression-decompression maneuver.

Abbreviations: PV, popliteal vein; SSVS, short saphenous vein stump.

(Image courtesy of Dr J.L. Gillet).

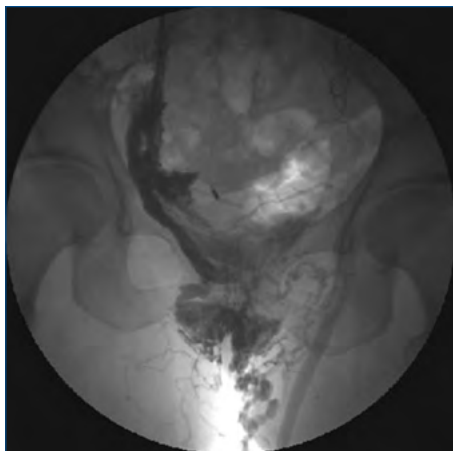


Figure 11. Selective phlebography of the right pudendal vein feeding the left GSV.

Abbreviations: GSV, great saphenous vein.

(Image courtesy of J. Leal Monedero and Dr S. Zubicoa Espeleta).

the anatomic and hemodynamic anomalies according to the operative treatment modalities, surgery, or endovenous treatment.³⁹

In a few select cases, ascending venography in 3D imaging may give complementary and valuable information. PREVAIT related to refluxing pelvic varices is investigated better by selective descending phlebography (Figure 11). Other investigations such as air plethysmography may be useful, but is never routinely performed.

Patient evaluation with quality of life questionnaires determines whether PREVAIT affects patients' quality of life (QOL). The health-related QOL scores for patients can be used in different ways for clinical studies. Beresford et al compared patients presenting with recurrences after conventional surgery versus patients with untreated varicose veins.⁹ No survey has compared operated patients with or without PREVAIT.

Treatment methods

Compression therapy

Compression for improvement in both symptoms and signs of varicose veins is frequently recommended, but it does not cure the disease.

Drugs

In varicose veins, venoactive drugs are prescribed mainly to improve edema and symptoms. The most commonly used are flavonoids, more particularly, the micronized purified flavonoid fraction (MPFF).

Operative procedures

The final objective of any operative procedure is multiple and consists of decreasing the ambulatory venous pressure, preventing worsening chronic venous disorders, avoiding further recurrences, and of course, relieving patients of their symptoms, signs, and any unpleasant cosmetic aspects of their legs.

Operative procedures share the same goals: (i) suppress reflux from deep to superficial venous systems, when reflux exists; (ii) ablate varices; (iii) in some specific cases, suppress deep vein abnormalities to prevent new recurrences; and (iv) suppress the reflux from pelvic and gonadal varices, when it exists, since the reflux feeds recurrent varices of the lower limbs.

Sclerotherapy

This treatment has been used for a very long time for the treatment of REVAS. Different protocols have been used, but no comparative study was available. Recently, UGFS has entered the ring, and a minimal consensus exists on the techniques, doses, concentrations, and sclerosing agents, according to the location and extent of varices.¹⁵⁷ One of the main advantages of UGFS is that the process is cheap, simple, less invasive than other operative procedures, and easily repeatable. UGFS can obliterate the refluxive varices and suppress most of the leak points between the deep and superficial venous systems, that is to say, an incompetent SFJ, SPJ, and perforator. For pelvic reflux, coils are used in association with a sclerosing agent.

Superficial vein surgery

Procedures can be classified into three groups according to their objective, and should be used in combination.

1. Procedures suppressing reflux from deep to superficial venous systems

Persistent reflux at the SFJ or SPJ. According to the extent of postoperative fibrosis, redo surgery may be difficult. Complications following reexploration of the groin are common.⁶⁴

Patch interposition at the SFJ has been recommended for avoiding new recurrences^{22,31,32} and closure of the cribiform fascia³⁶ or reflected pectineal flap.¹⁵⁸ No data are available concerning redo surgery outcomes at the SPJ.

Incompetent perforator ablation. When severe cutaneous and subcutaneous changes are present, subfascial endoscopic perforator surgery (SEPS) was the favored surgical technique, but chemical or thermal endovenous procedures can be used.

2. Procedures ablating refluxing varices

According to the location and type of varicose vein, various techniques can be used: stab avulsion and phlebectomy are the most commonly used techniques, while stripping, thermal ablation, and chemical ablation are used for treating the residual saphenous trunk.

3. Correction of deep reflux

Various procedures, whose goal is to suppress deep vein reflux, should be used as valvuloplasty or valve transfer, legitimated by several studies demonstrating that primary deep axial reflux is frequently associated with REVAS.^{159,160}

Embolization using coils and foam of the pelvic and gonadic veins

In patients whose varices are fed by pelvic or gonadic reflux, this procedure is less invasive than direct ligation.⁷⁸

Results

Compression therapy and drugs

We have no specific data on the efficacy of compression treatment and drugs in patients presenting with PREVAIT.

Chemical ablation

The efficacy of liquid sclerotherapy using one protocol—the compass technique—has been reported on a large series (253 legs), with a follow-up of 3.1 ± 1.7 years (range, 1.5-5.7 years). The cumulative obliteration rate was sustained at $>90\%$ and there was a significant decrease in the venous dysfunction score. Unfortunately, the end point of sclerotherapy sessions was not given.⁸² UGFS has been reported in 4 studies.

In a series by Kakkos et al, 45 lower limbs presenting REVAS were treated by UGFS (3% sodium tetradecyl sulfate foam). After the UGFS sessions, they were assessed by DS.⁶⁸ In 28 legs, a reflux appeared at the level of the groin, in 5 legs at the perforator vein level, and isolated GSV in the rest of the legs. Despite further sclerotherapy (single session with an injection of 6 mL in 58% of legs; ≥ 3 treatment sessions in 11%), complete occlusion at the end of treatment was achieved in only 39 of the 45 retreated lower limbs (87%).⁶⁸

Darke and Baker treated recurrent GSV varices in 18 legs with UGFS (3% polidocanol foam). Persistent or reconstituted GSV trunks were seen in all legs. In the 6 weeks following treatment, clinical examination of retreated legs and DS were performed. One treatment was sufficient to reach a complete occlusion in 10 legs, while 2 treatments had to be done in a further 5 legs. The 3 remaining legs had partial occlusion after 1, 2, or 3 treatments.²⁶

Coleridge Smith reported the outcome of a series of 267 recurrent varices due to incompetence of the GSV that had been managed by UGFS (mostly 3% STS foam). A total of 106 legs (40%) were reviewed at a mean follow-up interval of 11 months after treatment. The GSV had remained obliterated in 98/106 (92%); better than the 86% occlusion rate seen in primary incompetence.²⁰

O'Hare et al reviewed 32 recurrent veins at 6 months after UGFS (3% STS foam). Occlusion rate on DS was 72% (23/32), and 88% (28/32) of the patients were satisfied with the results. There was no significant difference in occlusion rates between primary (45/60, 75%) and recurrent (23/32, 72%) veins. Unfortunately, information regarding the type of recurrence treated is missing.⁸⁹

The most convincing data was the Birmingham' series. A total of 91 patients presenting with symptomatic recurrent great saphenous varicose veins were treated by 1 or 2 UGFS sessions. At a 1-year follow-up, above the knee reflux was eradicated in 81/88 legs and below the knee reflux in 72/80 legs. Unfortunately, no data were provided concerning the presence or absence of symptoms and varices.²⁷

Surgery

Surprisingly, very few data are available on the results provided by redo surgery in patients investigated preoperatively with DS. We reported a series of 145 limbs with a follow-up of 5 to 6 years. All patients had major reflux from the deep system at the SFJ or SPJ, feeding recurrent varices that were treated by surgery. Postoperative sclerotherapy was performed in all patients during the first 2 years. An external audit revealed a global objective improvement of 85%, but there was better improvement in signs and symptoms than cosmetic appearance.¹⁶¹

The results of 2 studies using an interposition patch for treating recurrence at the SFJ have been published. Creton used this procedure without resection of the groin cavernoma, but with combined resection of varices (saphenous trunks and/or tributaries), he only had 4.2% of recurrences at the SFJ at a mean 4.9-year follow-up (range, 3-7 years) in 119 extremities. Nevertheless, 22.6% of patients had diffuse varices, with a new site of incompetence between the deep and femoral systems.²⁵

De Maeseneer et al compared the results at 5 years of 2 nonrandomized groups with group 1 and without group 2 a patch in a prospective study. All patients had recurrent SFJ incompetence. At 5 years, thigh varicosity recurrences were observed in 26% and 58% in group 1 and group 2 respectively.³⁰

Thermal ablation

Fassiadis et al described his clinical experience on the use of RFA in 18 treated legs for recurrent GSV. Recurrences were due to neovascularization at the SFJ in 15 legs, a persisting midhigh perforator in 2 legs, and a refluxing anterior thigh branch reconnecting with the GSV in 1 leg. None of the 18 legs had recanalization of the GSV at 1 month, and all patients returned to daily activities within 3 days. At 12 months, the occlusion rate was also 100% in the 16 follow-up patients. The only complication was a temporary sensory disturbance at the inner thigh in one-third of patients.⁴⁶

Hinchliffe et al reported a randomized control trial in 16 patients with recurrent varices initially treated by isolated SFJ ligation. For each patient, 1 leg was selected at random to receive redo high ligation (HL) + conventional stripping and the other RFA. RFA treatment was faster than traditional redo groin surgery (25.5 min vs 40 min; $P=0.02$), and caused less pain and bruising. On DS examination at a 12-month follow-up, 15 lower limbs in the group treated by RFA had complete GSV occlusion, 3 had partial occlusion. In the group treated by surgery, complete GSV stripping was reported in 14/16 lower limbs. The authors were in favor of RFA, which was justified by shorter operative time and less postoperative bruising and pain.⁶⁶

van Groenendael et al retrospectively compared outcomes of 2 different procedures in 216 patients with a recurrent varicosity of the GSV. A total of 149 underwent conventional surgery consisting of redo HL+incompetent GSV or tributary phlebectomy and 67 patients were treated with EVLA. All patients had previously been treated at least once with a saphenofemoral disconnection (SFD) with or without stripping of the GSV. Of the surgically treated legs, 87% had previously been stripped, while there were 57% who underwent EVLA. The conventional surgery was performed successfully in all legs and success was achieved in 100% of the EVLA legs. All treated veins remained occluded

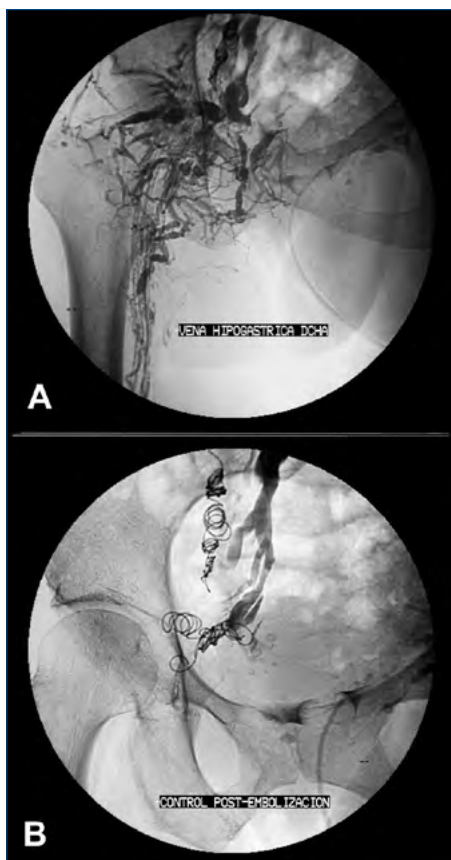


Figure 12. Selective phlebography.

Panel A. Selective phlebography in a patient presenting gluteal and lower limb varices after GSV stripping.

Panel B. Same patient embolization with coils and foam. PREVAIT is no longer present.

(Image courtesy of Dr J. Leal Monedero and Dr S. Zubicoa Espeleta).

Embolization

At a 6-month follow-up, 90% of 215 patients treated by embolization of gonadal and pelvic veins were significantly improved in both signs and symptoms (*Figure 12*).⁷⁸ Conversely, Castenmiller et al, with a mean 1.8-year follow-up (range, 1-3.5 years), 33 patients presenting PREVAIT after previous surgical treatment of lower varices disappeared only in 12% (4/33) after embolization. The explanation, as suggested by the authors, may be related to inadequate treatment of incompetent pelvic veins as only ovarian veins were treated by embolization.^{18,99}

postoperatively according to the DS, conducted an average of 8 weeks after EVLA in 46 legs (69%).

After a follow-up period of an average of 13.5 months in the conventional surgery group and of 15.0 months in the EVLA group, clinical recurrences occurred in 26% of the surgically-treated limbs and in 12% of the EVLA-treated limbs ($P=0.024$). This was no longer significant after correction for the length of follow-up. It must be highlighted that no definition was given for “clinical recurrence” by the authors and that repeated DS investigations were not performed. The postoperative pain score was significantly lower in the surgery group than in the EVLA group ($P=0.02$), and the median duration of postoperative pain was shorter (4.5 days in the surgery group vs 7 days in the EVLA group; $P=0.03$), but the use of nonsteroidal anti-inflammatory drugs was significantly higher in the surgical group. The authors concluded that if anatomically suitable EVLA is a good treatment alternative for recurrent GSV, only 31% of patients were suitable for EVLA in their series.¹²⁹

In a series of 42 patients presenting PREVAIT in the SSV territory, 26 were treated by EVLA and 16 by surgery including redo SPJ ligation+SSV ablation±tributary phlebectomy. After correction for the follow-up duration, the difference in terms of results did not reach statistical difference.¹³⁰



Figure 13. PREVAIT after short saphenous vein surgery. Panel A. Ligation of saphenopopliteal junction+stripping. Panel B. Clinical result after ultrasound-guided foam sclerotherapy. Panel C. Duplex scan investigation, persistent reflux at the saohenopopliteal junction. Image courtesy of Dr J.L. Gillet.

Indications for treating PREVAIT patients

Patients complaining of symptoms

They present with symptoms, and/or esthetic concerns, and/or signs of chronic venous disease (C₂-C₆). In all cases, these patients need to be investigated by DS.

Subjects attending a routine follow-up

The decision whether to undertake DS, or not, depends on the presenting complaint and physical findings. In practice, DS is usually done.

Asymptomatic patients

When hemodynamic or anatomic abnormalities are found in asymptomatic patients without severe signs, who are not concerned by their minor varices as cosmetic problems, the decision to treat depends on the severity of the noninvasive findings. In all cases, follow-up is required knowing that abnormal DS findings precede symptoms and signs.

Symptomatic patients

In patients presenting PREVAIT and hemodynamic anomalies, operative treatment must be considered. Although there is no RCT comparing redo surgery with chemical ablation, there is a consensus for treating them with UGFS as a first-line treatment for reasons exposed in the methods evaluation (*Figure 13*).^{27,18} The European guidelines for sclerotherapy in chronic venous disorders gives the recommendation grade 1B in PREVAIT.¹⁵⁷ in very few cases, when DS reveals an intact and large incompetent saphenous stump at the SFJ or SPJ with a massive reflux filling the varicose network, redo surgery at the junction should be considered in combination with UGFS.

Patients in CEAP class C_{4b}-C₆ with PREVAIT and primary deep vein axial reflux

UGFS and valvuloplasty, in association, must be considered in active patients reluctant to wear lifelong compression or patients with a recurrent ulcer.

Guidelines for prospective studies

In order to know the prevalence and annual incidence of PREVAIT after nonconservative treatment, we need prospective, detailed, and well-documented studies from the outset of surgical treatment as was done in the series by Kostas.⁷³ These studies may give information on: (i) the value of routine postoperative scanning in the early detection of persisting reflux; (ii) the relationship between hemodynamics and clinical recurrence; and (iii) the possible role of compression therapy and/or complementary postoperative sclerotherapy in preventing recurrences.

These studies may use both the updated CEAP and REVAS classification and a QOL questionnaire. Regarding the choice of the procedure, UGFS should be the first-line treatment for PREVAIT according to its satisfying outcomes. This method was assigned a grade 1B recommendation in the European Guidelines, despite the lack of RCTs comparing UGFS versus other methods—such studies are difficult to implement.¹⁵⁷

Conclusion

PREVAIT is a frequent condition frustrating both patients and physicians and has been poorly evaluated. In order to build a scientifically convincing evidence base and to achieve a greater degree of comparability between studies, an international consensus on conformity is required.

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