CONTENTS

PHLEBOLYMPHOLOGY

Hugo Partsch
Editor in Chief

Dear Readers,

In this issue of Phlebolymphology, ***Michel Perrin*** *continues his beautifully illustrated survey of the history of venous surgery. In the last issue (Vol 18, No. 3, 2011), after having discussed terminology, anatomy, and physiology, he gave us a wonderful overview of the history of venous surgery from the ancient Egyptians to the 19th century. In the present issue, he continues with the 20th century, including all newly described methods, some of them still controversial. Both articles are real pearls, full of information that cannot be found anywhere else in this condensed form.*

Readers will certainly also enjoy the other highly interesting and relevant original articles in this issue of Phlebolymphology which contain data reported for the first time.

René Milleret *from Montpellier reports the most recent results of his ingenious method of sclerosing incompetent vein trunks by superheated steam. The article not only includes his preclinical experiments, data from the literature, and his own results including follow-up experience, but also a detailed description of how this new technique should be performed. The use of small amounts of steam instead of the more aggressive physical or chemical methods seems to achieve comparable results with fewer side effects.*

Françoise Pitsch*, Paris, reports two large multicenter studies, the SYNERGY and SAFETY trials, which show that Daflon 500 mg improves patient-reported symptoms after sclerotherapy of small varicose veins and telangiectasias.*

Waldemar Olszewski*, Warsaw, continues where he left off in his previous article in Phlebolymphology (Vol. 17, No. 3, 2010), in which he described shifts of tissue fluid induced by compression in lymphedema patients. In the present article he has added scintigraphic results which prompt a fascinating discussion of basic concepts and of the mode of action of manual lymph drainage.*

The removal of incompetent superficial veins is very frequently performed, using various procedures, although the scientific evidence to justify active ablation, especially of uncomplicated varicose veins, is rather poor. ***Bo Eklöf****, Helsingborg, together with* ***Michel Perrin****, Lyon, has reviewed randomized, controlled trials published since 1990 in which different treatment modalities have been compared. The results are presented and discussed in 8 informative tables. This is the first part of a review the second part of which will appear in a future issue of Phlebolymphology.*

A book review concludes this issue of Phlebolymphology, which we hope you will appreciate.

Enjoy your reading!

History of venous surgery (2)

This is the second of the 3 chapters that make up a "History of Venous Surgery". In the latest issue of *Phlebolymphology* (Vol. 18, No. 3, 2011), an overview from the ancient Egyptians to the 19th century was presented. In the present issue, the history continues with the 20th century.

Michel PERRIN

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THE 20TH CENTURY

By the 20th century, venous surgery was no longer limited to treatment of varicose veins and had gradually expanded to include management of other venous diseases and treatment of veins other than superficial ones. We will successively describe varicose vein surgery and then other procedures.

VARICOSE VEIN SURGERY

2. Varicose vein surgery without preservation of the saphenous trunks

A. Open surgical excision

With the exception of the highly disfiguring Rindfleisch operation of the early 20th century (1908), modern surgery for varicose veins based on their removal began at this time. An explanation is required as a reminder of the principle on which treatment of varicose veins is based by removal without preservation of the saphenous trunks. It is based on 2 concepts:

- First, a general concept: open surgery was most often limited to resection or removal of diseased organs or tissues insofar as their removal did not result in an excessive mortality rate or complications and subsequently enabled patient survival under acceptable conditions. Insofar as the superficial veins are not essential to return blood to the heart, because of the decisive role of the deep veins for this purpose, their removal was possible.
- The second concept is specific to varicose veins. It was considered that the progression of varicose veins over time occurred "from the upper area downward", that is from the groin to the ankle. In other words, doctors were convinced that venous disease originated at the saphenous junction and increasingly extended towards the foot via the saphenous veins and their tributaries. Consequently, traditional open surgery consisted of ligation of the saphenous junction, and more or less extensive resection of the saphenous veins and of diseased tributaries. Since it was considered that the first incompetent valve was the last saphenous valve, ligation of the saphenous vein had to be performed on a level even with the deep vein.

Keywords:
history, venous surgery, varicose veins, stripping, phlebectomy, venous ablation

Phlebolymphology. 2011;19(4):167-173.

What was going to change was the technique used for removal of the saphenous trunk, which we have seen had been used for hundreds of years. The venous stripping procedure for its removal was also destined to change. To perform this procedure, a venous stripper is used, and as a reminder this instrument:

- is either inserted into the lumen of the vein—this is referred to as an endoluminal stripper,
- or is placed around the vein—this is referred to as an external stripper.

The advantage of the stripper is that it enables removal of the vein over an extensive length by means of small incisions made at the end of the vein and through which the vein is externalized and removed.

In the early 20th century, three American surgeons codified the technique for stripping of the great saphenous vein (GSV). In 1905, W.L Keller described stripping by invagination (*Figure 9*) which was revived in 1963 by Van der Stricht under the name of wire invagination (*Figure 10*). In 1906, C.H. Mayo reported his technique of external stripping (*Figure 11*). In 1903, W. Babcock popularized endoluminal stripping by using a rigid stripper which remained in favor for several decades.

It would be too time-consuming to describe all the procedures which have marked the history of the stripping technique from the time of the flexible endoluminal stripper recommended by Myers in 1947 to pin-stripping developed by A. Oesch in 1993 (*Figure 12*). A recently developed stripper even makes it possible to avoid having to make a lower extremity cutaneous incision.

In 1989, R. Milleret described "cryo-stripping" whose principle involves the use of a cryoprobe whose end is chilled to – 60-90°C with nitrous oxide. This probe is inserted into the lumen of the vein and the application of cold "glued" the vein to the catheter which was removed with the cryo-stripper (*Figure 13*).

Stripping was possibly supplemented by serial phlebectomy and ligation of the incompetent perforator veins to eliminate tributaries presenting reflux. Other teams preferred treating these abnormal tributaries and perforator veins with additional post-operative sclerotherapy.

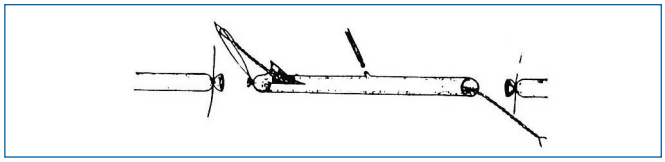

Figure 9. *Venous stripping by invagination, Keller (1905). The part of the vein resected between the 2 ligations is invaginated as the finger of a glove into the lumen of the vein from its upper end after attachment to a steel wire pulled through the lower orifice.*

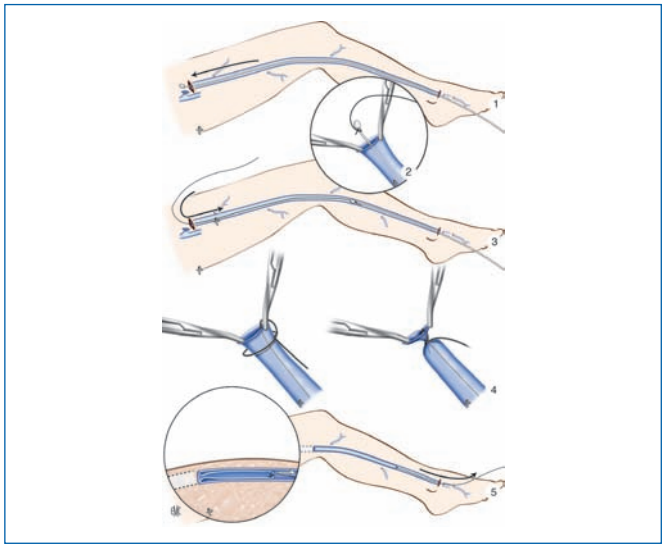

Figure 10. *Venous stripping by invagination according to Van der Stricht's procedure (1963).*
Caption: 1. The vein is catheterized with a stripper from the distal incision to the groin.
2. A sturdy wire is attached to the stripper.
3. The stripper is pulled through the vein from groin to ankle, the wire has taken its place.
4. This wire is secured to the great saphenous vein in the groin.
5. Pulling on the distal end of the wire produces stripping of the vein by invagination.

Source. Perrin M. Chirurgie à ciel ouvert de l'insuffisance veineuse superficielle. Principes. Techniques. Résultats.
EMC (Elsevier Masson SAS, Paris), Techniques chirurgicales - Chirurgie vasculaire, 43-161-B, 2007.

In 1956, a Swiss dermatologist in Neuchâtel, Dr Robert Muller, gave a boost to phlebectomy by serial incisions under the term ambulatory phlebectomy. He performed this technique as an office procedure under local anesthesia and patients were immediately able to resume walking. He treated all superficial varicose veins with this method. The French and Swiss Societies of Phlebology were somewhat skeptical of this method but, since then, many dermatologists, phlebologists and a certain number of vascular surgeons have taken up this procedure and advocate its use, albeit often limiting its indications to certain types of varicose veins.

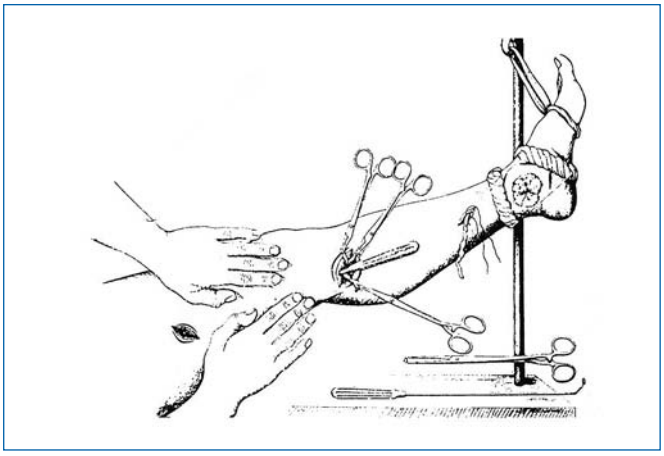

Figure 11. *External stripping, Mayo (1906). The external stripper in the right lower part of the original figure contained a ring at its end. This ring was placed around the vein like a thread in the eye of a needle while the previously sectioned vein was placed under tension by pulling on forceps and the tributary veins were successively torn away at the point of emptying into the saphenous trunk by pushing the external stripper from the skin incision below the knee up to that of the thigh. Thus, removal of the vein was achieved closer and closer to the saphenous trunk. Note elevation of the limb to minimize bleeding: the amount of blood in a vein is reduced by this position.*

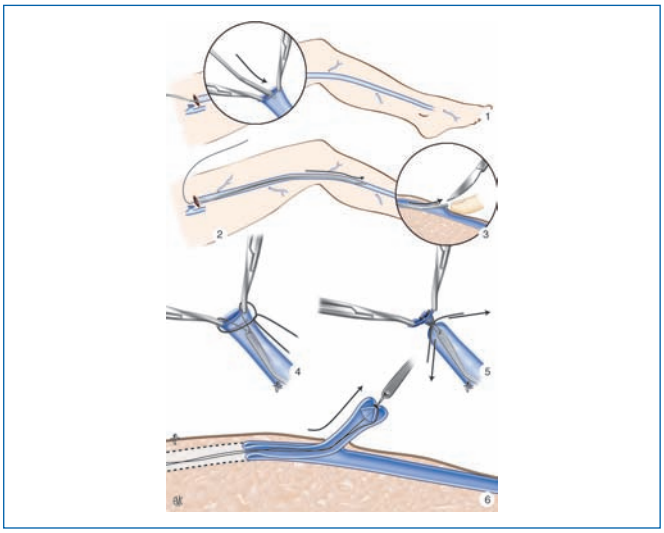

Figure 12. *Pin-stripping (Oesch 1963).*
Caption:1. The distal end of the pin-stripper is inserted into the venous lumen in the groin.
2,3. The pin-stripper is externalized at the lower end of the vein to be treated after making a minimal skin incision and perforation of the vein.
4,5. The wire secured to the eye hole of the pin-stripper is inserted into the venous lumen by pulling the stripper, and is then secured to the vein.
6. The stripper and the everted vein are removed through the distal incision.

Source. Perrin M. Chirurgie à ciel ouvert de l'insuffisance veineuse superficielle. Principes. Techniques. Résultats.
EMC (Elsevier Masson SAS, Paris), Techniques chirurgicales - Chirurgie vasculaire, 43-161-B, 2007.

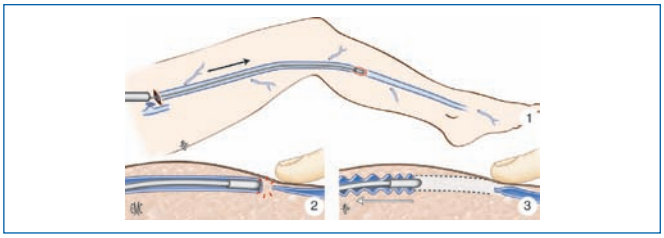

Figure 13. *Cryo-stripping (Milleret 1989).*
Caption: 1. The cryo-stripping catheter is lowered to the lower limit of the vein to be treated.
2. After freezing, the vein is ruptured by pulling the catheter.
3. The catheter is pulled from the incision in the groin while maintaining freezing. The frozen vein is secured to the catheter. The cryo-stripper is removed through the incision in the groin. The great saphenous vein has remained attached to the catheter by freezing.

Source. Perrin M. Chirurgie à ciel ouvert de l'insuffisance veineuse superficielle. Principes. Techniques. Résultats.
EMC (Elsevier Masson SAS, Paris), Techniques chirurgicales - Chirurgie vasculaire, 43-161-B, 2007.

Thermal and chemical ablation

These methods differ from the previous techniques by:

- the absence of ligation of the saphenous vein junction, which eliminates the incision in the groin for the GSV or in the popliteal fossa for the small saphenous vein (SSV).

- the manner of removing the saphenous veins and their incompetent tributaries. Instead of performing excision of these veins, they are destroyed in situ.

English-speaking doctors justifiably use the word "ablation" in this definition, adding the name of the procedure used, for example thermal ablation or chemical ablation. In fact, in science, the word ablation means progressive destruction of a material (a vein, in this case) by a physical agent. Therefore, thermal ablation or chemical ablation eliminates reflux into the treated vein after its destruction and fibrous transformation is obtained. This type of ablation differs from surgical ablation, which removes the organ treated but produces the same result in pathophysiological terms.

It should be noted that these procedures are usually performed by venipuncture of the venous lumen identified perioperatively by ultrasound methods of investigation commonly referred to as Doppler examination, named after the Austrian physicist and mathematician Johann Christian Doppler who in 1842

demonstrated the shift in the frequency of an acoustic or electromagnetic wave between the measurement at emission and measurement at reception when the distance between the transmitter and the receiver vary over time. In fact, the Doppler ultrasound used in phlebology couples an ultrasound device with a Doppler transducer.

As a brief reminder, ultrasound was first used during the Second World War to detect underwater submarines. In 1960, two Japanese scientists, S. Samotura and Z. Kaneko, were the first to apply ultrasound to investigate blood vessels, because blood contains formed elements, the blood cells, which are transported in the circulation in blood vessels, just as submarines travel underwater in the ocean.

Thermal ablation, laser ablation, radiofrequency ablation and steam ablation

These methods have in common the fact that they use a catheter or a fiber which is inserted into the lumen of the vein. The tip of this catheter is heated to a high temperature and applied to the inner wall of the vein, the intima, and the heat is transmitted to the entire wall of the vein. This high temperature destroys the lumen by progressive retraction of the tissues of the wall.

Laser ablation

A laser generator emits monochromatic light which is transmitted to the tip of the fiber. This light energy is converted into heat energy. Without going into technical details, diode and YAG laser fibers are used, whose wavelength and type vary. A laser shot can be performed continuously or discontinuously (*Figures 14 a, 14 b, 14 c*).

Radiofrequency ablation

This uses the heat properties of an electrical current produced by a generator which is delivered at the tip of a catheter. A certain number of physical parameters can be measured continuously and precisely on the energy delivered by the catheter (*Figure 15*).

Thermal ablation by high-temperature steam.

Initiated by the Frenchman R. Milleret in 2008, this is based on injection of pulsed steam into the lumen of the vein to be treated, using an electrically heated catheter. The steam condenses at the end of the catheter, transmitting heat to the wall of the vein.

Chemical ablation

This is commonly called sclerotherapy and, like in the thermal ablation methods the use of Doppler ultrasound during the procedure provides safety and accuracy.

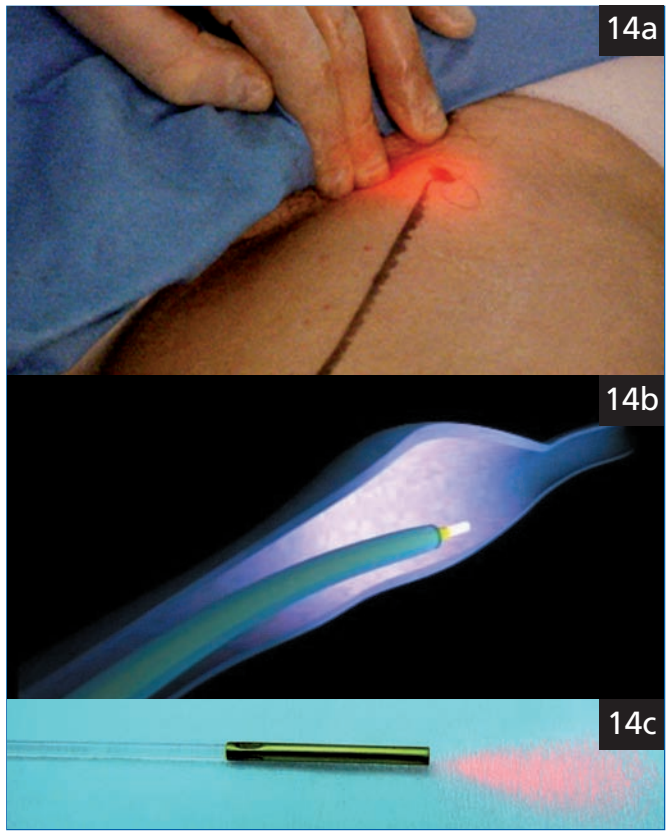

Figure 14 a. *Laser ablation method.*
The end of the laser catheter can be readily identified under the skin as it advances in the venous lumen.

Figure 14 b*. Diagram. The laser catheter in the venous lumen is progressively removed downwards.*

Source Perrin M. Traitement chirurgical endovasculaire des varices des membres inférieurs. Techniques et résultats. EMC (Elsevier Masson SAS, Paris), Techniques chirurgicales - Chirurgie vasculaire, 43-161-C, 2007.

Figure 14 c*. Protected frontal emission laser fiber. We see the laser light in the axis of the fiber whose end is capped on the side.*
Courtesy JL. Gerard, MD.

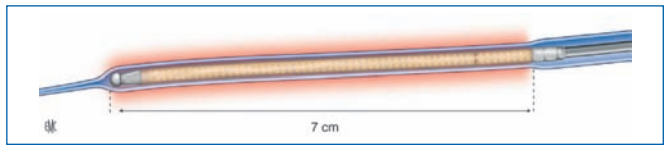

Figure 15. *Radiofrequency ablation.*
Closure FAST™ Catheter. The circular heating element of the catheter measures 7 cm in length which makes it possible to treat an equivalent length of vein in a few seconds.

Source Perrin M. Traitement chirurgical endovasculaire des varices des membres inférieurs. Techniques etrésultats. EMC (Elsevier Masson SAS, Paris), Techniques chirurgicales - Chirurgie vasculaire, 43-161-C, 2007.

But the novel item in sclerotherapy is the use of a sclerosing product as a foam (gas bubbles + sclerosing liquid) instead of the liquid form. This foam must be prepared just before it is to be used because it is unstable (*Figure 16*). Venipuncture and dissemination of the foam are done using ultrasound guidance (*Figure 17*).

Figure 16. *Preparation of foam for sclerosing injection. Two-syringe method according to Tessari's technique.*

Courtesy Tessari MD.

Figure 17. *Doppler ultrasound during injection of sclerosing foam. The needle and the foam can readily be identified.*

Courtesy Tessari MD.

Although use of foam sclerotherapy can be identified as early as 1930, it did not really develop until the last fifteen years or so and the contribution to the promotion of this method by the following people should be mentioned (in alphabetical order): J. Cabrera, A. Frullini, C. Hamel-Desnos, G. Mingo, A. Monfreux, M. Schadeck, L. Tessari, F. Vin. The advantages of this technique have now been well identified and the protocol it uses is well defined.

2. Varicose vein surgery with preservation of the saphenous trunk

These are open surgical procedures which use different methods but leave the saphenous trunk in place. Some of them have been abandoned, such as isolated resection over a few centimeters of the ending of the GSV or of the SSV, in which ligation of the GSV was supplemented by ligation of the perforator veins. This procedure was called crossectomy* and was proposed and performed in the 1980s by a team in Sweden.

Currently, 3 procedures with preservation of the saphenous trunk are performed (*Figure 18*). The rationale for these techniques is based on 2 points: the first is the potential utility of preserving the saphenous trunks which are the best graft material for the replacement of diseased arteries. The second point is that the saphenous trunks promote the drainage of venous blood in the superficial tissues of the lower limb, even if in some case they are the site of partial reflux due to incompetent venous valves.

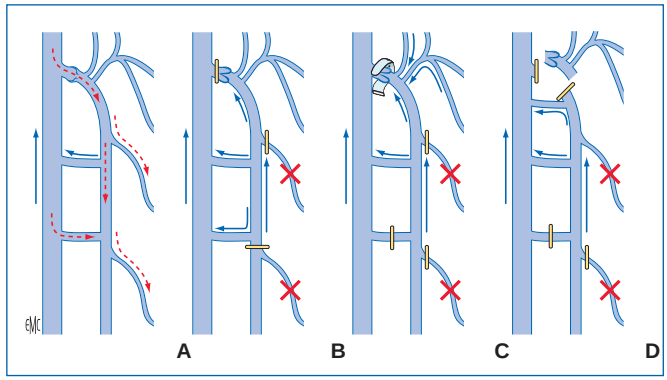

Figure 18. *Varicose vein surgery with preservation of the saphenous trunk.*

A. Diagram of an incompetent saphenous vein. On the left: deep vein axis. On the right: axis of the saphenous vein and its tributaries. Between the 2 systems: the perforating veins. The blue or white arrows indicate the normal direction of blood flow, the red arrows show reflux.

B. SALVA method. Diagram. The incompetent saphenous trunk is left in place. Only the incompetent tributaries are treated by phlebectomy.

C. CHIVA procedure. Diagram. The incompetent saphenofemoral junction is tied off, the incompetent tributaries are treated by phlebectomy and the saphenous trunk is tied off below re-entry of the perforating vein which returns blood to the deep venous trunk.

D. Diagram The incompetent saphenous vein is left in place. A sleeve is placed on the incompetent saphenofemoral junction, reduction of diameter of the vein restores the anti-reflux function of the terminal valve of the saphenous vein. The incompetent perforating veins are tied off and the incompetent tributaries are treated by phlebectomy.

Source. Perrin M. Chirurgie à ciel ouvert de l'insuffisance veineuse superficielle. Principes. Techniques. Résultats.
EMC (Elsevier Masson SAS, Paris), Techniques chirurgicales - Chirurgie vasculaire, 43-161-B, 2007.

** Crossectomy (extended saphenofemoral or saphenopopliteal junction ligation). The origin of this term, a procedure widely used in Germany, Spain, and France, is related to the morphology of the terminal part of the saphenous veins which is curved like the curved part of a bishop's miter.*

These 3 procedures differ in terms of both their technical execution and their hemodynamic objective, keeping in mind that they only require very small cutaneous incisions but call for more specific preoperative Doppler ultrasound examination than the other surgical techniques.

Phlebectomy of tributary veins

For over a hundred years it was considered that progression of varicose vein disease occurred "from the upper area downwards", as underlined above. But the systematic use of Doppler ultrasound and then of color duplex scanning in assessment of varicose veins called this notion into question:

- Venous reflux can be segmented, that is, highly localized to whatever venous segment;
- Chronologically, reflux does not necessarily develop from the root of the limb toward its distal extremity. In other words, saphenous reflux does not always begin at the saphenous vein junction into the deep veins. It can start in the tributary veins of the saphenous trunks.

This origin of reflux was demonstrated by N. Labropoulos (USA) in 1997 and has been confirmed by many studies.

Lastly, the degree of reflux and probably its progressive extension are promoted by the capacity of the reservoir in which this reflux can be evacuated. Compression of an incompetent tributary vein at its mouth, into which an incompetent saphenous trunk termination empties, partially or totally eliminates reflux in it (*Figure 19*). This process was mentioned in 1993 by French phlebologists.

In 1995, based on these findings P. Pittaluga (Nice, France) proposed phlebectomy of tributary veins to restore valvular competence of the GSV trunk, using the acronym SAVLA (Selective Ablation of Varicose Veins under Local Anesthesia) (*Figure 18b*).

The CHIVA procedure (hemodynamic preservation in venous insufficiency in ambulatory practice)

Proposed in 1988 by Franceschi (France), CHIVA is designed to create new hemodynamic conditions by dividing the pressure column in the varicose veins by disconnecting some venous anastomoses and by re-directing the reflux from the diseased superficial veins into the deep venous system (*Figure 18c*).

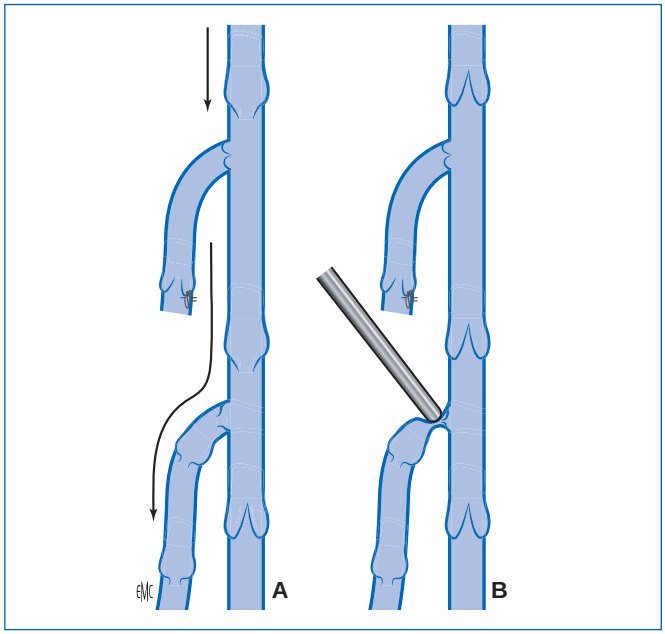

Figure 19. *Decrease in capacity of the reservoir to reduce or eliminate the reflux.*
A. The reflux in the primary venous trunk is drained into a tributary vein whose valves are incompetent. This "drain effect" increases the degree of reflux into the primary trunk.
B. Compression of the tributary at its point of emptying into the primary venous trunk eliminates the reflux into it.

Source: Perrin M. Insuffisance veineuse superficielle: notions fondamentales. EMC (Elsevier Masson SAS, Paris), Techniques chirurgicales - Chirurgie vasculaire, 43-161-A, 2007.

Valvular reconstruction

The terminal valves of the GSV can be treated by such reconstruction. The principle consists in restoring valvular competence by using different procedures to eliminate reflux through these valves: valvular repair (L. Corcos, Italy 1997), and exo-stent repair of the junction to reduce the diameter of the vein (S. Camilli, Italy 2002, J.R. Lane, Australia 2002) (*Figure 18d*). It should be noted that the therapeutic principle is based on the so-called "descending" theory of varicose vein disease as in traditional open surgery.

Perforating vein surgery

Although incompetent perforator veins are not peculiar to chronic venous disease, it is when they are associated with varicose veins in patients presenting with venous ulcer that they are treated surgically. In fact, when they are incompetent, they are responsible for reflux from the deep venous system towards the superficial venous system, which produces a constant increase in venous pressure. The latter is consistently identified in venous leg ulcers. R. Linton (USA, 1939) and then F. Cockett

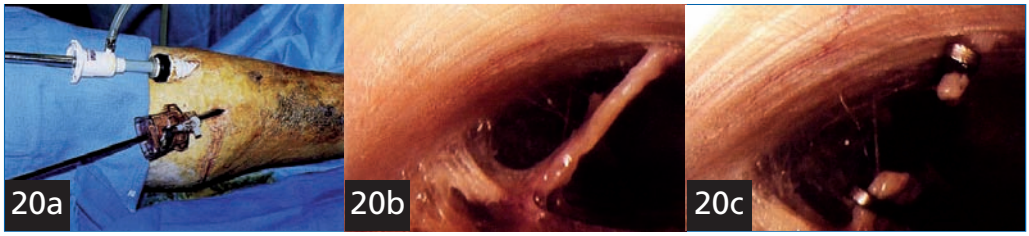

Figure 20a. *Subfascial endoscopic perforator surgery. Same surgical view.*

Figure 20b*. The perforating vein as the surgeon sees it on the video screen.*

Figure 20c*. Idem, after sectioning between the 2 clips.*

(United Kingdom, 1955) successively identified the role played by perforating veins in the occurrence of venous ulcer. They specified ligation of these veins by open surgery. These techniques had the disadvantage of producing delayed healing of cutaneous incisions when the skin is fragile. To compensate for this complication, Hauer (Germany, 1985) proposed endoscopic surgery on the perforating veins. This procedure gradually benefited from miniaturization of the instruments used (*Figures 20 a, b, c*).

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Obliteration of Varicose Veins with Superheated Steam

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INTRODUCTION

Endovenous heating techniques have been in clinical use since 1999: long-term results are now available for both radiofrequency and endovenous laser.[1] These results compare favorably with the gold standard: high ligation + stripping of the vein. Unfortunately, the cost of the equipment and disposable items necessary to implement these methods is still too high for many health systems in the world. The ideal technique would combine the advantages of currently used methods, and obviate their drawbacks. Heating the vein with superheated steam may provide significant medical and economic advantages.

PRINCIPLE

Water can be found in three physical states: ice, liquid, and vapor. In ice, H_2O molecules stick to each other. If heat is added, they become separated by less than 1 molecular diameter: this is the liquid phase, water as we drink it. If more heat is added, molecular agitation increases and H_2O molecules leave the surface as water vapor. This process is reversible: when vapor cools down as liquid, it gives back to surrounding molecules the heat which was used to change its state. A lot of heat is necessary to achieve the transition, thus vapor contains a lot of "latent heat" which can be used for heating tissues. As an example, more than 2000 KJ are needed to vaporize one liter of water at atmospheric pressure. Transition from liquid to vapor occurs at a temperature which is a function of pressure in the liquid: we all know that at atmospheric pressure this temperature is 100° C. If the pressure is increased to several hundred times atmospheric pressure, the steam will be emitted at a temperature up to several hundred degrees Celsius: it is called "superheated steam".

EQUIPMENT

The equipment was developped by Cerma Vein (Archamps - France). To emit steam at 150°C, we pressurize water, then force it through a very small diameter tube (0.1 mm) heated by an electrical current. The tube is at the tip

Keywords:
endovenous treatment, varicose veins, steam

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of a handpiece (*Figure 1*) to which a catheter can be connected. The single-use catheter is a thin tube of stainless steel coated with Teflon. At the tip of the catheter, steam is emitted at 120°C. The 1.2 mm (5F) catheter emits vapor near the tip through 2 lateral holes (*Figure 2*). A generator console controls the whole process and pressurizes the water.

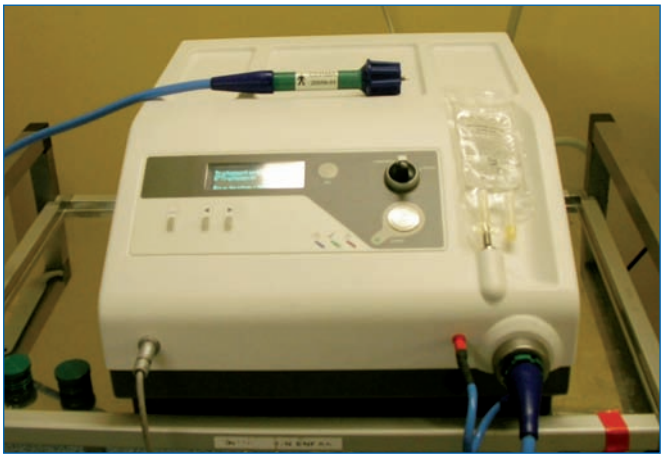

Figure 1. *The generator with the handpiece*

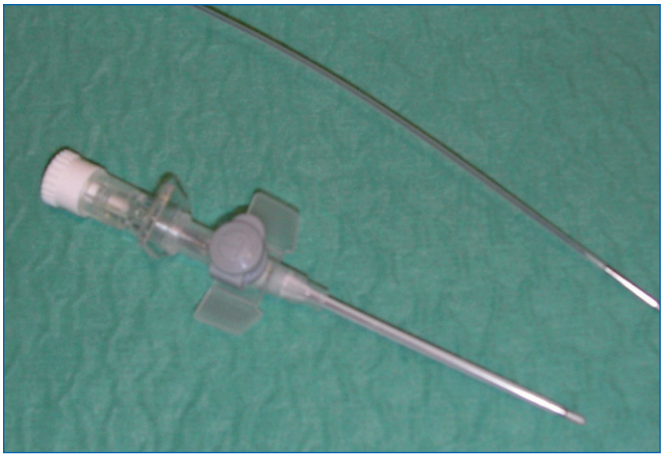

Figure 2. *The endovenous catheter*

DEVELOPMENT PHASE

In vitro studies

We have conducted studies on freshly stripped segments of great saphenous veins (GSVs). This allowed us to select the best way to deliver steam in order to obtain shrinking of the collagen in the vein wall. Best results were obtained with 2 pulses of 45 J/cm per centimeter of vein–which is close to what is delivered by endovenous lasers. Macroscopically, immediate diameter reduction of the GSV was seen (*Figure 3*), with separation of the endothelial layer and media. No damage was seen in the adventitia and no perforation was evidenced. Microscopically, these findings were confirmed by widening of the media, which proved the lesion of collagen fibers (*Figure 4*).

Figure 3. *Macroscopic view of heated vein on the left , untreated on the right*

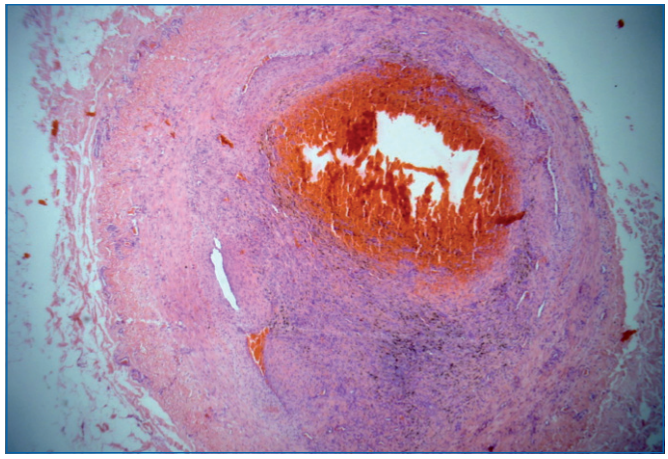

Figure 4. *Microscopic view of animal control*

Animal studies

Six ewes were used for animal studies. The external saphenous vein of the posterior limb was treated. Ten limbs were heated by steam, and 2 by radiofrequency (Closure® catheter) for comparative purposes. Different heating profiles were tested, either with or without tumescence around the vessel. Temperatures were measured peri-operatively at different levels: skin, directly around the vein by thermocouple, and in the inferior vena cava. Blood temperature was unchanged in this collecting trunk. Peri-venous temperature was

elevated to 45°C without tumescence, and 37°C with tumescence. Skin temperature was not modified if tumescence was applied.

No hemolysis was observed in blood samples. General parameters were not affected, except in 1 sheep which had tachycardia, but independently of heating: it was due to an anesthetic problem.

The veins were harvested at 1 month (4 limbs) and 3 months (8 limbs). No general complication was observed. There was no infection and no necrosis or inflammatory reaction of the peri-venous tissues. Veins heated at less than 45 J/cm were closed in some segments and remained open in others. Veins heated at 90 J/cm were closed along their full length.

Microscopic studies showed disappearance of the endothelial layer and the presence of fibrotic tissue in the lumen extending into the media, but no damage to the adventitia.

APPLICATION TO SURGICAL TECHNIQUE

Great saphenous veins

The treatment protocol follows the same steps as other thermal obliteration techniques. A duplex probe in a sterile cover is prepared. Sterile gel is not necessary, as we had good results by using saline or anesthetic solution applied with a soaked gaze.

Vein entrance:

Phlebotomy may be performed, but a transcutaneous approach is preferred. If the vein is of small caliber (often due to stress or cold-induced spasm), a tourniquet can be applied upward on the limb to increase pressure. The examination table can also be tilted to the anti-Trendelenburg position. A small amount of local anesthesia is injected with a fine (30G) needle at the point of puncture. To enter the vein, 2 devices can be used: a 16G infusion catheter or a 5F Seldinger puncture set. The latter is more expensive, but for small veins the smaller caliber of the needle can make it easier to obtain access. And a non-reflux valve is provided, avoiding oozing of blood during the procedure.

Transversal or longitudinal imaging of the vein can be used while puncturing the skin, and it is often useful to go from one to the other during the procedure. If several unsuccessful attempts are made, it is best to try upward at another location.

Catheterization:

Before entering the catheter in the vein, we measure on the skin the distance from the junction and apply a sterile tape at the level where we might stop *(Figure 5)*. The catheter is pushed in the vein through the infusor or introducer. Upward progression should be easy and smooth, holding it between thumb and index without exerting any pressure. If resistance is encountered and progression stops, the duplex probe is used to image the tip without trying to go further by force and to check why it is blocked. It is usually at the level of a valve or of a localized dilatation. To get through, the catheter is withdrawn for 2/3 centimeters and pushed up while compressing the vein with the other hand or with the probe. Continued blockage is exceptional if the vein has not been previously sclerosed or thrombosed. If, nonetheless, there is still a blockage, 2 solutions can be applied: either re-enter just above the block, or if an F5

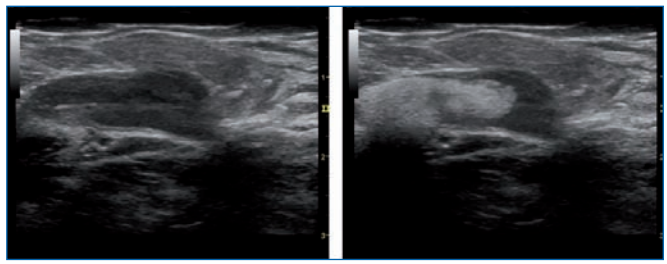

Figure 5. *Steam in a dilated junction*

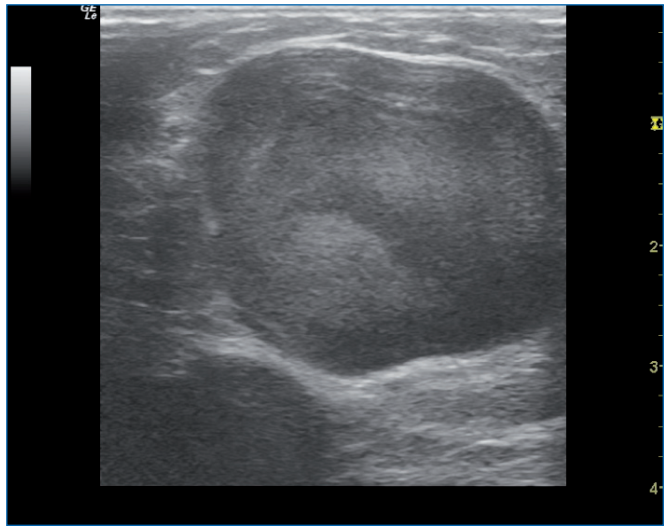

Figure 6. *Large trunk before treatment*

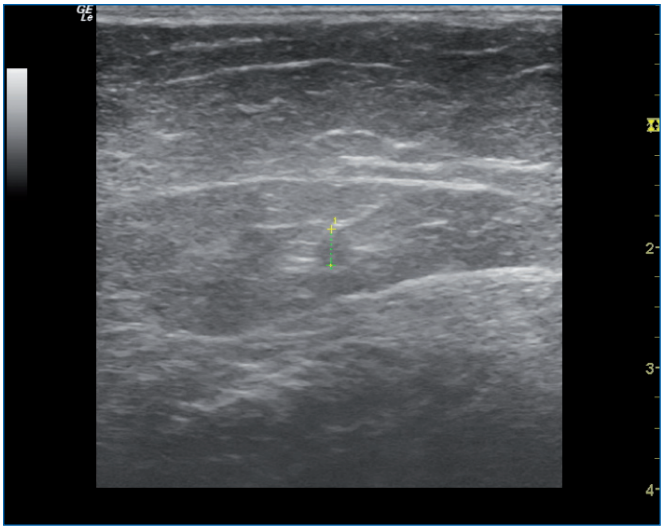

Figure 7. *Large trunk 1 year after treatment*

Seldinger introducer was used, try to go through with a guidewire, then slide in an F5 straight angiographic catheter and, after removing the guidewire, slide the steam catheter in it. Even though catheterization is easy, it is mandatory to use duplex ultrasound to check that the whole length of the catheter is in the vein lumen *(Figures 6, 7)*.

Checking the junction:

The safe distance to the junction **is 3 cm**. Longitudinal duplex scan is used to measure it. If there is an aneurysmal dilatation (anterior dilatation by jet effect) *(Figure 8)*, the tip can be drawn nearer, but when heating the junction must be compressed with the probe applied transversally to avoid heating in the femoral vein.

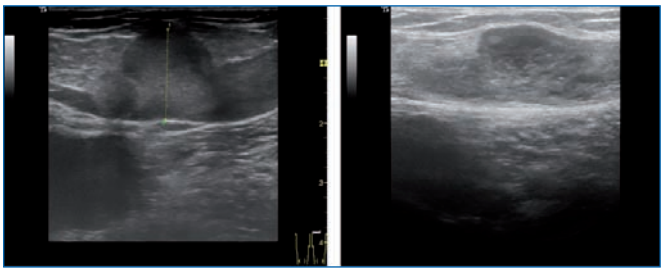

Figure 8. *Aneurysmal dilatation before and immediately after treatment*

Ultrasound-guided local anesthesia:

Compression of the vein is advisable. We use ultrasound-guided local anesthesia: injection of small quantities of anesthetic solution around the vein using ultrasound guidance. Volumes are smaller than tumescent anesthesia, in the order of 150/200 cc for a GSV. We use a 1.4% bicarbonate solution to which is added lidocaine. Our proportions are 8 cc of 1% lidocaine for 90 cc of bicarbonate. The solution is applied with a 21G, 50 mm needle. The standard Klein solution can also be used, but more time is needed for the anesthesia to take effect. A peristaltic pump is helpful as it saves time.

Heating of the vein:

The first two pulses are not pure steam because the catheter is cold, so the steam emitted by the hand piece condenses before reaching the catheter tip. So when beginning heating at the junction, 5 pulses are sent: 2 nonheating + 3 heating. *Then the catheter is withdrawn centimeter by centimeter. 2 pulses/cm for small veins: up to 7 mm (standing position), 3 pulses/cm in larger veins. If a localized dilatation has been mapped, or if the vein is more than 1.2 cm in diameter, >4 pulses are applied. As heat can accumulate inside the vein, it is best to stop heating for 5/10 seconds every 10 pulses*.

Care must be taken to avoid skin burning at the entry point when removing the catheter. A specific marking is provided in the last 10 cm: when it appears, the entry device is removed with the heating catheter. At the last 2 centimeters, heating is stopped, a 5-second cooling time is allowed, and the catheter is extracted. A particular case is lipodermatosclerosis: it can be difficult to inject local anesthetic. We have successfully used skin cooling with a pad of gel to obtain anesthesia during heating.

Peri-operative check:

A correctly treated vein exhibits a thickened wall and is retracted: its caliber is 40 to 60% that measured pre-operatively. Blood flow can sometimes still be observed in the lumen after distal compression in the first minutes after treatment, but will cease after 5/10 minutes when the thrombus is forming. If these modifications are not seen when *checking the vein before removing the catheter,* push it up again and repeat the procedure.

Post-operative care:

Compression stockings are recommended for 1 week, 2 weeks if the patient is standing at work. They are worn during the first day and first night, then only during the day. Pain is minimal or non-existent in most patients. If the patient complains of significant discomfort, we prescribe ibuprofen 400 mg: 1 tablet in the morning and

1 tablet in the evening for 5 days. Phlebectomy or foam sclerosis, if performed in the same session, is usually responsible for post-procedure pain.

Walking is resumed immediately. We advise the patient to wait until the next day before driving. As in other thermal techniques, prevention of deep vein thrombosis (DVT) and pulmonary embolism is advisable, using low-molecular-weight heparin for 8 days in all patients, and up to 15 days when there is a personal or family history of thrombosis.

Post-operative checks:

If possible, a duplex check the next day is useful in detecting any complications—extension of a thrombus in the femoral vein, phlebitis of a tributary, DVT—and in confirming that the treated vein is closed. A second check is usually programmed at 4 weeks, especially if tributaries have been left to be treated after closure of the trunk.

Small saphenous veins

The procedure is quite similar for small saphenous veins (SSVs). Vein entry is usually at the level of the mid-calf perforator. If this perforator is insufficient, entry should be proximal to it, so the obliteration of the saphenous trunk will suppress the reflux in the perforator in most patients *(Figure 9)*.

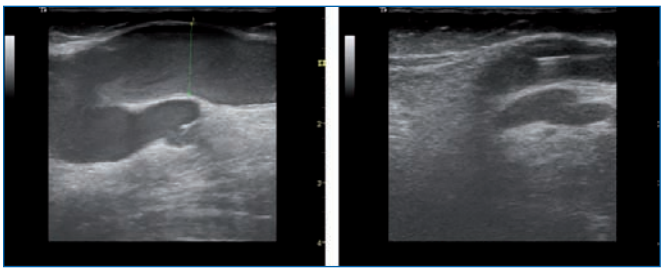

Figure 9. *Small saphenous vein before and after treatment*

If there is a bend of the vein toward the junction, the catheter can be advanced up to the bend without trying to go further down, as perforation of the vein wall could occur. If there is an insufficient axial posterior thigh vein or if the SSV has no junction at the popliteal level, the catheter can be pushed further with ultrasound guidance. Catheterization of a Giacomini communicating vein is usually achieved easily from below.

Heating parameters are similar to those used for a GSV: 2 pulses/cm for trunks under 7 mm and 3 pulses for larger trunks and localized dilatations. Local anesthesia is useful even if the patient is under general or spinal anesthesia because the nerve can be very close to the vein at the lower calf. If there is a common trunk with the gastrocnemius vein and this is to be spared, we advance the catheter up to 2 cm from the junction of both trunks and apply the probe transversally at the level of the junction to stop steam going further up.

PILOT CLINICAL STUDIES

First pilot study

We performed a first pilot clinical study on 10 limbs in 8 patients in 2007. All patients underwent duplex ultrasound 3 months, 1 year, and 2 years after treatment.

Material:

Female patients, aged between 36 and 65 years.
Veins to be heated: 9 GSVs and 1 SSV.

Results:

No general complication was observed, in particular no DVT. Post-operative pain was minimal, so that no drugs were needed post-operatively. Return to activity was fast: all patients left the hospital on the day of intervention. One peri-operative complication occurred: a leg skin burn due to insufficient heat insulation of the catheter which came into contact with unprotected skin.

At the 24-month duplex ultrasound check, 8 of 10 treated veins were obliterated. In the other 2 veins there was a short length where there was repermeation between two tributaries at the lower part of the thigh. There were no symptoms.

Dutch pilot study

Renate Van Den Bos and her co-workers from Professor Martino Neumann's team at the Erasmus Medical Center treated 20 limbs in 19 patients.[2] All were ambulatory and operated under tumescent local anesthesia. No complication was observed, incidents were limited to ecchymosis in 9 patients and one inflammatory reaction of the untreated vein under the point of puncture. Pain was minimal: 1 cm on a 10-cm visual analogue scale (VAS).

At the 6-month follow-up, venous scores had improved significantly as follows:

- Venous Clinical Severity Score (VCSS): from 5 to 2.5
- Aberdeen Varicose Vein Questionnaire (AVVQ): from 12.6 to 9.8

Thirteen limbs were totally occluded at 6 months, 5 had a partial reopening without reflux and less than 10 cm long, and 2 a partial reopening with reflux. But these last seven limbs had been treated with a lower energy per cm: one pulse/cm, 60 J versus two pulses/cm for the totally occluded cases.

Patient satisfaction score was 9.25 on a scale of 10.

French multicenter clinical trial

Eighty patients were treated in 4 centers: University Hospital of Besançon (Prof G. Camelot), private clinics in Lyon (Dr P. Nicolini), Montpellier (Dr R. Milleret) and Nancy (Dr D. Creton). Mean length treated was 42 cm for a mean diameter of 8 mm at mid-thigh. The only complication observed was a 1-cm extension of thrombus in the femoral vein in one of the first cases: it subsided without complications after low-molecular-weight heparin treatment.[3]

Pain was rated at 0.75 on 10 cm on the VAS at 8 days.

Vein resorption rate was better than 45% at 6 months:

	Before	6 months
Junction	9.84	5.65
Thigh	7.21	3.74

Partial results at 1 year show an absence of reflux in 98.5% of 75 patients.

The SF-12 quality of life score was improved in both physical and mental terms: 49.99 versus 51.27 and 46.01 versus 52.05 at 6 months.

Personal data

Saphenous trunks

We treated 164 saphenous trunks from 2007 to 2009 in our hospital: 117 GSVs and 47 SSVs. General anesthesia was used in 78 operations and local tumescent anesthesia in 76. No major complication was observed. One patient had calf vein DVT which healed after low-molecular-weight heparin treatment for 2 weeks. Three patients had minor skin burns at the entry point which healed in 4 to 6 weeks.

	1 year	2 years	3 years
N treated	164	95	22
N followed	129	77	16
Obliterated	120	71	15
Partial reop. Without reflux	6	4	0
Partial reop. With reflux	3	2	1

Follow-up results

Tributaries

We performed a comparative study of steam obliteration versus foam injection in large tributaries. The aim was to compare a chemical and a thermal technique in terms of efficiency, safety, cosmetic results, and patient satisfaction. Two groups of 20 patients were treated. Mapping was performed by the surgeon using ultrasound guidance. Foam was obtained using the Tessari method with 1% polidocanol for veins over 5 mm wide and 0.5% for smaller veins. No more than 10 cc was injected per session (Tegernsee Consensus).

Steam was applied using the generator and 18 g Venflon catheters for larger veins and 20G for smaller veins. Three to 6 pulses were applied at each entry point. Patients were followed up at 8/10 days, 1 month, and 6 months. A VAS was used to assess post-operative pain and overall satisfaction. Cosmetic results were classified from "very good" to "bad" in 4 steps.

Results:

All patients had a check-up at 8 days and 1 month. Three did not show at 6 months, 2 in the foam group and one in the steam group. No general complication was observed. One patient in the foam group had a transient visual disturbance. Inflammatory reactions were observed in 6 patients after foam injection and none after steam. Pain levels at 8 days were 2.4 after foam and 0.5 after steam.

At 1 month, blood extraction by a 16G needle under local anesthesia was performed in 12 patients of the

foam group and 6 after steam obliteration. Pigmentation was present at 1 month in all these 12 patients and in 4 out of 6 in the steam group. It was still visible at 6 months in 4 patients after foam and 2 after steam.

Cosmetic results were assessed by the patient at 6 months: they were good or very good for 10 out of 18 after foam and for 15 out of 19 after steam.

Our conclusion was that both techniques are safe. Steam leads to less pain and pigmentation due to the thickening of the vein wall, which implies a smaller lumen after treatment.

DISCUSSION:

Steam obliteration may have some advantages over current techniques. It is safe. The only by-product of this technique is water. As each pulse vaporizes only 0.08 cc of water, a GSV can be obliterated with 2 to 3 cc of water, a small quantity which will not induce hemolysis.

When treating saphenous trunks:

The mechanism of action is close to that of radiofrequency, with evenly distributed heat, as opposed to the more irregular pattern observed after endovenous laser with a bare fiber.[4] Thus the endoluminal clot is minimal, and inflammatory reactions are rarely observed even in large trunks. The absence of perforation and the fast heat exchange with the vein wall lowers the risk of injury to surrounding structures. External cooling may be used when the vein is close to the skin, and obviate the need for tumescence. Further studies of this question are planned.

The catheter is thin and its flexibility is close to that of a guidewire: vein entrance is easier and can be achieved in most patients without Seldinger catheterization. Tortuosities can be passed by gently moving the vein under the skin using ultrasound guidance. As with any endothermal method, sufficient heating per centimeter is essential to obtain long-term obliteration.

When treating tributaries and recurrences:

Compared with foam obliteration, water vapor has several advantages. No chemical is used other than water, so there is no risk of anaphylactic shock. There is a reduced risk of DVT. It is not contraindicated if a persistent foramen ovale has been diagnosed. And, as shown in our study, pain due to inflammation and pigmentation are minimal. Lastly, the procedure is faster than phlebectomy and requires no incisions (a comparative study is under way).

CONCLUSIONS

These results show that superheated steam is efficient in obliterating superficial veins, which remain occluded after 2/3 years. Duplex imaging and resorption rates are very similar to those observed after Closure Fast® RF obliteration. The reduction in diameter is in line with what we found in a study of 25 limbs treated with Closure Plus® catheters.[5] A randomized, multicenter study of water vapor versus endovenous laser is being performed at the Erasmus Medical Center (Rotterdam, Prof Martino Neumann) and 2 other Dutch centers to evaluate this new technique in a larger number of patients. The ability to obliterate tributaries with the same generator is promising as current heating techniques are mainly applied to saphenous trunks.

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Benefit of Daflon 500 mg in combination with sclerotherapy of telangiectasias of the lower limbs: results from the SYNERGY and SATISFY surveys

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INTRODUCTION

Telangiectasias are defined as a confluence of dilated intradermal venules less than 1 mm in caliber. Synonyms include spider veins, hyphen webs, and thread veins.[1] Telangiectasias are common in adult populations. In the Basle study,[2] telangiectasias were combined with varicose veins in 36% of men and 44% of women. In a study of 696 women working in a department store in Slovakia,[3] 46% of women were found to have telangiectasias. In Poland, Jawien found telangiectasias without varicose veins in 16.5% of consecutive patients seeking medical help at primary outpatient clinics,[4] while the prevalence rises to 59% in the adult general population of Bonn.[5]

PATHOPHYSIOLOGY OF TELANGIECTASIAS

One common area for the development of telangiectasias is the medial thigh. It was thought this would be a result of pressure exerted by crossing the legs, but no formal study has confirmed this hypothesis. Many causes are associated with telangiectasias, including genetic and congenital factors, acquired (disease of vascular collagen) or primary cutaneous disease (varicose veins) , hormonal factors (pregnancy and estrogen therapy), and physical factors trauma, infection, etc.).[6]

TREATMENT OF TELANGIECTASIAS

Sclerotherapy or microsclerosis is the first choice treatment of telangiectasias. Sclerotherapy is carried out from the lumen of the venule and results in its occlusion. Use is made of chemical sclerosing agents (liquid or foam) or thermal energy, such as laser energy.

Keywords:
telangiectasias, sclerotherapy, chronic venous disease

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The mechanism of action for sclerosing agents consists in generating endothelial damage (endosclerosis) which causes endofibrosis. The extent of damage to the blood vessel wall determines the effectiveness of the solution. Total endothelial destruction results in the exposure of subendothelial collagen fibers, causing platelet aggregation, adherence, and release of platelet-related factors. This series of events initiates the intrinsic pathway of blood coagulation by activating factor XII. Ideally, sclerosing agents should not trigger thromboplastic activity because this would initiate the extrinsic pathway of blood coagulation. Excessive thrombosis is detrimental to the production of endofibrosis because it may lead to recanalization of the vessel as well as excessive intravascular and perivascular inflammation.[7]

Laser treatment of telangiectasias uses thermal energy from a laser fiber and generator. Electromagnetic energy from the laser acts on the vessel wall, which shows loss of intima, thickening, and inflammatory changes. Usually, many fibroblasts and inflammatory cells are present, and collagen is the predominant histological finding.[8] There is a body of evidence that inflammation is involved whatever the process, chemical or thermal.

Some studies have compared sclerotherapy using sodium tetradecyl sulfate (STS) or polidocanol (Pol) with laser therapy. In a study of 20 patients with telangiectasias of 0.1 to 1.5 mm, 0.25% STS was more rapidly effective than Nd-YAG laser therapy.[9] Another study of 14 patients comparing 1) 0.5% Pol and then Nd-YAG laser therapy, 2) Nd-YAG laser therapy and then 0.5% Pol, 3) 0.5% Pol only, and 4) Nd-YAG laser therapy only, showed that 0.5% Pol as first choice was the most cost-effective.[10]

Side effects are more frequent with STS than with Pol or placebo,[11] the most important being pigmentation (92% with 0.25% STS) and ulceration (7% with 0.25% STS, and none with Pol).

The superiority of foam sclerotherapy over liquid sclerotherapy still remains controversial. Pigmentation, matting, and thrombi may be more frequent with foam than with liquid. The second Consensus Meeting on Foam Sclerotherapy, Tergersee, Germany, 2006, recommends the use of foam second line for the treatment of telangiectasias.[12]

RATIONALE FOR THE USE OF DAFLON 500 MG IN COMBINATION WITH SCLEROTHERAPY

Microsclerosis is based on the chemical destruction of the venule endothelium. This may cause post-intervention complications such as pain, induration of the treated venule, swelling, and pigmentation.

Two trials in patients with varicose veins who underwent phlebectomy have evaluated the benefits of the micronized purified flavonoid fraction (MPFF, Daflon 500 mg), which consists of 90% diosmin and 10% other flavonoids expressed as hesperidin, diosmetin, linarin, and isorhoifolin,[13] as part of the pharmacological post-operative recovery.[14-17] In both studies, Daflon 500 mg helped attenuate pain, decrease postoperative hematomas and accelerate their resorption, and increase exercise tolerance in the early post-operative period.

On the other hand, successful microsclerosis depends on elimination of sources of venous hypertension to prevent reflux before starting such treatment. Daflon 500 mg experimentally reduced reflux through pressurized veins in an animal model of acute venous hypertension.[18] Daflon 500 mg is the only available venoactive drug known to modify the chain of events leading to chronic venous hypertension. Therefore Daflon 500 mg currently possesses the most appropriate profile for use with microsclerosis to reinforce the latter's effect on telangiectasias, with beneficial effects on clinical severity, symptoms, and quality of life.[19]

OBJECTIVES

Primary objective

To assess the impact of microsclerosis plus Daflon 500 mg on telangiectasias:

- symptoms: pain, sensation of swelling and heaviness, by means of the visual analogue scale[20]
- change in the quality of life using the CIVIQ-14[21]

Secondary objectives

The secondary objectives will be to assess:

- Investigators' overall evaluation of the benefit of the combination
- Frequency of use of available microsclerosis techniques (foam, liquid, or laser)

- Breakdown of sclerotherapy indications
- Patients' global satisfaction by means of the visual analogue scale[20] and pictures (additional survey called "SATISFY" in 240 practitioners)

METHODS

Study design

Open trial of patients undergoing microsclerosis with foam, liquid sclerosing agents, or laser, combined with Daflon 500 mg, 2 tablets daily, from the first session to the last.

Patient pathway

The study did not alter the normal patient pathway in the management of chronic venous disease. More particularly, the reported data were those usually collected during examination of patients for chronic venous disease.

Inclusion criteria

- adult of any race
- aged between 30 and 60 years
- having given written informed consent
- with no known allergy to sclerosing agents
- having taken no phlebotropic during the 4 weeks before selection
- presenting with symptomatic telangiectasias, the diagnosis of venous disease according to the CEAP classification: C1s with or without complications (±C2, ±C3), the absence of deep venous reflux confirmed by duplex ultrasonography (measured in upright position at 3 cm below the saphenofemoral junction and after the Valsalva maneuver; the patient will stand on the contralateral limb)
- available for at least 2 of 3 sclerotherapy sessions at an interval of 3 weeks

Exclusion criteria

- phlebotropic treatment in the 4 weeks before selection
- history of alcohol or drug abuse, known history of allergy or intolerance to diosmin or any other phlebotropic agent and to sclerosing agents
- asymptomatic telangiectasias
- participation of the patient in another clinical trial during the previous 3 months

RESULTS

The SYNERGY survey was performed in several centers in France, between January and November 2009. A total of 392 phlebologists participated in the study and 3202 patients were included.

Investigator practice

- The mean number of sclerotherapy sessions performed per phlebologist and per week was **57.4 ± 32.9.** Extrapolating for the total number of phlebologists practicing in France, this means that there are more than 3 million sclerotherapy sessions every year in France.
- Liquid sclerotherapy remains the most often practiced in France: in 100 patients, **73 underwent liquid sclerotherapy,** 23 foam sclerotherapy, and 4 a combination of the two.
- Sclerotherapy is most often performed on varicose veins in France: **66% of patients underwent sclerotherapy for varicose veins,** 57% for telangiectasias, and 2% for other reasons (total might be >100%). In fact, at the inclusion visit, **84% of patients were already assigned C2s or C3s** of the CEAP classification, while 16% were C1s patients.

Patient profile

- 90% of patients seeking sclerotherapy were women. Sedentary patients requested treatment the most (28% were employees, 20% retired, 13% executives or white-collar workers, 8% blue-collar workers or farmers)
- Mean duration of chronic venous disease-related symptoms was 14.7 years ±11.6, and mean duration of edema was 9.7 years ±10.1 at the inclusion visit
- Prevalence of risk factors:
  - Family history of chronic venous disease, 82.4%
  - Number of pregnancies >1, 76.8%
  - Prolonged standing position, >6 hours per day, 42.2%
  - Sedentary lifestyle and prolonged standing position, >6 hours per day, 40% and 28%, respectively
  - BMI>30, 36%

- Most patients were already managed for chronic venous disease with:
  - Venoactive drugs, 73.2%
  - Sclerotherapy, 71.5%
  - Compression therapy, 58.7%

Patient expectations

Before sclerotherapy, patients were expecting treatment not only to improve the cosmetic appearance of their legs, but also to get rid of all symptoms related to chronic venous disease.

Leg pain and heaviness were the symptoms patients complained of most (*Figure 1*).

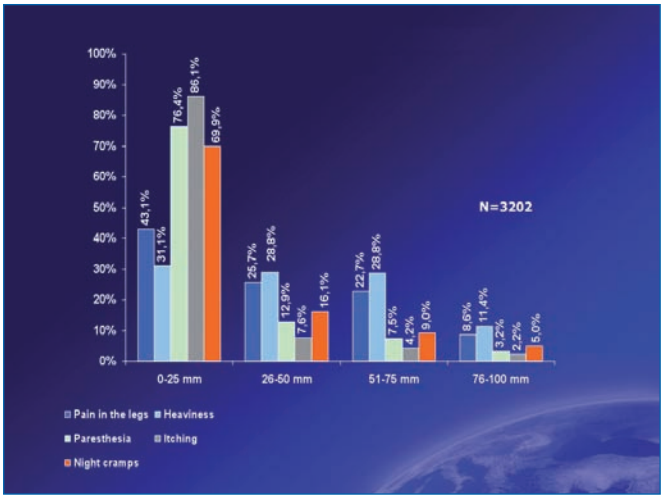

Figure 1. *Pre-treatment intensity and frequency of symptoms*
Treatment = combination of sclerotherapy + Daflon 500 mg

Patient satisfaction

After sclerotherapy in combination with Daflon 500 mg, side effects were present in 2.4% of cases only. These were essentially hematomas (0.4%), post-procedure pain (0.3%), and inflammation (0.3%).

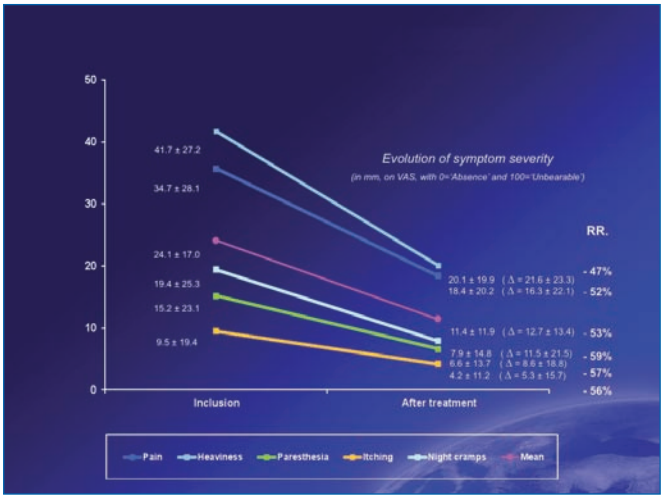

Figure 2. *Intensity of symptoms before and after treatment*
Treatment = combination of sclerotherapy + Daflon 500 mg

All symptoms associated with chronic venous disease were significantly decreased after treatment (*Figure 2*), and quality of life as assessed with the CIVIQ-14 was significantly improved (*Figure 3*).

Most patients (81%) were satisfied or very satisfied with the combination of sclerotherapy + Daflon 500 mg (*Figure 4*).

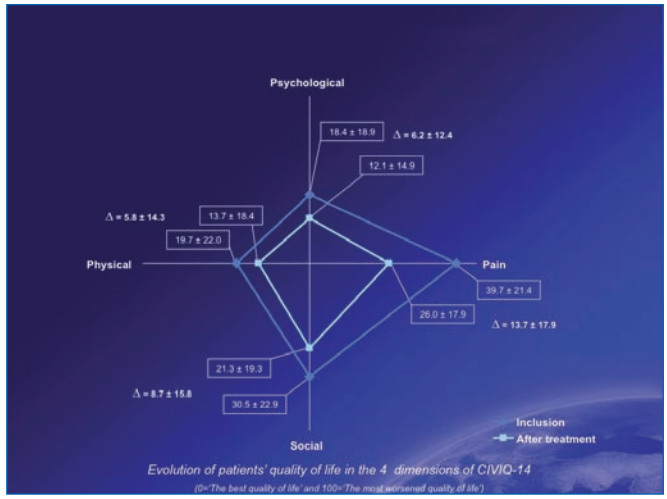

Figure 3. *Quality of life scores before and after treatment*
Treatment = combination of sclerotherapy + Daflon 500 mg

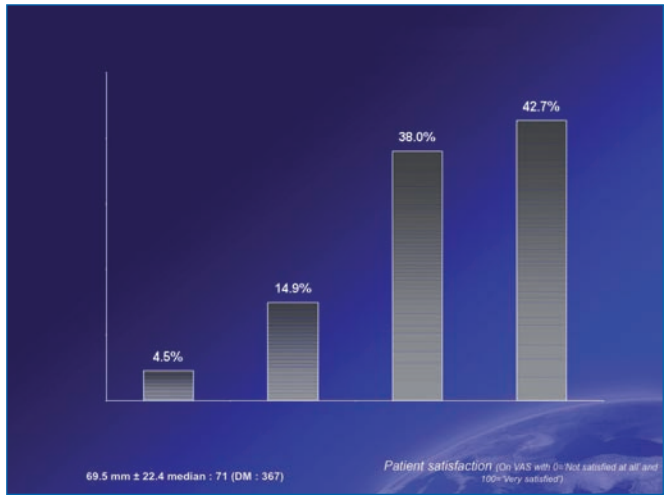

Figure 4. *Patient satisfaction after treatment*
Treatment = combination of sclerotherapy + Daflon 500 mg

DISCUSSION

In the present survey, most patients consulting for treatment presented with telangiectasias combined with varicose veins and edema. This is in line with former

epidemiological trials in which patients often showed a combination of telangiectasias and varicose veins.[2-4] Phlebologists therefore treated a higher proportion varicose veins than telangiectasias, mostly with liquid sclerosing agents rather than foam. Despite the good results obtained with foam sclerotherapy,[22] it is clear that at the time of the survey French phlebologists were not yet used to delivering such treatment, or laser therapy, which is not even mentioned.

Patients in European countries and the USA seek therapy mainly because of the unsightly appearance of telangiectasias and varicose veins. A survey in the USA has shown that American women are more concerned by telangiectasias of the lower limbs than by any other cosmetic problem.[23] It should be pointed out that patients in this survey were mainly sedentary and at high risk of venous disease (with family history of disease, obesity, or prolonged standing or sitting positions). In addition, and this is shown also in the present survey, many patients suffered from venous symptoms and expected treatment to get rid of them.[24]

Daflon 500 mg, 2 tablets daily for 2 months, combined with a microsclerosing treatment, significantly relieved patients' symptoms and improved their quality of life. In addition, the frequency of side effects due to the procedure was very low (2.4%). Further study including a control group with no addition of Daflon 500 mg is needed to confirm the results of the present survey, but there is evidence that Daflon 500 mg may help normalize the underlying pathologic physiology, which is the primary aim of any treatment.

Telangiectasias like varicose veins are believed to be the manifestations of higher than normal venous pressure. Venous hypertension, when chronic, causes a sequence of hemodynamic and clinical disturbances, including cutaneous manifestations like telangiectasias, leg ulcer, and edema. By reducing the likelihood of leukocyte adhesion to the venous wall, Daflon 500 mg presumably acts by hampering the cascade of events that leads to venous hypertension.

Addition of Daflon 500 mg may increase the success of sclerotherapy and greatly relieve patients' symptoms.

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Where do lymph and tissue fluid flow during intermittent pneumatic massage of lower limbs with obstructive lymphedema?

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SUMMARY

In obstructive lymphedema of the lower limbs, lymphatic collectors are obliterated and lymph and tissue fluid accumulate in the spontaneously formed tissue spaces. Thus, the transport of stagnant fluid should be supported by external mechanical forces. Sequential intermittent pneumatic massage serves this purpose. The effectiveness of pneumatic massage is assessed by change in limb volume. The open questions remain where does the fluid flow to, where does it accumulate, and can it pass to the non-swollen tissues of hypogastrium and gluteal regions?

We investigated during pneumatic massage of the limb the pathways of lymph and mobile tissue fluid flow: a) from the calf and thigh across the inguinal and gluteal regions to the healthy non-swollen tissues of hypogastrium, and b) in the hypogastrium to the lateral and upper abdominal quadrants, with use of lymphoscintigraphy. To prove that there was effective fluid flow during pneumatic massage, plethysmographic flow measurements were carried out. We showed that: (i) pneumatic compression propelled isotope in lymph in the remaining patent lymphatics and tissue fluid in the interstitial space toward the inguinal region and femoral channel, (ii) no isotope crossing the inguinal crease or running to the gluteal area could be detected, (iii) no isotope flow to the hypogastrium was observed in the lymphatics or in tissue fluid, and (iv) isotope injected intradermally in the hypogastrium did not spread during massage to the upper and contralateral abdominal quadrants.

In conclusion, intermittent pneumatic compression is effective in propelling mobile tissue fluid and translocating large fluid volumes toward the groin. However, there remains the question of how to facilitate further flow toward the non-swollen tissues and local absorption of fluid.

INTRODUCTION

In obstructive lymphedema of the lower limbs, most or all lymphatic collectors leading to the superficial and deep inguinal lymph nodes are obstructed following infections, trauma, surgery, or irradiation.[1] The limited hydraulic function of the damaged collecting lymphatics results in accumulation in the interstitial space of capillary filtrate containing plasma humoral and cellular components, as well as parenchymal cell products. Impairment of flow away of plasma-filtered macromolecules and protein-bound ions generates high osmotic pressure. This attracts water from the vascular compartment and further increases the stagnant tissue fluid volume. Furthermore, the accumulating fluid deforms the soft tissue structure and spontaneously creates fluid conducting channels in the subcutaneous tissue.[2]

This natural hydraulic process still remains insufficient in transporting fluid away from swollen regions and should be supported by external mechanical forces. Such forces can be applied to the swollen limb by massage to squeeze the mobile edema fluid toward the root of the extremity.

In the calf and thigh the spontaneous fluid channels form along large blood vessels, as the saphenous, popliteal, and femoral veins, and also around small unnamed vessels, leading to the groin region. There they end up at the inguinal crease where skin is connected with the inguinal ligament and external oblique muscle by natural elastic fibers.[3]

The question arises whether the accumulated tissue fluid can form spontaneous subcutaneous channels across the inguinal crease to the hypogastrium. This would facilitate absorption of fluid in normal hypogastrium tissues, presumably forming connections with normal lymphatics. Such newly formed flow pathways would justify the common practice of treating the core (truncal) lymphatics as a major therapy component before limb massage.[4,5] The essence of this concept is that treatment must first be directed at lymphatic territories, such as the hypogastrium and trunk, so that they are adequately prepared to receive lymph (tissue fluid) from swollen regions.

In this study we investigated with use of lymphoscintigraphy the pathways of lymph and mobile tissue fluid flow: a) across the inguinal and gluteal regions to the healthy non-swollen tissues of hypogastrium, and b) in the hypogastrium to the lateral and upper abdominal quadrants, during pneumatic massage of the limb. To prove that there was effective fluid flow during pneumatic massage, plethysmographic flow measurements were carried out.

MATERIAL AND METHODS

Patients

The study was carried out in 15 patients, aged 28-56 years, mean weight 65 kg (58-72), mean height 168 cm (161-178), with a diagnosis of lymphedema of one lower limb, stage II to IV, duration of 2 to 15 years (*Table 1*). Eleven patients reported small foot skin abrasions or light trauma of foot in the past followed by development of foot and calf transient edema. More severe edema developed months to years later and in 50% of cases was complicated by 1 to 3 attacks of dermatolymphangioadenitis. In 4 patients edema developed for no detectable reason. Patients with acute inflammation, chronic venous insufficiency, and systemic etiology of edema were excluded from the study. Five patients without lymphedema with suspected enlarged abdominal lymph nodes served as controls. Lymphoscintigraphy and tissue fluid flow measurements are, in our hospital, the mandatory diagnostic procedures in all cases of lymphedema.

The consent of patients was obtained and the study was approved by the Warsaw Medical University Ethics Committee.

Clinical staging

Staging was based on clinical evaluation: level of edema embracing limb from foot to groin and degree of skin keratosis and fibrosis. Briefly, in stage II pitting edema affected the foot and the lower half of the calf, in stage III the foot and calf were involved, with hard foot and ankle area skin, in stage IV the whole limb was edematous with foot and calf skin hyperkeratosis and papillomatosis of the toes.[1]

Lymphoscintigraphic staging

Lymphatic pathways were evaluated on lymphoscintigraphic images (*Table 1*), which revealed in stage II spread of tracer in the foot and lower calf, and an interrupted outline of a single lymphatic and a few small

M/F	Age	Group/stage	Level of edema	Skin changes	Lymphoscintigraphy
2M,3F	28-45	II	mid-calf	none	foot & lower calf spread, few collectors and inguinal nodes
3M, 2F	25-52	III	knee	foot keratosis	foot & calf spread, single collector, inguinal node remnants
3M,2F	26-48	IV	whole limb	foot, calf keratosis	foot & calf spread, no lymphatics and inguinal nodes
2M,3F	28-52		no lymphedema, controls		limb lymphatics normal

inguinal nodes with irregular outline. In stage III no draining lymphatics were seen, with some inguinal nodes of irregular outline appearing 2 hours after isotope injection. Stage IV was characterized by spread of tracer in the foot and the entire calf without visualization of collecting lymphatics and nodes.

Lymphoscintigraphy technique

Lower limb lymphoscintigraphy was carried out in each patient in two sessions, the first without pneumatic massage and the second days later following a 45-minute limb pneumatic massage. An intradermal injection of ^{99m}Tc-Nanocoll (3 mCi) (Amersham, Switzerland) was given between the first, second, and third toes (to visualize the superficial lymphatic system) and in the subcutis of the mid-portion of the sole (to visualize the deep system). Imaging was performed using a gamma camera (Orbiter ZLC 750, Siemens, Germany) immediately after isotope injection and after 45 minutes of pneumatic massage. The images were classified according to the stage of lymphedema. In 5 of these patients (3 stage II, and 2 stage IV), lymphoscintigraphy of the skin and subcutis of hypogastrium was additionally performed by intradermal injection of 1/10th of the Nanocoll dose used for limb scintigraphy. The spread of isotope in the limb and its movement toward the groin were observed simultaneously with spread of isotope injected into the hypogastrium.

For semiquantitative evaluation of scintigrams, the images of the lower leg and thigh lymphatics and lymph nodes were evaluated quantitatively. Lymphoscintigrams were scanned and analyzed using specialized PC software (Olympus Micro Image™ ver. 3.0.0., Olympus Optical Co., Hamburg, Germany). The surface area of the lymphatics (Lv) and inguinal lymph nodes (LN) of both extremities was evaluated in the inguinal area, thigh, and calf. Data were expressed as indices obtained from the equations $I_{Lv\ or\ LN}=S_{L\ LV\ or\ LN}/S_{CLv\ or\ LN}$, where $S_{Lv\ or\ LN}$ was the surface area of lymph vessels or lymph nodes measured for the lymphedema (L) and contralateral normal (C) extremity.

Pneumatic compression appliance

We used a device produced for us by Biocompression (Moonachie, NJ) (*Figure 1*). The sleeve was composed of 8 segments each 9 cm long and was sequentially inflated at inflation pressures from 50 to 125 mm Hg. Gradient pressures were decreased proximally by 20%, inflation time of each chamber was 50s, total inflation time equaled 400s, there was no deflation of distal chambers, deflation time of all chambers was 50s at the end of each cycle. The sleeve embraced the whole limb to the inguinal crease.

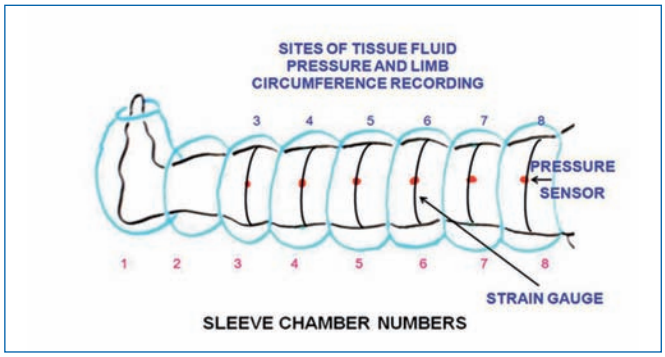

Figure 1. *Schematic presentation of lower limb in a pneumatic sleeve with 8 chambers each 9 cm wide. Tissue fluid pressure was measured at 6 points indicated by large dots. The lowest point in the calf was at chamber 3 level, then at levels 4 and 5. In the thigh, pressures were measured at chamber levels 6, 7, and 8. The lines encircling calf and thigh show the site of strain gauge placement for continuous measurement of circumference changes during compression.*

	Lymphoscintigraphy		Calculated flow (mL/cycle) Total volume reaching groin
	Before massage	After massage	During massage
Stage II	tracer spread in foot and calf, single vessel, few small inguinal nodes, no iliac lymphatics	tracer spread in foot and calf, lymphatics up to the groin, inguinal nodes, iliac lymphatics	20-30
Stage III	tracer spread in foot and calf, fragments of vessels, sporadically small inguinal node no iliac lymphatics	tracer spread in lower thigh, lymphatics and fragments of nodes visible, no iliac lymphatics	40-60
Stage IV	tracer spread in foot and calf, no vessels and nodes visible	tracer spread in foot, calf and thigh up the inguinal crease, no lymphatics and nodes visible, tracer in femoral canal	60-120

Table 2. *Comparison of lymphoscintigraphic images and lymph and tissue fluid flow after intermittent pneumatic massage.*

	Limb area (incl. lymphatics and tissue spread of tracer)		Inguinal lymph nodes
	Calf	Thigh	
Before	2.4±4.5	1.2±2.5	0.3±0.4
After	2.8±5.0	2.5±3.0*	0.6±1.0*

*after vs before treatment $P<0.05$

Table 3. *Semiquantitative densitometric evaluation of lymphoscintigrams before and after intermittent compression (edematous/normal limb ratio)*

Manual massage of hypogastrium

Manual massage for hypogastrium fluid clearance was done for 10 minutes at the site of isotope injection in the upper and lateral direction.

Measuring tissue fluid flow volume

Strain gauge plethysmography was used to measure sequential changes of circumference in the calf and thigh during massage (*Figure 1*). The data obtained were used to calculate volume changes of the massaged limb segments. A plethysmograph (Hokanson, Bellevue, WA, type EC6) in a recording vein mode was applied. Six mercury strain gauges of a length of 22 cm to 53 cm were put around limb at chamber levels 3 to 8 (*Figure 1*). Increase in circumference caused elongation of the gauge which was read off on the recorder graph scale in mm. The numerical data obtained were used to calculate volume by multiplying the cross area of limb segments by 90 mm (length of the compressing chamber). Subtracting the volume before compression from that during compression provided data on the proximally transferred volume.

Statistical evaluation.

For comparison of numerical data on lymphoscintigram densitometry, Student's t-test was applied with significance at $P<0.05$.

RESULTS

Lymphoscintigraphic evaluation of lymph and tissue fluid flow in the massaged limb

Lymphoscintigraphic and volumetric evaluation of lymph and tissue fluid flow is presented in *Tables 2* and *3*.

The pathways of lymph and tissue fluid flow during pneumatic massage are shown in *Figures 2-7* and the evaluation is presented in *Table 2*. After massage in stage II (*Figure 2*) and some cases in stage III (*Figures 3, 4*), the tracer filled the upper parts of the thigh tissues. It flowed along the lymphatics to the femoral canal and retroperitoneal space. In stage IV, it reached the inguinal crease and accumulated in the upper thigh (*Figures 5, 6, 7*). No pictures of isotope flow from the thigh across the inguinal crease to the lower abdominal quadrant were observed. In normal limbs, isotope flowed along the superficial and deep lymphatic system to the inguinal nodes and through the femoral canal to iliac lymph nodes.

Semiquantitative evaluation of lymphoscintigrams before and after intermittent compression.

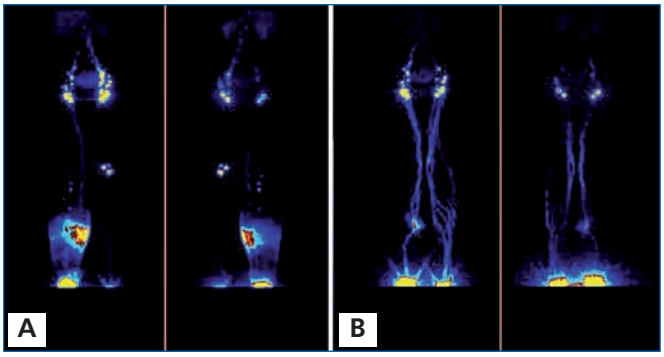

Figure 2. Lymphoscintigrams in postinflammatory lymphedema of the right lower limb, stage II. A. Before massage. Accumulation of isotope in the swollen calf. Weak outline of the superficial lymphatics. Inguinal and iliac lymph nodes visualized. B. After 1 hour of pneumatic massage most isotope was moved along normal thigh lymphatics to the groin and iliac vessels. This proved the efficacy of the pneumatic massage.

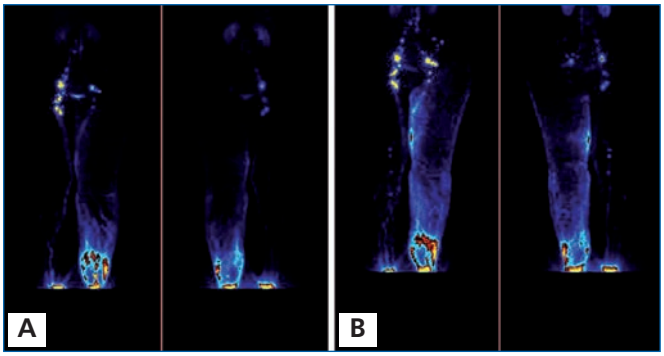

Figure 3. Lymphoscintigrams in postinflammatory lymphedema of the left lower limb, stage III. A. Before massage. Isotope accumulated in the subcutaneous space of the swollen calf. No superficial and deep lymphatics are seen. Some subepidermal flow in the thigh and a small inguinal lymph node. No iliac nodes. B. After 1 hour of pneumatic massage most isotope was moved along the subcutaneous space to the groin to visualize single small inguinal nodes. Further isotope flowed through the femoral canal along large iliac blood vessels visualizing single iliac nodes. It did not flow to the hypogastrium or gluteal region.

In the whole group of patients there was an increase in the spread of tracer to the thigh and inguinal region including the inguinal lymph nodes (*Table 3*). There were wide individual variations.

Lymphoscintigraphic evaluation of lymph flow from the hypogastrium during limb massage

There was minimal radial spread of the isotope from the site of injection with no signs of its movement toward the upper or contralateral quadrants (*Figure 7*). In two patients flow was directed toward the inguinal nodes.

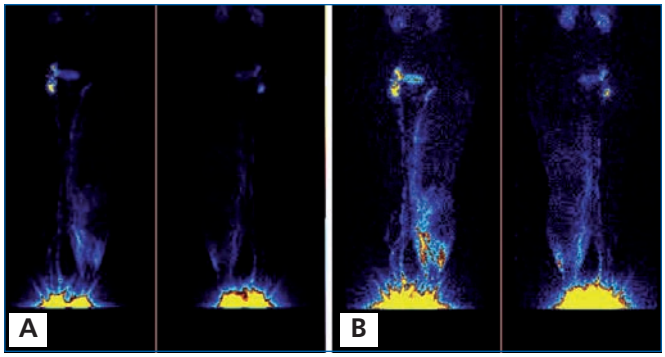

Figure 4. Lymphoscintigrams in posttraumatic lymphedema of the left lower limb, stage IV. A. Before massage. Isotope accumulates in the internal aspects of the calf with a faint outline in the thigh. No lymphatics are seen. B. After 1 hour of pneumatic massage only some isotope moved along the internal aspect of the thigh to the groin level but did not visualize inguinal nodes. This was caused by obliteration of lymphatics and fibrosis of inguinal nodes proved by biopsy. There was no flow to the hypogastrium or gluteal region.

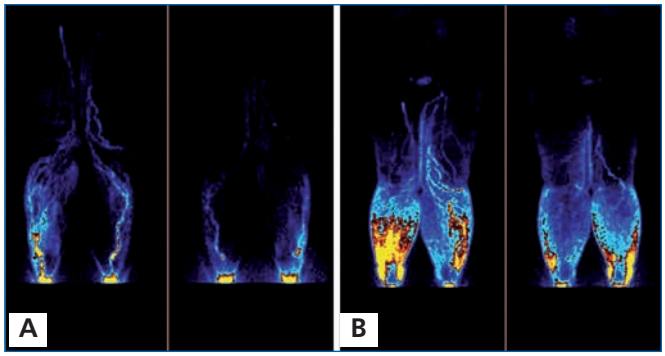

Figure 5. Lymphoscintigrams in postinflammatory lymphedema of both lower limbs, stage IV. A. Before massage. Isotope in dilated calf lymphatics and tissue subcutaneous spaces reaching mid-thigh level. B. After 1 hour of pneumatic massage most isotope was moved to the thigh but did not reach the groin. This was presumably due to the resistance to flow in the fibrotic inguinal lymph nodes. There was no flow to the hypogastrium or gluteal region.

Tissue fluid volume transfer during pneumatic massage

Continuous recording of circumference changes during sequential compression gave indirect insight into the volumes of fluid translocated from the compressed segments to the proximal ones. The increase in circumference at each level was recalculated as increase in volume. Summarized data of 15 patients are presented in *Figure 8*. The tissue fluid flow ranged from 20-30 mL/cycle in the calf to 60-105 mL/cycle in the thigh.

Relationship between the isotope spread and tissue fluid flow

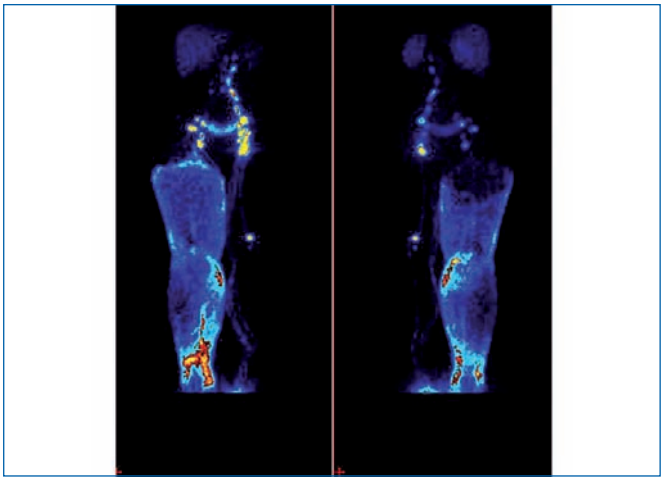

Figure 6. Lymphoscintigrams in postinflammatory lymphedema of the right lower limb, stage IV after one hour of pneumatic massage. The isotope visualized dilated subcutaneous spaces up to the inguinal level but not lymphatics. Note a sharp border for isotope flow at the inguinal ligament level. Further, isotope moved along the femoral canal to the iliac region and visualized two small lymph nodes. There was no flow to the hypogastrium or gluteal region.

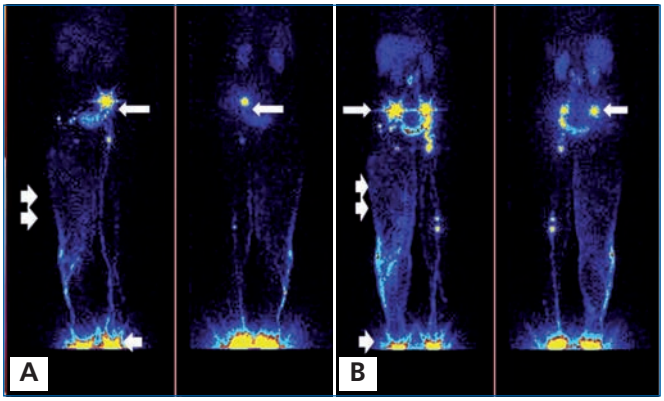

Figure 7. Lymphoscintigrams in postinflammatory lymphedema of the right lower limb, stage III.
A. Before massage. Left normal side. 99Tc Nanocoll was injected into the toe web of the foot (arrow) and it visualized the superficial and deep lymphatics. To visualize lymph drainage from the hypogastrium, another dose of Nanocoll was injected intradermally in the left lower abdominal quadrant (arrow). Right lymphedema side. Nanocoll injected into right foot (with lymphedema) showed few calf lymphatics (two arrows).
B. After 1 hour of pneumatic sequential massage of the lymphedematous right limb, isotope spread in the subcutaneous tissue of the calf and part of the thigh, but did not cross the groin level despite high pressure sequential compression. Isotope did not move to the abdominal area. Moreover, isotope injected bilaterally into the hypogastrium spread slightly radially, but did not flow to the upper or lateral quadrant.

Pneumatic compression caused flow of tracer toward the groin in both the lymphatics and interstitial space (stages II and III). In stage IV, tracer spread in the interstitial space of the entire limb with a sharp border at the inguinal crease, not entering the femoral channel. The proximal flow of tracer was accompanied by tissue fluid flow (*Table 2, Figure 8*). Most tracer and massaged fluid accumulated in the thigh.

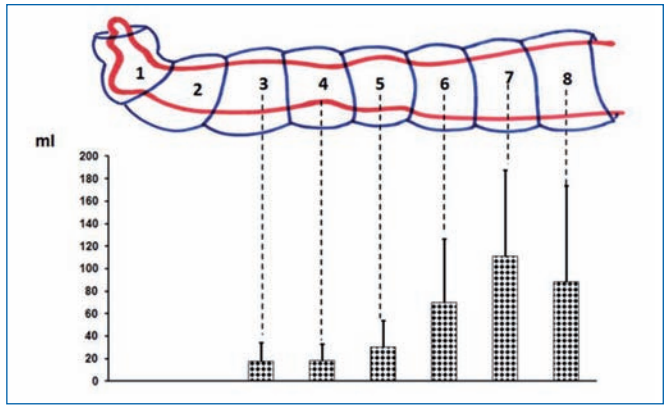

Figure 8. The calculated tissue fluid flow during intermittent pneumatic compression from the calf to the groin (mL/cycle, mean+- SD of 15 patients stage II-IV). The sleeve chambers are numbered. Inflation from 1 to 8 at 120 mm Hg, each chamber 55s, no distal deflation.

DISCUSSION

This study provided the following information: (i) pneumatic compression of the lower limb propelled isotope in lymph in the remnant lymphatics and tissue fluid in the interstitial space toward the inguinal region and femoral canal, (ii) no isotope filling fluid channels crossing the inguinal crease or running to the gluteal area was visualized, (iii) there was no isotope flow to the hypogastrium in either lymphatics or tissue fluid, and (iv) the isotope injected intradermally in the hypogastrium did not spread during massage to the upper and contralateral abdominal quadrants.

Our study showed that sequential pneumatic compression with high inflation pressure is very effective in propelling stagnant lymph and tissue fluid in cases of obstructive lymphedema. The lymphoscintigrams showed that tissue fluid finds its way toward the root of the extremity along the natural pathways with least hydraulic resistance. These are the perivascular spaces and are spontaneously formed by tissue deformation subcutaneous channels.[2] Isotope accumulated along the great saphenous vein and internal aspect of the thigh. Even if there was some flow along femoral and iliac lymphatics, tissue fluid reaching the inguinal crease did not pass it. In advanced stage IV, tissue fluid moved to the knee or lower thigh level only.

During pneumatic compression the flow of tracer followed the tissue fluid flow. Large volumes of proximally moved fluid indicated that it was not only lymph in the subepidermal plexus and the remaining patent lymphatics, but also tissue fluid accumulating in the spontaneously formed tissue spaces, where the bulk of edema fluid is usually found.[2] The qualitative comparison of lymphoscintigraphic pictures and flow data clearly showed that sequential compression propelled lymph and stagnant tissue fluid toward the groin. Most of the fluid accumulated in the groin, which was expected. However, in contrast to the general view, it did not move toward the hypogastrium, but rather to the femoral channel.

Our results again raise the question: What is the fate of fluid accumulating in the groin? Does it find its way to the pelvis through the femoral and obturator channels? How large a portion of fluid is absorbed in the upper thigh and genitals? It cannot be water only as tissue fluid protein concentration remains at a low level and at the same concentration as in the calf fluid (personal observations)

There are few publications on lymph and tissue fluid flow during pneumatic compression of swollen limbs.[6,7] Based on the results of lymphatic vascular factorial analysis, a beneficial effect of intermittent pneumatic compression was detected in 18 of 22 limbs examined. It facilitated radiocolloid transport in the proximal portion of the limb and also propelled tracer from the injection site toward the lymphatics. The effect was evident as soon as external compression therapy began.[6] In another study, pneumatic compression brought about decrease in the volume of the massaged limb, although no flow of tracer toward the groin was observed.[7] The authors concluded that water was absorbed but that fluid proteins remained in the massaged regions. No data on applied pressure and inflation timing were presented that would allow analysis of tissue fluid flow. None of these papers addressed the problem of massaged fluid flow through the groin to the hypogastrium or pelvis through the femoral channel.

There is a widely accepted notion that emptying of the hypogastrium by manual or pneumatic massage prior to limb massage creates space for lymph and tissue fluid from the massaged tissues. The essence of this concept is that treatment must first be directed at lymphatic territories, such as the trunk, so that they are adequately prepared to receive lymph from subsequently treated lymphedematous regions such as the arm or leg. This truncal clearance or decongestion approach makes intuitive sense to most intensively trained practitioners.

According to Földi,[4] lymphatic tributary regions or territories are separated by lymphatic watersheds. The term *watershed* is borrowed from hydrology, where it can be thought of as a drainage basin usually bounded by ridges of higher ground. Although lymphatic watersheds are not true anatomical structures, their dividing lines delineate the direction of lymph flow.[5] Although treatment of the trunk has long been a standard manual lymph drainage process, there have been no anatomical studies confirming the presence of watersheds or randomized clinical trials comparing manual lymphatic drainage with and without truncal decongestion.

In our study we were not able to confirm lymph and tissue fluid flow to the hypogastrium and from there to the neighboring quadrants. The isotope-containing lymph and tissue fluid were stopped at the inguinal crease and flow was directed toward the femoral channel. Also isotope flow away from the hypogastric subcutaneous tissue was not observed. Manual massage of this region revealed radial spread of isotope, but not flow to the upper or lateral quadrant. We think the concept of hypogastrium clearance should be reevaluated based on objective physiological studies of tissue fluid hydraulics.

Taken together, sequential intermittent compression of lymphedematous lower limbs is effective in propelling lymph and tissue fluid toward the groin. It is directed toward the femoral canal, but not to the hypogastrium. These findings point to the need to apply high compression pressures at the groin region and also to search for pharmacological and surgical methods to facilitate fluid flow across the inguinal crease.

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Randomized controlled trials in the treatments of varicose veins

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PART 1

This is the first part of the 2 chapters about randomized controlled trials of treatments of varicose veins, either by open surgery or endovascular ablation. Although the American College of Chest Physicians Task Force took into account observational studies to establish the strength of recommendations according to the quality of the evidence,[1] randomized controlled trials (RCTs) remain the most reliable source of evidence *(Table I)*.[1-6]

Grade of Recommendation/ Description	Benefit vs Risk and Burdens	Methodological Quality of Supporting Evidence	Implications
1A/strong recommendation, high-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	RCTs without important limitations or overwhelming evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1B/strong recommendation, moderate quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	RCTs with important limitations (inconsistent results, methodological flaws, indirect, or imprecise) or exceptionally strong evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1C/strong recommendation, low-quality or very lowquality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Observational studies or case series	Strong recommendation but may change when higher quality evidence becomes available
2A/weak recommendation, highquality evidence	Benefits closely balanced with risks and burden	RCTs without important limitations or overwhelming evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2B/weak recommendation, moderate-quality evidence	Benefits closely balanced with risks and burden	RCTs with important limitations (inconsistent results, methodological flaws, indirect, or imprecise) or exceptionally strong evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2C/weak recommendation, lowquality or very low-quality evidence	Uncertainty in the estimates of benefits, risks, and burden; benefits, risk, and burden may be closely balanced	Observational studies or case series	Very weak recommendations; other alternatives may be equally reasonable

Table 1. *Grading Recommendations*

Keywords:
varicose veins, randomized controlled trials, thermal ablation, chemical ablation, surgery

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We have therefore analyzed RCTs on treatment of varicose veins published since 1990 and have classified them by topic and added a brief comment. Nevertheless, as valuable as RCTs are, some have important limitations that are not always easy to identify[7-10] and we may therefore have missed some of these in our comments. We successively consider and comment upon:

Treatment	Article	Conclusions
Open surgery versus conservative treatment	Michaels JA Brazier JE, Campbell WB, Palfreyman S, Macintyre JB, Ratcliffe J. Randomized clinical trial comparing surgery with conservative treatment for uncomplicated varicose veins. *Br J Surg.* 2006;93:175-181.	246 patients Uncomplicated varicose veins (C_{2s}) with saphenofemoral and/or saphenopopliteal junction reflux Conservative treatment (lifestyle advice) versus open surgery **Follow-up 2 years** *After surgery* Quality of life improvement Symptom relief (pain and edema) Cosmetic benefit
	Ratcliffe J, Brazier JE, Campbell WB, Palfreyman S, Macintyre JB, Michaels JA Cost effectiveness analysis of surgery, versus conservative treatment for uncomplicated varicose veins in a randomized control trial. *Br J Surg*. 2006;93:182-186.	246 patients Uncomplicated varicose veins (C_{2s}) with saphenofemoral and/or saphenopopliteal junction reflux Conservative treatment (lifestyle advice) versus open surgery **Follow-up 2 years** *Surgery* offers a modest health benefit for relatively little healthcare cost compared with conservative treatment

Table II. Open surgery versus non operative treatment

NB. Open surgery: saphenofemoral and/or saphenopopliteal junction ligation + stripping +/- perforator ligation+/- tributary phlebectomy

Table II comment

These two RCTs are the only ones comparing outcome at 2 years in C2s patients treated by classic surgery versus conservative treatment. Surgical patients reported better quality of life and significant benefits in symptomatic and anatomical measures, with modest reductions in healthcare costs. One may be surprised by paucity of RCTs on C2s patients, who represent the most important group in epidemiologic studies on varicose veins.

The conclusions are interesting, but it should be noted that conservative treatment consisted only of lifestyle advice, without prescription of compression and/or venoactive drugs. This is surprising as we know that, at least in continental western Europe, many observational studies have demonstrated their effectiveness in C2s patients.

Operative procedure	Reference	Conclusions
Open surgery + compression vs isolated compression in C5-C6 or C6 patients	Guest M, Smith JJ, Tripuraneni G, et al. Randomized clinical trial of varicose vein surgery with compression versus compression alone for the treatment of venous ulceration. *Phlebology*. 2003;18:130-136.	76 patients C6 **Follow-up 24 weeks** Venous ulcer healing Four-layer bandaging. Group 1 (n=39) versus Open surgery + four-layer bandaging. Group 2 (n=37) No difference between *the two* groups in terms of - healing rate (adjusted hazard ratio-0.69, *P*=0.41) - health-related quality of life (adjusted hazard ratio-0.79, 95% CI 0.45-1.39 generic (SFR 36) and specific (CXVUQ)
	Barwell JR, Davies CE, Deacon J, et al. Comparison of surgery and compression with compression alone in chronic venous ulceration (ESCHAR study): randomized control trial *Lancet*. 2004;363:1854-1859.	500 lower limbs C6 Open surgery + compression versus Isolated compression Venous ulcer healing **Follow-up 24 weeks** 40 patients lost to follow-up Venous ulcer healing Overall healing rates similar Venous ulcer recurrence **Follow-up 1 year** Recurrence rate reduced in open surgery + compression group 12% vs 28%, hazard -2.7 65% CI-1.78 to 4.27, *P*<0.0001
	Gohel MS , Barwell JR, Earnshaw JJ, et al. Randomized clinical trial of compression + surgery versus compression alone in chronic venous ulceration.(ESCHAR study)-haemodynamic and anatomic changes. *BJS*. 2005;92:291-297.	214 lower legs (saphenous reflux+/- deep vein reflux Compression (n=112) versus open surgery + compression (n=102) **Follow-up 1 year** *Open surgery+ compression* Venous refill time improved P<0.001 Deep venous reflux abolition 10/22 when segmental 3/17 when axial
	Gohel MS, Barwell JR, Taylor M, et al. Long term results of compression therapy alone versus compression plus surgery in chronic venous ulceration (ESCHAR): randomized controlled trial. *BMJ*. 2007;335:83-89.	500 lower legs C5-C6 Open surgery + compression versus compression. **Follow-up 3 years** Venous ulcer healing rates (C6) Nonsignificant difference P=0.73 **Follow-up 4 years** Venous ulcer recurrence rates *Open surgery + compression* Ulcer-free time longer. P=0.007 *In patients with isolated superficial reflux* Recurrence rates lower. P<0.01 *In patients with combined deep segmental reflux.* Recurrence rates lower. P=0.04 *In patients with combined deep axial reflux* Recurrent rates nonsignificant P=0.33

Table III. Open surgery + compression versus compression in C6 patients

NB. Open surgery: high ligation + saphenous stripping +/- perforator ligation +/- tributary phlebectomy

Table III comment

In Guest's study as well as the ESCHAR study, operative treatment did not improve healing rate in C6 patients.

Concerning venous ulcer recurrence in the primary etiology, classic surgery plus compression gave better results than compression alone in patients without associated deep axial reflux. This does not mean that endovenous treatment, ie, chemical or thermal ablation, is less effective, but randomized, controlled trials are not yet available.

Operative procedure	Article	Conclusions
Open surgery versus cryostripping	Menyhei G, Gyevnár Z, Arató E, Kellemen O, Kollár L. Conventional stripping versus cryostripping : a prospective randomised trial to compare improvement in quality of life and complications. *Eur J Vasc Endovasc Surg*. 2008;35:218-223.	Open surgery (n=86) versus high ligation + cryostripping (n=79) **Follow-up 6 months** No difference in terms of - Postoperative pain - Clinical results. Less hematoma with cryostripping *P*=0.01
	Klem TMAL, Schnater JM, Schütte PR, Hop W, van der Ham AC, Wittens CH. A randomized trial of cryostripping versus conventional stripping of the great saphenous vein. *J Vasc Surg*. 2005;49:403-409.	Open surgery (n=245) versus high ligation + cryostripping (n=249) **Follow-up 6 months** No difference between the 2 groups

Table IV. Open surgery versus cryostripping

NB. Open surgery: high ligation + saphenous stripping +/- perforator ligation +/- tributary phlebectomy

Table IV comment

Although cryostripping is not at present frequently used, the 2 randomized controlled trials available were published 3 and 2 years ago, respectively. Postoperative hematoma is less frequent with cryostripping, but we know that with appropriate skill hematoma in classic stripping can easily be reduced.

Operative procedure	Article	Conclusions
Open surgery versus high ligation + tributary phlebectomy +/- perforator ligation	Campanello M, Hammarsten J, Forsberg SC, et al. Standard stripping versus long saphenous vein saving surgery for primary varicose veins: a prospective, randomized study with the patients as their own controls. *Phlebology*. 1996;11:45-49.	Open surgery (n=18, group 1) versus high ligation+ tributary phlebectomy +/- perforator ligation (n=18, group 2) **Postoperative course** Less subjective postoperative discomfort in group 2 **Follow-up 4 years** No difference in terms of clinical outcome and plethysmography results between groups 1 and 2 as far as incompetent perforators had been treated Ultrasound examination: Patent and compressible great saphenous vein in group 2
	Dwerryhouse S, Davies B, Harradine K, Earnshaw JJ . Stripping the long saphenous vein reduces the rate of reoperation for recurrent varicose veins. J *Vasc Surg.* 1999;29:589-592. Winterborn RJ, Foy C, Earnshaw JJ. Causes of varicose vein recurrence : late results of a randomized controlled trial of stripping the long saphenous vein. *J Vasc Surg.* 2004;40:34-39.	Open surgery (n 52, group 1) versus high ligation + tributary phlebectomy +/- perforator ligation (n=58, group 2) **Follow-up 5 and 11 years** No difference in rate of recurrence between the 2 groups, but more redo surgery in group 2

Table V. Open surgery versus high ligation + tributary phlebectomy

NB. Open surgery: high ligation + saphenous stripping +/- perforator ligation +/- tributary phlebectomy

Table V comment

Preservation of the great saphenous vein (GSV) has been an issue since the 1950s. Fegan in Dublin was one of the pioneers when in 1950 he started compression sclerotherapy of incompetent perforators after which even large incompetent GSVs "normalized". Michael Hume in Boston, a founder and past-president of the American Venous Forum, was also one of the founders of the informal "Society for the Preservation of the Main Trunk of the GSV" in the 1980s. Large in Australia reported in 1985 good clinical results after phlebectomy without stripping of the GSV, and Rose and Ahmad in Manchester (UK) in 1986 recommended excision of varicose veins leaving the GSV intact. Campanello and colleagues in Sweden in 1996 presented a randomized clinical trial on preservation of the GSV after high ligation, phlebectomy, and perforator ligation. It is interesting to note that the French alternatives for GSV preservation, CHIVA (1988; ambulatory conservative hemodynamic management of varicose veins) and ASVAL (2005; ambulatory selective varicose vein ablation under local anesthesia) were presented during this period. However, high ligation + tributary phlebectomy is not used today. The explanation lies probably in both the more precise information provided by duplex ultrasound investigation of the saphenofemoral junction (SFJ) and the outcome after endovenous ablation. Duplex ultrasound has shown in GSV incompetence that reflux at the SFJ is absent in many cases, and that the terminal valve is competent in about 50% of cases in the presence of SFJ reflux.

In thermal ablation as well as in chemical ablation, the termination of the SFJ remains open and this does not seem to negatively influence the results. Furthermore, high ligation is supposed to enhance recurrence related to neovascularization.

Operative procedure	Article	Conclusions
Open surgery including hook phlebectomy versus transilluminated powered phlebectomy	Scavée V, Lesceu O, Theys S, et al. Hook phlebectomy versus transilluminated powered phlebectomy for varicose veins surgery. Early results. *Eur J Vasc Surg.* 2003;25:473-475.	80 patients Great saphenous vein General or spinal anesthesia Open surgery with tributary stab avulsion (n=40) versus transilluminated powered phlebectomy (n=40) **Follow-up 6 weeks** *With transilluminated powered phlebectomy* Fewer incisions. *P*<0.001 More bruising *P*=0.06 No difference in terms of postoperative pain, number of complications, residual varicose veins, cosmetic result
	Ray-Chaudury SB, Huq Z, Souter RG, McWhinnie D. A randomized controlled trial comparing transilluminated powered phlebectomy with hook avulsions: an adjunct to day surgery. *One Day Surg.* 2003;13:24-27.	98 patients Great saphenous vein Open surgery with tributary stab avulsion versus transilluminated powered No difference in terms of postoperative pain
	Aremu M, Mahendran B, Butcher W, et al. Prospective randomized controlled trial: conventional versus powered phlebectomy. *J Vasc Surg.* 2004;39:88-94.	141 lower extremities Great saphenous vein General anesthesia Open surgery with tributary stab avulsion versus transilluminated powered phlebectomy *With transilluminated powered phlebectomy* **Follow-up 2-52 weeks** Shorter operative time *P*=0.16 NS Fewer incisions. *P*<0.0001 No difference in terms of patient satisfaction and cosmetic result

Table VI. Hook phlebectomy versus Trivex

NB. Open surgery: high ligation + saphenous stripping +/- perforator ligation +/- tributary phlebectomy

Table VI comment

Published data do not show any significant advantage of transilluminated powered phlebectomy (TIPP) over conventional phlebectomy, except for fewer incisions, but the reports refer to earlier generation systems and techniques. TIPP has become less traumatic with the newer systems, but there are no randomized clinical trials to show any benefits.

Operative procedure	Article	Conclusions
Open surgery versus CHIVA	Carandina S, Mari C, De Palma M, et al. Varicose Vein Stripping vs Haemodynamic Correction (CHIVA): a Long Term Randomised Trial. *Eur J Vasc Endovasc Surg*. 2007:35:230-237.	Patients C2-6 Open surgery (n=75) versus CHIVA (n=75) **Follow-up 10 years (mean)** *After CHIVA* Less recurrence OR 2.2, 95% CI 1-5, *P*=0.04
	Parés O, Juan J, Tellez R, et al. Varicose vein surgery. Stripping versus the CHIVA method: a randomized controlled trial. *Ann Surg*. 2010;251:624-631.	Patients C2-6 Open surgery with clinical marking (n=167) versus open surgery with duplex marking (n=167) versus CHIVA (n=167) **Follow-up 5 years** *After CHIVA* Better clinical outcome (symptoms and signs) - Less recurrence - OR 2.01,CI 1.4-3, *P*<0.001
CHIVA + compression versus compression in C6 patients	Zamboni P, Cisno C, Marchetti, F, et al. Minimally Invasive Surgical Management of Primary Venous Ulcers vs. Compression Treatment: a Randomized Clinical Trial. *Eur J Vasc Endovasc Surg*. 2003;25:313-318.	45 patients C6 (47 venous ulcers) CHIVA + compression (Group I) 21 patients (23 venous ulcers) versus compression (Group II) 24 patients (24 venous ulcers) Venous ulcer healing rate Group I 100% 31 days (mean) Group II 96% 63 days (mean) *P*<0.005 Venous ulcer recurrence *Follow-up 3-year (mean)* Group I 9% Group II 36% *P*<0.02 Group I better quality of life (SF 36) *P*>0.05

Table VII. Open surgery versus CHIVA and CHIVA+ compression versus Compression in C6 patients

Abbreviations:
CHIVA = ambulatory conservative hemodynamic management of varicose veins
NB. Open surgery: high ligation + saphenous stripping +/- perforator ligation +/- tributary phlebectomy

Table VII comment

When CHIVA[1] was proposed in 1988, French phlebologists were divided in pro and con camps, as were the French people at the beginning of the previous century into dreyfusards and *antidreyfusards*.*

Many observational studies have been published on CHIVA techniques and outcome, but the first randomized clinical trial (RCT) appeared only 4 years ago.

As use of CHIVA has since moved mainly to Italy and Catalonia, it is not surprising that RCTs are performed in these parts of Europe. The Carandina RCT was limited to shunt I+II varicose veins according to the CHIVA nomenclature, while the article by Parés encompasses all kinds of primary varicose veins. Nevertheless, this large, well-documented randomized, open-label, controlled, single-center study raises some questions.

First, more than 90% of patients presented uncomplicated varicose veins (C2). Second, one outcome assessment is not considered in this article, the patient evaluation. This point is particularly important given that one of patients' main complaints after CHIVA is a persistent cosmetic problem.

CHIVA + compression versus compression. The third RCT is limited to C6 patients, but also concludes that

CHIVA is superior. Nevertheless one may be surprised by the healing rate, which is abnormally high in this series—100% in the CHIVA group and 96% in the compression group at 31 days, and 96% at 63 days, and also by the 9% recurrence rate at 3 years in the CHIVA group.

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*Dreyfus affair (French: l'affaire Dreyfus) was a political event that divided France in the 1890s and early 1900s. It involved the conviction for treason in November 1894 of Captain Alfred Dreyfus, a young French artillery officer of Alsatian Jewish descent.

Operative procedure	Article	Conclusions
Open surgery versus radiofrequency ablation	Rautio T, Ohinmaa A, Perälä A, et al. Endovenous obliteration versus conventional stripping operating in the treatment of primary varicose veins: a randomized controlled trial with comparison of the costs. *J Vasc Surg.* 2002;35:958-965.	VNUS closure bipolar catheter (*n*=15) versus high ligation + stripping (*n*=13) **Follow-up 2 months** *With radiofrequency ablation* Less post-operative pain *P*=0.017–0.036 Shorter convalescence. *P*<0.001 Cost-saving for society in employed patients
	Lurie F, Creton D, Eklof B, et al. Prospective randomized study of endovenous radiofrequency obliteration (closure procedure) versus ligation and stripping in a selected patient population (EVOLVeS Study). *J Vasc Surg.* 2003;38:207-214.	86 patients VNUS closure bipolar catheter versus high ligation + stripping **Follow-up 4 months** *With radiofrequency ablation* Return to normal activity shorter *P*=0.02 Return to work shorter *P*=0.05 Better health-related quality of life
	Lurie F, Creton D, Eklof B, et al. Prospective randomized study of endovenous radiofrequency obliteration (closure) versus ligation and vein stripping (EVOLVeS) Two-year follow-up. *Eur J Vasc Endovasc Surg.* 2005;29:67-73.	65 patients VNUS closure bipolar catheter versus high ligation + stripping **Follow-up 2 years** *With radiofrequency ablation* Clinical and duplex ultrasound results at least equal to those after high ligation + stripping Better health-related quality of life
	Perälä J, Rautio T, Biancari F, et al Radiofrequency endovenous obliteration versus stripping of the long saphenous vein in the management of primary varicose veins: 3-year outcome of a randomized study. *Ann Vasc Surg.* 2005;19:1-4.	VNUS closure bipolar catheter (*n*=15) versus high ligation + stripping (*n*=13) *With radiofrequency ablation* **Follow-up 3 years** No difference in terms of clinical result
	Hinchliffe RJ, Ubhi J, Beech A, Ellison J, Braithwaite BD. A prospective randomised controlled trial of VNUS closure versus surgery for the treatment of recurrent long saphenous varicose veins. *Eur J Vasc Endovasc Surg.* 2006;31:212-218.	16 patients presenting REVAS with persistent great saphenous vein trunk RF VNUS closure bipolar catheter versus redo-groin surgery + stripping **Follow-up 10 days** *With radiofrequency ablation* Procedure shorter *P*=0.02 Less post-operative pain. *P*=0.02 Less bruising *P*=0.03
	Kianifard B, Holdstock JM, Whiteley MS. Radiofrequency ablation (VNUS closure) does not cause neo-vascularisation at the groin at one year: results of a case controlled study. *Surgeon*. 2006;4:71-74.	55 patients treated by VNUS closure bipolar catheter versus high ligation + stripping (control group) **Follow-up 1 year** After radiofrequency ablation Absence of neovascularization 11% after high ligation + stripping. *P*=0.028

Operative procedure	Article	Conclusions
Open surgery versus radiofrequency ablation	Stötter L, Schaaf I, Bockelbrink A. Comparative outcomes of radiofrequency endoluminal ablation, invagination stripping and cryostripping in the treatment of great saphenous vein. *Phlebology*. 2006;21:60-64.	VNUS closure bipolar catheter (*n*=20) versus high ligation+ invagination stripping (*n*=20) versus high ligation + cryostripping (20) **Follow-up 1 year** No difference in the physician-assessed clinical status between the 3 groups Radiofrequency ablation patients continued to be significantly more satisfied with both their operative procedure *P*=0.001 and the cosmetic appearance *P*=0.006
	Subramonia S, Lees T. Radiofrequency ablation vs conventional surgery for varicose veins - a comparison of treatment costs in a randomised trial. *Eur J Vasc Endovasc Surg.* 2010;39:104-111.	VNUS closure bipolar catheter (*n*=47) versus high ligation + stripping (*n*=41) Radiofrequency ablation was more expensive but return to work was earlier *P*=0.006
	Elkaffas KH, Elkashef O, Elbaz W. Great saphenous vein radiofrequency ablation versus standard stripping in the management of primary varicose veins- a randomized clinical trial. *Angiology* 2010;62:49-54	180 patients Incompetent sapheno-femoral junction+ saphenous reflux VNUS closure bipolar catheter versus high ligation+stripping *With radiofrequency ablation* Lower overall complication rate Shorter hospitalization . *P*= 0.001 More expensive, *P*=0.003 **Follow-up 2 years** No difference in term of recurrence

Table VIII. Open surgery versus radiofrequency ablation.

NB. Open surgery: high ligation + saphenous stripping +/- perforator ligation +/- tributary phlebectomy

Table VIII comment

Seven randomized controlled trials (9 articles) have been identified and almost all of them conclude that after radiofrequency ablation there was less postoperative pain, faster recovery, and earlier return to work and normal activities, as well as greater patient satisfaction. The longest follow-up was 3 years and there was no difference in clinical results between classic surgery and radiofrequency ablation.

It should be noted that the bipolar catheter (Closure Plus) was used in all series, knowing that the new ClosureFast® catheter has given better results in published observations. It should, however, be pointed out that modern, less invasive open surgery under local anesthesia in the office setting is showing similar good outcomes.

Operative procedure	Article	Conclusions
Open surgery versus endovenous laser ablation	de Medeiros CA, Luccas GC. Comparison of endovenous treatment with an 810 nm laser versus conventional stripping of the great saphenous vein in patients with primary varicose veins. *Dermatol Surg.* 2005;31:1685-1694.	Great saphenous vein Spinal anesthesia 980 nm diode laser, bare fiber, stepwise laser withdrawal (n=20) versus open surgery (n=20) **Follow-up 9 months (mean)** No difference in postoperative pain *After endovenous laser* Fewer swellings and less bruising *P* not given Better outcome. P not given
	Vuylstecke M, Van den Busche D, Audenaert EA, Lissens P. Endovenous laser obliteration for the treatment of primary varicose veins. *Phlebology* 2006;21:80-87	Great saphenous vein General anesthesia 980-nm diode laser bare fiber, stepwise laser withdrawal (n 118) versus open surgery (n 124) **Follow-up 1, 8 weeks, 9 months** *After endovenous laser ablation* Less postoperative complications Sick leave shorter. *P*< 0.001 Total cost lower
	Ying L, Sheng Y, Ling H, Lian Y, Hui Y, Ming W. A random, comparative study on endovenous laser therapy and saphenous veins stripping for the treatment of great saphenous vein incompetence [Article in Chinese]. *Zhonghua Yi Xue Za Zhi.* 2007;87:3043-3046.	Great saphenous vein 980 nm diode laser, pulse mode (n=40) versus open surgery (n=40) **Follow-up 1 year** *After endovenous laser* Less bleeding *P*<0.01 Less postoperative pain *P*<0.05 Hospitalization shorter *P*<0.05 No air plethysmography difference
	Rasmussen LH, Bjoern L, Lawaetz M, Blemings A, Lawaetz B, Eklof B. Randomized trial comparing endovenous laser ablation of the great saphenous vein with ligation and stripping in patients with varicose veins : short-term results *J Vasc Surg.* 2007;46:308-315.	Great saphenous vein Tumescent anesthesia 980 nm diode laser, bare fiber, stepwise laser withdrawal (n=62) versus open surgery (n=59) **Follow-up 1, 2, 6 months** No difference in terms of efficacy and safety *After endovenous laser* Less postoperative pain and bruising. *P*=0.05
	Darwood RJ, Theivacumar N, Dellagrammaticas D, Mayor AL, Gough MJ. Randomized Clinical trial comparing endovenous laser ablation with surgery for the treatment of primary great saphenous veins. *Br J Surg.* 2008;95:294- 301.	Great saphenous vein 980 nm diode laser, bare fiber, stepwise laser withdrawal (n=42) continuous laser withdrawal (n=29) versus open surgery (n=32) **Follow-up 3 months** No difference between endovenous laser and open surgery in terms of reflux abolition and quality of life (specific questionnaire) *After endovenous laser* Earlier return to normal activity in both laser groups. *P*=0.005
	Kalteis M, Berger I, Messie-Werndl S, et al. High ligation combined with stripping and endovenous laser ablation of the great saphenous vein: Early results of a randomized controlled study. *J Vasc Surg.* 2008;47:822-829.	Great saphenous vein Diode 810 nm diode laser, bare fiber, stepwise laser withdrawal + high ligation (n=47) versus open surgery (n=48) **Follow-up 1, 4, 16 weeks** *After endovenous laser* Less bruising *P*=0.001 Longer period of time until return to work *P*=0.054 Quality of life (CIVIQ) no difference
	Theivacumar NS, Darwood MJ, Gough MJ. Neovascularization and Recurrence 2 years after treatment for sapheno-femoral and great saphenous reflux : a comparison of surgery and endovenous laser. *Eur J Vasc Endovasc Surg.* 2009;38:203-207.	Great saphenous vein 980 nm diode laser, pulse mode (n=69) versus open surgery (n=60) **Follow-up 2 years** Recurrence rates similar *After endovenous laser* Neovascularization less frequent *P*=0.001

Operative procedure	Article	Conclusions
Open surgery versus endovenous laser ablation	Christenson JT, Gueddi S, Gemayel G, Bounameaux H. Prospective randomized trial comparing endovenous laser ablation and surgery for treatment of primary great saphenous varicose veins with a 2-year follow-up. *J Vasc Surg.* 2010;52:1234-1241.	Great saphenous vein 980 nm diode laser, stepwise mode (n=100) versus open surgery (n=100) under general or spinal anesthesia **Follow-up 12 days** No difference in postoperative pain, use of analgesics and time to return to normal activity More hematoma in open surgery group More bruising in the endovenous laser group **Follow-up 1 and 2 years** No difference in terms of symptoms, Venous Clinical Severity Score or quality of life Great saphenous vein reopening endovenous laser =7. open surgery=0. *P*<0.051
	Pronk P, Gauw SA, Mooij MC, et al. Randomised Controlled Trial Comparing Sapheno-Femoral Ligation and Stripping of the Great Saphenous Vein with Endovenous Laser Ablation (980 nm) Using Local Tumescent Anaesthesia: One Year Results. *Eur J Vasc Endovasc Surg.* 2010;40:649-656.	Great saphenous vein 980 nm diode laser, continuous laser withdrawal + postoperative sclerotherapy for persistent varicose veins (n=62) Versus Open surgery: high ligation + pin-stripping + tributary stab avulsion + (n=68) For both local tumescent anesthesia **Follow-up 1-14 days** *After endovenous laser* More postoperative pain *P*<0.01 More hindrance in mobility and daily activities *P*>0.01 **Follow-up 1 year** No difference in terms of duplex ultrasound recurrence
	Rasmussen LH, Bjoern L, Lawaetz M, Blemings A, Lawaetz B, Eklof B. Randomized trial comparing endovenous laser ablation with stripping of the great saphenous vein : clinical outcome and recurrence after 2 years. *Eur J Vasc Endovasc Surg*. 2010;39:630-635.	Great saphenous vein 980 nm diode laser, pulse mode (n=62) versus open surgery (n=59) **Follow-up 2 years** No significant differences in - Clinical or duplex ultrasound recurrences - Clinical severity scores (Venous Clinical Severity Score) - Quality of life (Aberdeen Questionnaire)
	Rass K, Frings N, Glowack P, Hamsch C, Gräber S, Vogt T, Tilgen W. Comparable Effectiveness of Endovenous Laser Ablation and High Ligation With Stripping of the Great Saphenous Vein *Arch Dermatol online september19,.2011 doi:10.1001/archdermatol.2011.27*	Great saphenous vein Incompetent saphenofemoral junction (SFJ) + saphenous reflux at least down the knee level 810-nm diode laser continuous laser withdrawal ,applied energy 20 J/cm2 vein surface (n 185) versus open surgery (n 161) Tumescent local anesthesia **Follow-up 2 years** *Presence of varices after operative treatment (PREVAIT)* After endovenous laser ablation (EVLA) 16.2%, open surgery 23.1 %. *P*= NS Duplex ultrasound : recurrence: reflux at the SFJ: EVLA 17.8% (clinically silent in 81%, Open surgey 1.3%. *P*<0.001 *Clinical venous severity scoring* (HVSS): no difference *Quality of life* (CIVIQ), *Recovery time, ability to work*: NS difference

Table IX. Open surgery versus endovenous laser ablation

NB. Open surgery: high ligation + saphenous stripping +/- perforator ligation +/- tributary phlebectomy

Table IX comment

There are ten randomized controlled trials (11 articles) comparing classic open surgery with endovenous laser ablation. All except two used 980 nm bare-tipped fibers. Observation time was <2 years in 7 studies and >1 year in 3 studies. Quality of safety and early efficacy was high with no real difference between the groups. After two years no significant difference was found in clinical or duplex ultrasound recurrence, clinical severity, or quality of life. No randomized clinical trial has been reported with the new radial or jacket-tipped laser fibers.

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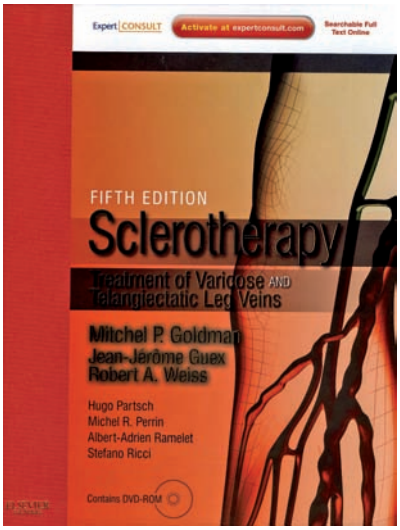
Review by Michel PERRIN



Sclerotherapy. Treatment of Varicose and Telangiectatic Leg Veins.

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Phlebolymphology. 2011;19(4):208.

First published in 1991, and republished in 1995, 2001, 2007, this book remains the backbone of our knowledge concerning sclerotherapy of chronic venous disorders. Divided into 15 chapters plus 8 appendices, this reference work of 401 pages covers not only sclerotherapy, but also anatomy (Stefano Ricci), surgery (Michel Perrin) and intravascular procedures (radiofrequency and lasers) for treating varicose veins, the use of compression (Hugo Partsch), venoactive drugs (Albert-Adrien Ramelet), and laser and high-density pulsed light treatment of telangectasias.

I particularly appreciated the chapter on noninvasive investigations before sclerotherapy (35 pages including 182 references).

The chapters on sclerotherapy itself (7, 8, 9, 12, 13) provide all the details that beginners and the experienced phlebologists alike need to know. At the end of the various treatment chapters, the reader will find several case histories with outstanding illustrations that are crucial to understanding the clinical course throughout treatment, from pre-interventional status to the final result. The last chapter (15) provides very practical and useful recommendations on how to set up a sclerotherapy practice.

The 8 appendices, which are only available online (www.expertconsult.com) are instructive and practical. They give information on compression, manufacturers and distributors of sclerosing solutions, equipment sources, patient brochures, answers to questions frequently asked in the postoperative period, what to tell a patient presenting with a varicose hemorrhage, a check-list of questions for your secretary to ask a patient on the telephone before making an appointment, and a coding and billing guide for endovenous laser ablation. Of course, some of this information is specific to the USA.

More than 2800 references are quoted, including 612 on sclerotherapy complications and how to avoid them. Over 500 figures, most of them new and in color, illustrate the book and facilitate understanding of the anatomy, physiology, and pathophysiology, and of the technical details recommended by the authors.

The DVD-ROM supplied with the book is particularly appealing and easy to use.

Without a doubt, if you perform sclerotherapy you should acquire this book for your library, and more importantly you should read it.

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AIM AND SCOPE

Phlebolymphology is a quarterly peer-reviewed publication that aims to provide clinicians with updated information on every aspect of the venous and lymphatic disorders: epidemiology, pathophysiology, diagnosis, management, and basic science. Articles are usually in the form of review articles on timely topics with a broad update of recent developments and their clinical applications.

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Chapter in a book: Coleridge Smith PD. The drug treatment of chronic venous insufficiency and venous ulceration. In: Gloviczki P, Yao JST, eds. *Handbook of Venous Disorders: Guidelines of the American Venous Forum.* 2nd ed. London, UK: Arnold; 2001:309-321.

Web-based material: Nicolaides AN. Investigation of chronic venous insufficiency: a consensus statement. American Heart Association, 2000. Available at: http://www.circulationaha.org. Accessed October 17, 2005.

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