

## **PREFACE**

When less is more. That is the feeling when I finished reading the book about saphenous preservation, written and organized by the colleague and friend Felipe Faccini. He was masterful to invite experienced authors to create a focused and concentrated book that will certainly change the comprehension of venous hemodynamics and the principles of CHIVA technique.

The human being has a natural resistance to changes and tendency to oppose new, unfamiliar things. This is particularly true in the case in which the problem to be solved already has several methods to deal with it. The treatment of the saphenous vein with reflux has several current treatment possibilities. The saphenous-stripping, thermal ablations (laser, radiofrequency), glue, foam, high-frequency ultrasound among others are commonly performed, and they all have one thing in common, the destruction of the saphenous vein. On the other hand, the disruptive technique CHIVA breaks the tradition of destroying the vein with a new concept of preserving the vein based on hemodynamic knowledge. Those of us that do surgeries have already needed a vein for a graft and there was no vein to do it. This is valid for limb salvage and also for coronary bypass and depicts the importance of the saphenous preservation.

In the first chapter, the book presents a valid question: Are we over treating the saphenous vein? The introduction of new techniques made the procedures less invasive and easy to do and recover, the answer is yes. This book presents a technique that is not new, but is not largely known and used. As the authors comment, it needs study and a learning curve. Thus, the surgeon needs to

believe in the benefit to the patients if he/she is about to change the current practice and spend time to learn the technique.

This book presents the pathway to change the current practice in an easy-to-understand and objective manner. The first chapter is a reflection of current practice and provokes the reader to prepare for the rest of the book. The rest of the book presents clearly and comprehensively hemodynamics and principles of saphenous preservation technique. The contents are suitable for the starter and also for knowledgeable specialists. The results are presented with scientific evidences and the book also gives us chapter about ASVAL, hemodynamic sclerotherapy and hemodynamic CLaCS. A book that teaches, updates and convinces.

I believe reading this book is pivotal to the colleagues who constantly seek the utmost objective of our profession, an excellence service to the patients. I invite the colleagues to think in an empathic manner when they are about to indicate the elimination of a saphenous vein. We should think if this procedure, independent on the technique used, is the best that we can offer to our patient.

I finish with the words I started, less is more. Less elimination of the saphenous vein, better and long-lasting results. I congratulate the authors for the excellent job. An easy, detailed and captivating book, indispensable for the good modern practice of vascular surgery, focused on the quality-of-life of the patients.

Bruno de Lima Naves, President of the Brazilian Society of Angiology and Vascular Surgery, SBACV 2020/2021.

# **1. Chronic Venous Insufficiency - A proactive approach.**

Felipe Puricelli Faccini, Claudia Sathler-Melo and Claude Franceschi

<https://doi.org/10.5281/zenodo.6490385>

## **Key Points**

**Are we over treating the saphenous vein?**

**What are the consequences of saphenous elimination and overtreatment?**

**Is preserving the saphenous vein conceivable?**

**Approach to preserve the saphenous vein**

The past and current treatment of varicose veins and venous insufficiency aims to eliminate all segments with reflux. If we see a vein with reflux that disrupts flow balance and creates symptoms, the reactive action is to eliminate it. If we see a perforator with reflux according to guidelines criteria, the reactive action is to eliminate it. Although this brings immediate relief, the body's counter reaction is certain and not predictable. The results of venous treatments are full of mishaps, recurrence, and relapses. We frequently see patients who underwent several interventions to treat varicose veins, sometimes under anesthesia. More than half of the patients who have the great saphenous vein eliminated have recurrent symptoms during their lives <sup>1</sup>.

A recent Phlebology editorial addressed the trade-offs of varicose vein surgery. The editorial starts with the following

statement: " The unprecedented range of treatments now on offer for varicose veins poses dilemmas, uncertainties, and incentives for both patients and practitioners" <sup>2</sup>. It is crystal clear for us that personal experience must play an important role to help the surgeon choose the best treatment for his patients. For example, a surgeon that performs stripping, phlebectomy and sclerotherapy for decades and has thousands of happy patients may be better off to keep going. Although, we might need a compass to guide us and help us reflect where we are going from time to time. In our opinion, we should pursue the real principles of medical treatment, instead of being kept in the middle of analyzing collateral endpoints (occlusion rates, for example). The recurrence, quality-of-life and incidence of complications seems for us as great principles to pursuit in Phlebology.

### **Are we eliminating the GSV too much?**

A few years ago, the procedure to eliminate the saphenous vein comprised stripping the vein under general or spinal anesthesia. The recovery was not immediate, and most patients needed a few weeks until complete recovery after the operation. Most patients suffered post-operative pain and had to stay some time out of work. Both the patients and the surgeons usually thought a lot before performing an operation. Most patients undergoing venous procedures involving the saphenous vein were symptomatic, high-scaled at CEAP class and deeply affected regarding quality-of-life.

Modern procedures brought easier recovery and a softer threshold to eliminate the saphenous vein. We can now easily perform the procedures that once had hard recoveries. The

general anesthesia became local anesthesia, achieving immediate recovery, and low pain scores. Both endolaser venous ablation of the vein and foam sclerotherapy of the great saphenous vein are obvious examples of this statement. The number of saphenous veins eliminated is increasing along with the ease to do it. The NY Times has published an analysis about vascular procedures in which the venous procedures increased close to 150% from 2005 to 2013 in the USA <sup>3</sup>. Later, this discussion has grown out of the newspaper and became a scientific discussion. The evaluation of venous procedures performed in the US between 1996 and 2014 shows an 4529% increase in the number of procedures, the increase starts after 2004 <sup>4</sup>. The situation seems to be broader than a country's bias. A recent study has shown that in Belgian, the saphenous procedures rose by 0.83% a year from 2007 to 2017. The same study showed that patients with limited financial resources (preferential reimbursement) had significantly lowered intervention rates than usual system patients <sup>5</sup>. Some may argue that the modern methods made it possible to treat patients early in the disease's course, but the possibility that we started over-treating patients is common sense. An editorial of the Society for Vascular Surgery official publication proposed the creation of a new vascular society, the SOS - Save Our Saphenous Society <sup>6</sup>.

You know a man by the company he keeps. To depict the modern method versus over-treating paradigm, we should discuss the characteristic of over-treating centers and doctors. Vascular surgeons are responsible for less than 30% of saphenous ablations in the US <sup>7</sup>. A study confirmed the increasing trend of doctors performing over two ablations per patient in the US between 2012-2015. The same study showed that several specialties are

performing these ablations without inter-physician analysis <sup>7</sup>. Another study accounting for endovenous thermal ablation in Medicare beneficiaries showed that some centers/physicians had a clear tendency to do more ablations. These ablation outliers were of a nonvascular surgery specialty, have fewer years in practice, and have a higher overall venous ablation practice volume <sup>8</sup>. Baber et al. compared rates of endovenous therapy performed by several specialties and providers in the USA. The study showed that physicians who do not traditionally treat CVD and high-volume providers are more likely to do endovenous therapy. The odds ratio was 9-times higher to have the saphenous vein treated in providers above the 75 percentile of procedures/year as compared to below 75 percentile providers <sup>9</sup>.

A recent editorial of the Journal of Vascular surgery discusses the causes and solutions for this overtreatment <sup>10</sup>. The authors suggested that physicians that over-ablate should examine their indications and vascular laboratory. Societies should reinforce information and education to help physicians meet standards. Insurers should inspect providers that perform several ablations in a single setting. The authors pointed out seven causes for the over ablation of the saphenous veins.

- 1) The medical training may cause overtreatment (nonvascular specialties not habituated might incorporate procedures without adequate training).
- 2) Disease complexity.
- 3) Inadequate Duplex Mapping
- 4) Physician may not be up-to-date with guidelines and literature

- 5) Billing mistake, charging every puncture instead of every vessel.
- 6) Many procedures in labs instead of hospitals - less oversight.
- 7) Hopefully rare, but fraud and reflux over diagnose may happen.

## **Recurrence - What happens when we remove a vein?**

The recurrence of varicosities is a constant concern in patients undergoing venous operations and causes significant burden to patients in the long term. Studies have shown that the recurrence rates after stripping of the great saphenous vein can be as high as 60% in a 30-year follow-up<sup>1</sup>. Newer techniques to eliminate the saphenous vein do not have enough years of follow-up to address this matter. Although, newer techniques cannot show recurrence advantage even in shorter time range studies as compared to saphenous stripping<sup>11</sup>.

Recent studies are suggesting that excessive venous resection may cause more recurrence. Biochemical and animal studies showed that an increase in the pressure on veins and chronic shear stress of the vein wall cause venous remodeling and may lead to recurrence<sup>12,13</sup>. Matting and spider veins may develop soon after intervention as a reaction to venous modification<sup>14</sup>.

Animal studies have shown that transcription factor activator protein 1 (AP-1) appeared to be a prerequisite for venous remodeling/proliferation and MMP-2 [matrix metalloproteases] expression. MMP-2 expression and venous proliferation follow the sudden interruption of the ear vein in rats<sup>12,13</sup>. A clinical study showed that the ligation of all the junctional saphenous tributaries causes a higher recurrence risk of varicose veins. This

study compared recurrence between two groups, high ligation of the saphenofemoral junction with and without ligation of all the tributaries. The group that had all tributaries ligated had a sevenfold increase in recurrence <sup>15</sup>. These data suggest that an approach with less resection may help reduce recurrence.

Summarizing, we should remember that chronic venous disease is a lifelong disease and recurrence is a constant problem. Eliminating the venous capital of the patient all at once might not have the long-term effect that we desire. A recent editorial of Phlebology reminds us that patients must take part in the choice of treatment (including an understanding of the consequences of no treatment) <sup>2</sup>. We should remember that there is the possibility of not performing interventions (lifestyle, elastic stocking) and performing less destructive interventions, preserving venous capital.

### **What can we do to preserve the saphenous veins?**

The principal purpose of this book is to offer alternatives to help the surgeon avoid saphenous vein elimination. Several chapters explain venous hemodynamics and all aspects of the CHIVA technique. We base the CHIVA technique on the hemodynamics of the leg and aim to correct flow disturbances with minimum venous resection. When we stop a reflux source, the veins wilt and most of them do not require resection. The hemodynamic surgery is a challenge that requires advanced knowledge of venous hemodynamics to fit all patients. The surgeons with excellent results in CHIVA often perform only saphenous sparing procedures. Poor planning of the procedure may end up in a superficial thrombophlebitis. Although, some

cases that do not involve a substantial length or ostium of the great saphenous vein are simple to do and might fit to any vascular practice.

We will divide the practice of CHIVA in two chapters, one for cases we consider simple (Physician non-specialist in hemodynamic), and another addressed to surgeons ready to go deeply into hemodynamics. If the reader likes saphenous sparing procedures and feels comfortable with simple cases, the chapter on hard cases brings additional insight on the technique. In the second case, we consider they should perform further training before putting these cases to practice. We will also discuss other techniques that aim to preserve the saphenous vein and venous capital, i.e. ASVAL.

The foam, laser or liquid sclerotherapy can also avoid saphenous elimination. We might use the opportunity of treating esthetic and low CEAP class patients and try to prevent venous deterioration of the leg. We hear much discussion if C1-C2 class patients should have a duplex mapping. If you inject or point a laser to a vein, why not make a duplex mapping? We may profit from the opportunity of treating esthetic/few symptoms patients to address the problem entirely. Obviously, that the rule of a patient's choice and explaining that the patients may do nothing still applies. However, society and patients demand esthetic treatments and if the specialist will not do it, unspecialized people will do it.

There are several cases in which the great saphenous vein is not the crucial source of reflux. In these cases, sclerotherapy aimed at the vein creating the reflux may correct the reflux and solve symptoms or solve symptoms without reflux reversion.

This approach is independent of the fundamental theories of reflux, ascending and descending. For instance, a case of a saphenous vein with reflux created by a collateral that has dilated over time along with its reservoir. Sclerotherapy of this collateral may solve the problem and end reflux. We can treat a case of saphenous vein reflux coming from a pelvic leak or perforator with sclerotherapy of the vein, and the reflux ends. We have solved with sclerotherapy several cases that had a previous indication of saphenous removal or ablation, keeping and even reverting flow of the saphenous vein. The long-term results of sclerotherapy procedures are surely less than ideal, and we may need new procedures. Although, the procedure is simple and 3.5 times cheaper than thermal ablation<sup>16</sup>. We consider that a hemodynamic-driven approach to sclerotherapy may improve results.

### **Last Comment**

In conclusion, there are several saphenous sparing techniques that can add to the modern vascular surgeon armamentarium. The readers should decide which to include in their practice. The insurance companies are getting more aware of the overtreatment paradigm and are progressively hardening the policies. Our proposal is not a drastic change in the vascular surgeons' practice. We can use ultrasound to better understand the hemodynamic problem of the patient. This value our work to anyone who can understand the enormous benefit of such an approach. In our experience, many patients choose procedures that preserve the saphenous vein instead of other procedures if we inform them. We note this both in surgical procedures

(CHIVA versus endolaser) and sclerotherapy (“see, shoot” versus hemodynamic sclerotherapy).

Therefore, we have successfully included saphenous preservation in our practice with satisfactory clinical and financial results. One could consider including hemodynamic sclerotherapy for simple C1-3 patients, for example. Several cases with esthetic concern pay for their treatments, as insurances do not reimburse it. We offer hemodynamic sclerotherapy as an alternative to these patients. We destroy fewer veins and get excellent results with this approach. Another example, saphenous veins with small diameter (<5.5) and no venous disease complications<sup>17,18</sup>, for which most insurance companies deny reimbursement. These patients sometimes have aesthetic reasons to ask for a procedure. We can offer hemodynamic sclerotherapy and/or CHIVA at lower cost and with much less vein destruction than if we were to do an ablation plus sclerotherapy. In the cases with no reimbursement, this lower cost is pivotal.

The financial aspects are also important. We consider them favorable to procedures that preserve the saphenous vein, both in the private sector and in the public sector. The first reason is that in our opinion there might be a significant number of unnecessary saphenous treatments nowadays. Another reason, the ablation procedures require use of disposable material that adds up cost to every procedure. This increases the fixed costs of the clinic, hospital and health care system. If the clinic can charge the same for a preserving procedure than for an ablation, in the year’s end you will probably have a surprise. We asked about the annual clinic’s spending with disposable material in ablation procedures to the participants of a conference. Several large numbers came

in. If this extra cost brought us better results, they would warrant it. However, the extra costs do not bring long-term hard endpoint advantages like fewer recurrences<sup>19</sup>. Short-term results of saphenous preserving procedures under local anesthesia show fewer nerve damages and bruises than stripping, with very low complication rates. Long-term results show fewer recurrences than stripping at 10 years in randomized clinical trials. The number and profile of trials is still not ideal, as it is impossible to blind the doctors performing post-operative Duplex ultrasound (saphenous vein is still there)<sup>20</sup>.

A significant advantage of saphenous sparing procedures is that surgeons need training in venous hemodynamics to perform it. This is an opportunity to strengthen our knowledge in venous disease and to get back all the patients treated by nonvascular doctors<sup>7</sup>. The opinion of the authors is that the patients receive better care from professionals highly specialized in the field than from a physician (or other healthcare professional) that does the procedures without in-depth involvement with the disease.

Decades ago, the CHIVA technique started in Europe, and many centers started doing it. Some centers had a significant incidence of superficial phlebitis<sup>21</sup> while others had very little incidence<sup>20</sup>. We consider that difficult CHIVA procedures need a learning curve. Fortunately, there is a substantial part of CHIVA procedures and ASVAL that are easier to perform. ASVAL is another saphenous sparing technique<sup>22</sup>. Surgeons have wonderful options at their discretion. We can treat the simpler cases with saphenous sparing procedures or even hemodynamic sclerotherapy. The harder cases are for surgeons after full hemodynamic training in CHIVA. May this book help the readers go further in excellent pathways at their own discretion.

## References

1. Fischer R, Linde N, Duff C, Jeanneret C, Chandler JG, Seeber P. Late recurrent saphenofemoral junction reflux after ligation and stripping of the greater saphenous vein. *J Vasc Surg* [Internet]. 2001 Aug;34(2):236–40. Available from: <http://dx.doi.org/10.1067/mva.2001.115802>
2. Campbell B, Franklin IJ, Gohel M. The choice of treatments for varicose veins: A study in trade-offs [Internet]. *Phlebology: The Journal of Venous Disease*. 2020. p. 026835552092270. Available from: <http://dx.doi.org/10.1177/0268355520922708>
3. Creswell J, Abelson R, editors. Medicare payments surge for stents to unblock blood vessels in limbs [Internet]. Vol. A1. *The New York Times*; 2015. Available from: <https://www.nytimes.com/2015/01/30/business/medicare-payments-surge-for-stents-to-unblock-blood-vessels-in-limbs.html>. Accessed June 12, 2018.
4. Lawrence PF. “Better” (sometimes) in vascular disease management. *J Vasc Surg* [Internet]. 2016 Jan;63(1):260–9. Available from: <http://dx.doi.org/10.1016/j.jvs.2015.10.022>
5. Guillaume GM, Vuylsteke ME, Dalcq V, Van der Borgh L, Meeus P, de Maeseneer MG. Influence of reimbursement policies on phlebological surgical practice in Belgium between 2007 and 2017. *Int Angiol* [Internet]. 2020 Feb 20; Available from: <http://dx.doi.org/10.23736/S0392-9590.20.04305-9>
6. Samson R. Calling SOS -- Save Our Saphenous! *Vascular Specialist Online* [Internet]. 2013 Nov 21 [cited Accessed 04/25/2020]; Available from: <https://www.mdedge.com/vascularspecialistonline/article/84109/calling-sos-save-our-saphenous>
7. Crawford JM, Gasparis A, Almeida J, Elias S, Wakefield T, Lal BK, et al. A review of United States endovenous ablation practice trends from the Medicare Data Utilization and Payment Database. *J Vasc Surg Venous Lymphat Disord* [Internet]. 2019 Jul;7(4):471–9. Available from: <http://dx.doi.org/10.1016/j.jvsv.2019.01.066>

8. Mann M, Wang P, Schul M, Khilnani NM, Park A, Makary MA, et al. Significant physician practice variability in the utilization of endovenous thermal ablation in the 2017 Medicare population. *J Vasc Surg Venous Lymphat Disord* [Internet]. 2019 Nov;7(6):808–16.e1. Available from: <http://dx.doi.org/10.1016/j.jvsv.2019.06.019>
9. Baber JT Jr, Mao J, Sedrakyan A, Connolly PH, Meltzer AJ. Impact of provider characteristics on use of endovenous ablation procedures in Medicare beneficiaries. *J Vasc Surg Venous Lymphat Disord* [Internet]. 2019 Mar;7(2):203–9.e1. Available from: <http://dx.doi.org/10.1016/j.jvsv.2018.09.012>
10. Lawrence PF, Gloviczki P. Appropriate care for venous disease. *J Vasc Surg Venous Lymphat Disord* [Internet]. 2019 Jul;7(4):469–70. Available from: <http://dx.doi.org/10.1016/j.jvsv.2019.03.005>
11. Paravastu SCV, Horne M, Dodd PDF. Endovenous ablation therapy (laser or radiofrequency) or foam sclerotherapy versus conventional surgical repair for short saphenous varicose veins. *Cochrane Database Syst Rev* [Internet]. 2016 Nov 29;11:CD010878. Available from: <http://dx.doi.org/10.1002/14651858.CD010878.pub2>
12. Feldner A, Otto H, Rewerk S, Hecker M, Korff T. Experimental hypertension triggers varicosis-like maladaptive venous remodeling through activator protein-1. *FASEB J* [Internet]. 2011 Oct;25(10):3613–21. Available from: <http://dx.doi.org/10.1096/fj.11-185975>
13. Pfisterer L, König G, Hecker M, Korff T. Pathogenesis of varicose veins - lessons from biomechanics. *Vasa* [Internet]. 2014 Mar;43(2):88–99. Available from: <http://dx.doi.org/10.1024/0301-1526/a000335>
14. Timperman PE. Prospective evaluation of higher energy great saphenous vein endovenous laser treatment. *J Vasc Interv Radiol* [Internet]. 2005 Jun;16(6):791–4. Available from: <http://dx.doi.org/10.1097/01.RVI.0000165044.41012.C8>
15. Cappelli M, Lova RM, Giangrandi I, Ermini S, Giancesini S. Ligation of the Saphenofemoral Junction Tributaries as Risk Factor for Groin Recurrence. *Journal of Vascular Surgery: Venous and Lymphatic Disorders* [Internet]. 2018;6(2):290. Available from: <http://dx.doi.org/10.1016/j.jvsv.2017.12.030>

16. Lattimer CR, Azzam M, Kalodiki E, Shawish E, Trueman P, Geroulakos G. Cost and Effectiveness of Laser with Phlebectomies Compared with Foam Sclerotherapy in Superficial Venous Insufficiency. Early Results of a Randomised Controlled Trial. *Eur J Vasc Endovasc Surg* [Internet]. 2012 May 1;43(5):594–600. Available from: <http://www.sciencedirect.com/science/article/pii/S1078588412000755>
17. Gibson K, Meissner M, Wright D. Great saphenous vein diameter does not correlate with worsening quality of life scores in patients with great saphenous vein incompetence. *J Vasc Surg* [Internet]. 2012 Dec;56(6):1634–41. Available from: <http://dx.doi.org/10.1016/j.jvs.2012.02.065>
18. Navarro TP, Delis KT, Ribeiro AP. Clinical and hemodynamic significance of the greater saphenous vein diameter in chronic venous insufficiency. *Arch Surg* [Internet]. 2002 Nov;137(11):1233–7. Available from: <http://dx.doi.org/10.1001/archsurg.137.11.1233>
19. O'Donnell TF, Balk EM, Dermody M, Tangney E, Iafrati MD. Recurrence of varicose veins after endovenous ablation of the great saphenous vein in randomized trials. *J Vasc Surg Venous Lymphat Disord* [Internet]. 2016 Jan;4(1):97–105. Available from: <http://dx.doi.org/10.1016/j.jvsv.2014.11.004>
20. Bellmunt-Montoya S, Escribano JM, Dilme J, Martinez-Zapata MJ. CHIVA method for the treatment of chronic venous insufficiency. *Cochrane Database Syst Rev* [Internet]. 2015;(6). Available from: <https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD009648.pub3/abstract>
21. Mandolesi S, Ballo M, Galeandro I, Filippo S, Migaldi D, Spinelli F, et al. [The 1st national multicenter study of the CHIVA (Conservative Therapy and Hemodynamics in Venous Insufficiency in Outpatient Departments) method of treatment of varices. One-year follow-up]. *Ann Ital Chir* [Internet]. 1990 Jul;61(4):425–7. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/2082780>
22. Chastanet S, Pittaluga P. Ten-Year Outcomes of Treatment of Varicose Veins by Ambulatory Selective Ablation of Varices Under Local Anesthesia (ASVAL) [Internet]. Vol. 6, *Journal of Vascular Surgery: Venous and Lymphatic Disorders*. 2018. p. 289. Available from: <http://dx.doi.org/10.1016/j.jvsv.2017.12.028>