Evaluation of the CHIVA theory

C.Recek: Black and blue. .Franceschi response: Red

CHIVA is a conception comprising, on the one hand, evidenced hemodynamic elements; it opposed the generally acknowledged theory of incompetent calf perforators; it termed calf perforators ***"re-entry points"*** of venous reflux irrespective of their size, in contrast to ***escapes points*** according to the theory of incompetent calf perforators; it stressed the effectiveness of saphenous reflux interruption at the sapheno-femoral junction. In this regard, it represented a progressive contribution as it opposed the generally accepted false opinions prevailing at that time OK. But on the other hand, it encompasses subjectively contrived ideas and perceptions that do not reflect or are at odds with the reality.

First of all, the so called "physiological drainage" of venous blood from superficial thigh veins into the deep lower leg veins through the preserved incompetent saphenous remnant in the thigh after high ligation. The superficial veins content in "normal" is blood that flows from the microcirculation where the tissues are drained. In "abnormal" this draining flow remains in addition to flow coming abnormally from other veins. Why not? Please explain . Furthermore, it uses superfluous terminology describing fictive situations: closed and open shunts, subdivided moreover into subtypes, fractioning of hydrostatic pressure, vicarious circulation, subdivision of the venous network in R1 – R4; this all adds to unnecessary complexity and to additional confusion. Could you tell why these patterns are fictive, since there are assessed and elicited by most independent DUS practitioners. They allow to change the apparently inextricable/ confusing network in clear patterns thanks to a systematisation of the normal and abnormal hemodynamic/anatomic configuration of the venous flow. Ultimately, CHIVA does not take into account some proven evidences, such as ambulatory venous hypertension, ambulatory pressure gradient.Nevertheless, CHIVA is based on these parameters.

The term ***fractioning of hydrostatic pressure*** is a pure invention. Hydro**static** pressure exerts its effect in the ***quiet standing position*** and has the same value before CHIVA treatment as after the procedure. High ligation or any other ligation along the incompetent GSV does not fractionate the hydrostatic pressure; it just precludes reflux in incompetent GSV or its tributaries and counteracts in this way the development of ambulatory venous hypertension during calf pump activity. Yet, as you know , according to various studies (last one from E.Mendoza cited on Vasculab) , the calibre of the GSV is reduced dramatically after SFJ ligation/section. On the otherr hand, (first step fo CHIVA 2 steps (as in ASVAL) in SHUNT III the GSV calibre reduce despite the non ligation of the previously refluxing SFJ. This is due to the disconnection of the closed shunt (stop of the overloading flow). But it reduces even more , when the recurrence of the reflux occurs, lead to the SFJligation/section, proving the fractioning effect on the hydrostatic pressure.

When we are speaking about reflux, we must define: where is the source (point with higher pressure); where is the issue (point with lower pressure); where is the reflux

carrying conduit connecting both points. The position of the two pressure points determines the flow direction. The ***physiological flow direction*** in the venous system is ***centripetal:*** from the periphery to the heart. That does not mean that it must take always a straight way; the path can be winding. In the lower extremity, the point with higher pressure is situated more distally, the point with lower pressure more proximally (at rest, during calf muscle contraction). Ambulatory pressure gradient arising during calf pump activity inverts the position of the two points: the point with higher pressure is now alternately situated more proximally (in the thigh), the point with lower pressure more distally (in the lower leg); the resulting flow direction in an incompetent vein connecting both pressure points is ***centrifugal;*** it is a ***pathological flow***; it is a ***reflux***. We must realize that this pathological centrifugal flow produces ambulatory venous hypertension, the degree of which depends on reflux intensity. Drainage of venous blood from the thigh veins into the lower leg veins does not exist under physiological conditions; competent valves preclude it. As you say , the drainage of the thigh veins into the lower leg veins is not physiological …but it plays the same role provided it is not overloaded by a shunt and/or strained by a too high column of pressure CHIVA fractionates the column and disconnects the shunts). So its role remains physiological, despite "anormal" because "descending" as well as the "normal" descending flow of the descending tributaries of the GSV arch. The physiological drainage "job" is fulfilled. (Have glance to the APG and RPG assessment below)

CHIVA does not proceed on the assumption that the venous flow direction is determined by physiologically changing pressure gradients. Yet it does. Particularly it stresses on the Pressure Gradient changes during the Diastole/systole p) pahasic action of the muscular pump., . It defines the physiological direction of venous flow as a ***flow respecting the hierachy of the physiologic drainage N3>N2>N1, i.e. from superficial into deep veins.*** Thus, according to the CHIVA theory, the drainage through the preserved incompetent great saphenous remnant after high ligation is considered to be a physiological situation, a favourable phenomenon because it respects the hierarchy of venous drainage from superficial into deep veins. The CHIVA theory does not take into account that the pathophysiological function of the deep lower leg veins is quite different from that one of the deep thigh veins. High ligation, which is the most effective therapeutic component of the CHIVA procedure, abolishes saphenous reflux, removes the hemodynamic disturbance, and restores physiological decrease in pressure in the lower leg veins during calf pump activity; in contrast to that, the ambulatory pressure in the thigh veins remains unaffected.OK Unfortunately, the excellent immediate result deteriorates progressively during the follow-up due to recurrent reflux. If you agree that t e immediate results are excellent, you must agree with the hemodynamic strategy. , The CHIVA theory disregards that, once the saphenous reflux has been abolished, new connections develop in the course of time between deep thigh or iliac veins and superficial veins in the thigh and provide new escape points for recurrent reflux. Thus, the centrifugal flow in the saphenous remnant is the consequence, let's use the CHIVA terminology,

of newly developed (closed) shunts; the incompetent GSV remnant in the thigh constitutes the main route for recurrent reflux. The hemodynamic situation a few years after CHIVA differs from that one before CHIVA just in a lower level of reflux intensity causing recurrent hemodynamic disorder. Air plethysmographic evaluation performed by Zamboni, himself a CHIVA proponent, showed that the original value of reflux intensity before CHIVA treatment was 5.4 ml/s; 6 months after CHIVA it improved to 2.9 ml/s, but 3 years after CHIVA the intensity of recurrent reflux was 5.0 ml/s, i.e. nearly the same as before treatment, documenting in this manner the hemodynamic failure of the CHIVA method . I'm afraid there is an "artifact" which is corrected by the text extracted from our Book where extensive measurements are described referring to publications. The book: Principles of Venous of Hemodynamics.Novapublisher . New Yoyr 2010. On the same book (other extract below) you will see that the recurrence rate (CHIVA vs Stripping :10 years follow up: RCT study Carandina and al) at the SFJ is very low (stripping also), and the difference of varicose recurrence compared to Stripping relies on the absence of "novel" varices in the first one and high presence in the second one. The predominant cause of recurrence in CHIVA is the re-canalisation of some peripheral disconnections.

Varicose vein disease embodies a surprising and astonishing run of events: abolition of saphenous reflux removes the hemodynamic disorder, but simultaneously it creates hemodynamic preconditions for development of recurrent reflux. This phenomenon starting the same trouble while fixing the problem has been called hemodynamic paradox. Why , if the strategy is correct, we see some recurrences (nevertheless only 50% regarding the Stripping recurrences) ? Could be partly due to the tactics i.e . the technical method used to achieve the strategy . We improved in using non absorbable thread stiches on the veins divisions and avoiding to leave behind stumps.

As mentioned above, CHIVA takes the centrifugal into the deep lower leg veins oriented, although reflux-carrying flow for a beneficial draining phenomenon because it abides by the *"hierarchy of the physiological drainage"*; actually, it is reflux, a harmful phenomenon producing ambulatory venous hypertension. On the other hand, the systolic centripetal flow evoked by higher pressure in deep lower leg veins and lower pressure in superficial lower leg veins, streaming within calf perforators into the GSV and further via femoral vein toward the heart is regarded a reflux because the flow direction at the beginning is oriented from deep into superficial veins, i.e. it runs afoul of the "physiological drainage" *N3>N2>N1*. In reality, this systolic flow is a physiological centripetal double-barrelled streaming toward the heart through both the popliteal/femoral vein and the GSV. Thus, according to CHIVA theory, the harmful centrifugal streaming is referred to be a physiological phenomenon, whereas the physiological centripetal streaming is referred as reflux.

Articles claiming lesser recurrence rate after CHIVA than after ablative methods are misleading and at odds with the reality because they do not include the "drainage" in

the preserved incompetent saphenous remnant, in reality recurrent reflux, into the recurrence rate; if this "drainage" had been included, the recurrence rate would have exceeded 80% in a few years of follow-up. Recurrent reflux is an indispensable part of varicose veins recurrence. In cases after CHIVA procedures, the recurrent reflux takes place mainly through the persistent incompetent saphenous remnant Yet, in most of all the CHIVA strategies (except in SHUNT 3 1st Step and SHUNT 2) the FLOW IN THE TREATED REMAINS RETROGRADE (Reflux) . So a REMAINING reflux is EXPECTED, but relieved (draining its physiologic blood) because no longer overloaded (shunt escape point disconnected and column is fractioned) ; after ablative procedures, new superficial reflux carrying channels must first develop (in CHIVA terminology "vicarious circulation"). OK (see below the results)

Principally, the results after CHIVA were not assessed by air- or strain gauge plethysmography, which are quite suitable methods enabling evaluation of the degree of the hemodynamic disorders caused by reflux or recurrent reflux; the exception was the article by Zamboni et al. Consequently, the presented results after CHIVA do not objectively reflect the real situation. Therapeutic results after CHIVA comply with those after sheer crossectomy;(Any study CHIVA vs Crossectomy validate your statement ? the main therapeutic effect is namely achieved by abolition of saphenous reflux at the sapheno-femoral junction. Other therapeutic measures do not ameliorate this effect. For example: additional stripping does not improve the ***immediate*** hemodynamic benefit achieved by interruption of saphenous reflux at the SFJ.

Thus, the CHIVA theory diverges in several points from the reality. CHIVA reality is validated by long term RCTs and Cochrane Review. Could you cite a study about our "reality"? - **CHIVA method for the treatment of chronic venous insufficiency**

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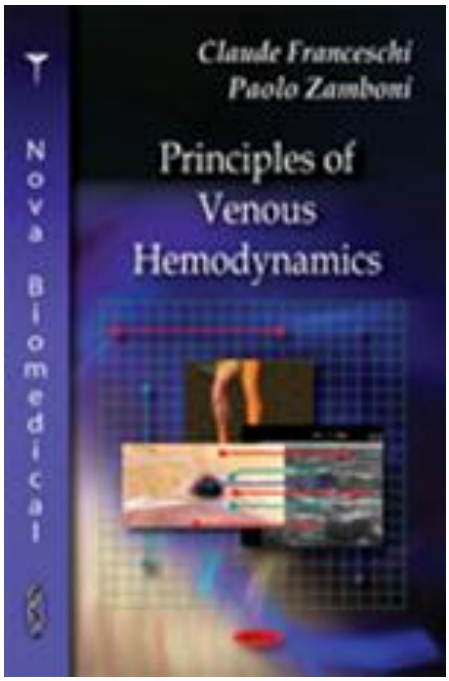
Cochrane Review number: 1671. July 2013 .

This evaluation does not aim to discredit the CHIVA procedure; it intends to present objective assessment of the CHIVA theory, based on proven evidences, and to prevent overestimating the effectivity of this method . Once more, see by long term RCTs and Cochrane Review.

Curiously, according to the survey among 675 surgeons of the French speaking Vascular Surgery Society performed 2003 by Perrin, only 0.3% of surgeons performed CHIVA. As on 2004 more than 40% of the superficial venous treatments in Spain where CHIVA, what is the reason? IN FRANCE , under the pressure of some leaders (included Perrin) overwhelmed the vascular community CHIVA of false informations: CHIVA short term recurrence, based on the failure of many surgeons who didn't study CHIVA properly and limited it, whatever the hemodynamic configuration to GSV high ligation and random varicose tributaries phebectomies. A study (**Recurrent varicose veins of the lower limbs after surgery. Role of surgical technique (stripping vs. CHIVA) and surgeon's experience.** Milone M, Salvatore G, Maietta P, Sosa Fernandez LM,

Milone F:G Chir; 2011 Nov-Dec;32(11-12):460-3) shows that CHIVA performed by experts (i.e who studied properly) is better than stripping and worse when performed by non experts (who didn't study properly)
I'm not sure to have convinced everybody but CHIVA being not a religion, one have not to convice anybody , but hope that some colleague understand properly the explainations and their validation by EBM.
So far, CHIVA is validated as better than the "scientific gold standard" i.e CHIVA. Gold standard based on mainstream behavior is not "scientifical" but refers to extra-scientifical reasons.

EXTRACTS FROM



CHIVA Functional Results

Venous function can be assessed invasively, by the means of duplex, ambulatory venous pressure (AVP), and non invasively, by the means of photoplethysmography (PPG)-light reflection reography (LRR), or air plethysmography (APG) (see chapter 8).

1. Duplex Scanning

One of the most debated point of the so called CHIVA 1 procedure is the reverse flow downward the re-entry perforator obtained after high ligation (see chapter 10). Many investigators considered it a reflux [108,211]. Postoperative duplex investigation in CHIVA 1 procedure demonstrates significantly different haemodynamic parameters of the reverse flow without change of compartment as compared to preoperative reflux.

Particularly, peak systolic velocity (PSV), peak diastolic velocity (PDV) and resistance index (RI) as an impedance parameter derived from the formula

RI = PSV/PSV-PDV are significantly different (G. Tacconi, E. Menegatti personal communication EVF Annual Meeting Barcellona 2008). Furthermore draining reverse flow corresponds to significant reduction of the cross sectional area of the GSV, which is in turn correlated to reduction of venous volume (Figure 11.1).

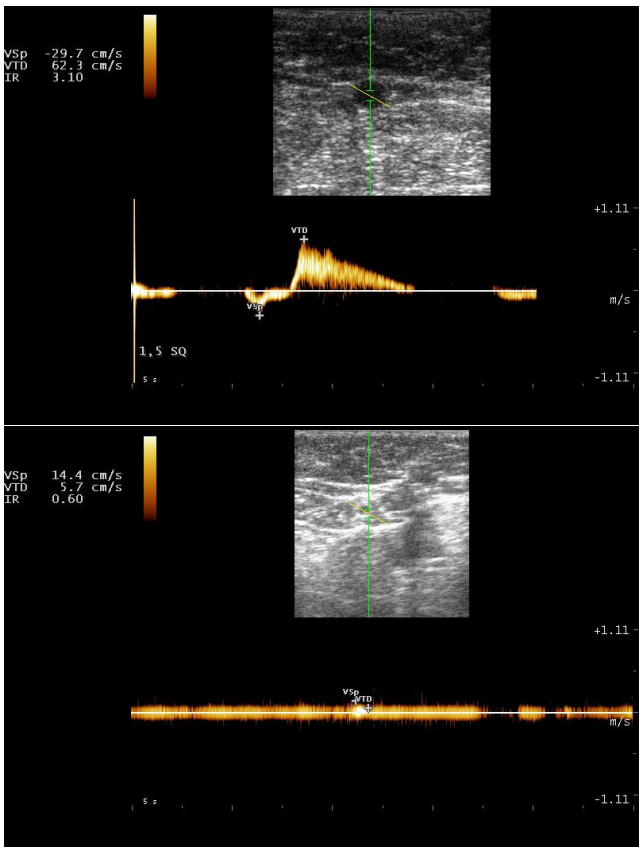


Figure 11.1. Top panel: preoperative reflux wave assessed 15 cm below the SFJ in type I shunt. Bottom panel: draining reverse flow assessed in the same position 6 months after CHIVA 1 procedure. The significant change in PSV PDV and RI are indicated as Vsp, VTD, and IR respectively on the left side of the Doppler trace of the top and bottom panel. Particularly, RI passed from 3.10 to 0.60 clearly indicating the modification of flow impedance obtained by CHIVA 1 procedure. In addition the dramatic reduction of the cross sectional area of the GSV are apparent by comparing the preoperative saphenous eye image with that obtained postoperatively.

Therefore, reverse flow of drainage without change of compartment is observed also in human physiology and is classified as shunt 0 (see chapter 5). In addition, the significance of the draining reverse flow is testified by the relationship between it and the improvement of functional parameters like AVP and APG described in the next paragraphs.

2. AVP (Ambulatory Venous Pressure)

The fall of venous pressure occurring with exercise represents the functional reserve of the venous system of the lower limbs and closely correlates with the clinical class of CVD [23,183,184]. It can be measured by the means of a needle transducer inserted into a foot vein, assessing the pressure at rest in standing (hydrostatic pressure), and after exercise (usually 10 tip-toe movements). In addition, it permits to assess the refilling time RT, i.e. the time to return from the minimal pressure value reached stopping the exercise to the initial value in standing position (Figure 11.1). Parameters can be assessed also excluding the superficial reflux by encircling the thigh with a tourniquet. Although some overlap exists between AVP values obtained in either healthy or insufficient veins of the lower limbs, such a measure is widely considered the gold standard in the evaluation of venous function.

Seventythree patients underwent preoperatively and 6 months postoperatively AVP assessment by the means of classic puncture with a needle transducer of a foot vein, after a CHIVA I procedure. CHIVA I contemplated SF

disconnection plus flush ligation of the tributaries at the saphenous trunk complemented by multiple stab avulsions (see chapter 10). The preoperative value assessed after ten tip-toe exercise was 50.13±6.56 mmHg; it passed to 28.82±7.14 mmHg six months postoperatively. The difference between pre and postoperative measurements was statistically significant using both Student 's t and Wilcoxon' s tests ($p<0.001$) [270].

3. LRR (Light Reflection Reography)

The same group of 73 patients underwent to LRR evaluation preoperatively and 6 months postoperatively. LRR and PPG are both non -invasive methods capable to give a rough estimation of the calf muscular pump based on the slope of the curve obtained with tip-toe exercise. More precisely both methods can assess refilling time non-invasively (Figure 11.1) [19,214]. Refilling time measured preoperatively was 10.12±2.6 seconds. After CHIVA I procedure was prolonged to 19.80±4.91seconds, confirming the finding measured by the means of EVT (Figure 11.2). The difference between pre and postoperative measurements was statistically significant using both Student 's t and Wilcoxon' s tests ($p<0.001$) [270].

4. APG (Air Plethysmography)

APG permits to extrapolate four parameters which investigate several aspect of venous function [19,58,59]. Total Volume (TV), which is the amount of blood to be found in the venous reservoir, and measures the change in volume (in ml air) produced by the passage from the supine position with the leg raised at 45° to the standing position.

Venous Filling Index (VFI), the volume variation produced in a limb in a defined time by the passage from the supine to the standing position. VFI is related to the severity of the reflux and is expressed in ml air/sec.

Ejected Fraction (EF) which is the rate of the reduction of TV after a single tip toe movement. It reflects the calf muscular systole.

Residual Volume Fraction (RVF), the rate of reduction of TV obtainable after ten tip toe movements. This index is linearly and significantly related to ambulatory venous pressure measurement (Figure 11.3).

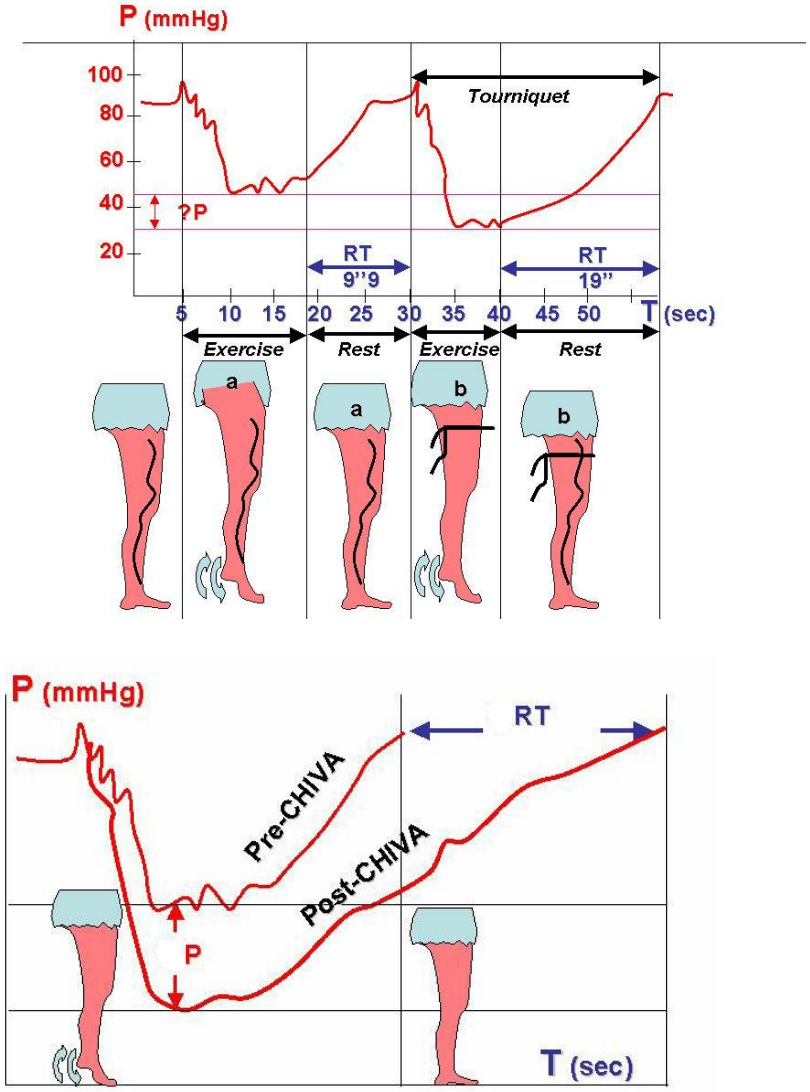


Figure 11.2. Ambulatory Venous Pressure. Top panel: Normal Values P:Pressure. PAE: P after exercise < 30mmHg , ΔP: PEA variation between a and b conditions. RT: refilling time after exercise , i.e. the time necessary to return to the resting pressure, > 18 sec. Normal PAE drop and RT are due to normal haemodynamics which allows the valvulomuscular pump to achieve the dynamic fractionation of the hydrostatic pressure (DFHP). a:In the case(a) the spontaneous PAE is to high > 30 mmHg and RT too short. b: A tourniquet at the proximal thigh corrects the values up to normal. Why? Because the tourniquet closure of the superficial at the thigh restores the DFHP, pressing and so disconnecting a superficial closed shunt probably due to a great saphenous reflux in that case. Bottom panel: The preoperative value assessed after ten tip-toe exercise was 50.13±6.56 mmHg, passed to 28.82±7.14 mmHg six months postoperatively. Refilling time measured preoperatively was 10.12±2.6 seconds. After CHIVA I procedure was prolonged to 19.80±4.91secondsThe difference between pre and postoperative measurements was statistically significant using both Student 's t and Wilcoxon' s tests ($p<0.001$).

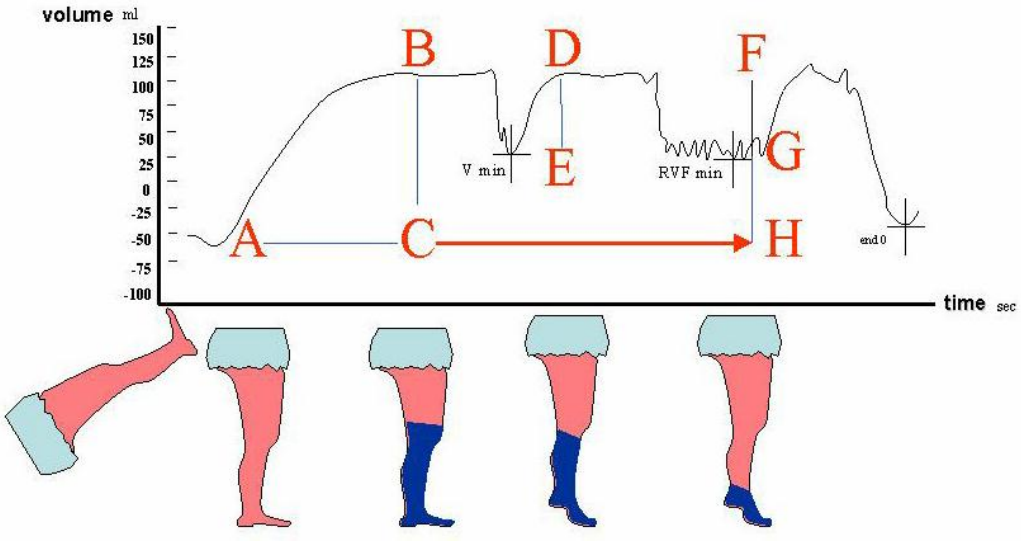


Figure 11.3. APG Trace. TV n.v. < 130ml; total volume of blood in the venous reservoir of the leg = segment BC. VFI n.v. < 2 ml/sec; time for refilling of blood the leg passing from leg elevation to the standing posture = BC/AC. EF n.v. > 55%TV; expelled volume with just one tip-toe exercise, systolic ejection fraction of the calf pump = DE/BC %. RVF n.v. < 30%TV; residual volume in the venous reservoir of the leg = GH/BC%.

APG examination was performed in all cases between 8 and 10 a.m. at the same temperature (23C°), just before CHIVA was performed for correction of chronic venous insufficiency.

Interestingly, APG were measured after simple disconnection of varicose tributaries from the main saphenous trunk, the so called first step of CHIVA II procedure (see chapter 10) [252].

All air-gas plethysmographic parameters, with the exception of Ejection Fraction (EF), significantly improved: Venous Volume (VV) changed from 150 ml ± 9 to 119 ± 6 and 114 ml ± 7 after 1 and 6 months, respectively ($p < 0.0001$), Venous Filling Index (VFI) from 4.9 ml/sec ± 0.5 to 2.3 ±0.2 both after 1 and 6 months, respectively ($p < 0.0001$), and Residual Volume Fraction (RVF) from 42 ml ± 3 to 29.8 ± 2 and 30.2 ± 2 after 1 and 6 months, respectively ($p < 0.0001$).

In the graphics of Figure 11.4 and Figure 11.5 the improvement of VFI and RVF is well apparent, so demonstrating that reflux in the GSV is firmly suppressed by the disconnection of the TV containing the re-entry PV, just eliminating the gradient between the reflux point (i.e. the SFJ) and the re-entry point in the deep veins.

Reflux doesn't exist more until the reappearance of the gradient. Reflux did recur in 15% of the patients in which a re-entry perforating vein newly developed. This time opening of the perforator was found on the main GSV trunk.

Reflux elimination achieved by the elimination of the gradient determines significant improvement in venous function, as assessed by means of APG, and it is not related to a false finding measured by diplex scanning.

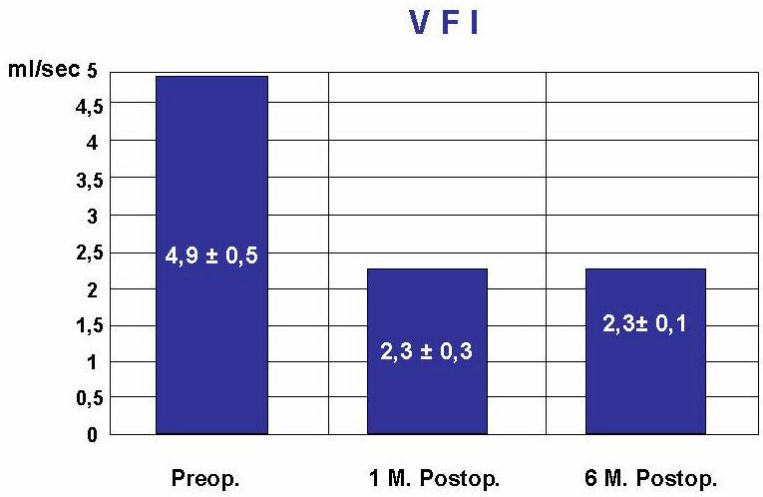


Figure 11.4. VFI changes after 1st step CHIVA 2 PROCEDURE Eur. J. Vasc. Endovasc. Surg. 2001.

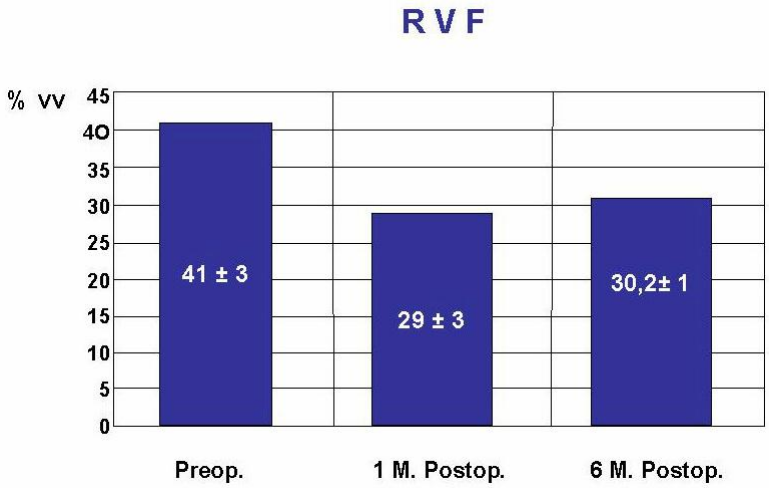


Figure 11.5. RVF changes after 1st step CHIVA 2 PROCEDURE Eur. J. Vasc. Endovasc. Surg. 2001.

5. Long Term APG Assesment

Non invasive air gas plethysmography was used for assessment of changes in venous function in a randomized study comparing CHIVA (CHIVA I and CHIVA I +II) to compression in course of active primary ulcers.

Parameters were assessed at the time of randomization and repeated six months and three years later, respectively (Table I).

In the haemodynamic CHIVA group, all four parameters, with the exception of the ejection fraction, significantly improved 6 months after the operation. However, after three years, only Residual Volume Fraction was found to be consistently corrected and significantly improved. However, this is the more important parameter since correlates with AVP and represents the net-volume of blood which remains stowed in the hold of the leg veins after exercise [251].

Interestingly, RVF was found in pathological values only if SF recurrence occurred.

Table I. Pre and postoperative APG parameters assessed in the surgical group. Grey cells describes postoperative parameters significantly different as compared to preoperative assessment (p < 0.001)

APG assessment	TV	VFI	EF	RVF
Preoperative	170 ± 54.6	6.7 ± 3.4	48 ± 12.5	40 ± 15.7
6 m. after surgery	**134 ± 44.1 (-25%)**	**3.0 ± 51 (-44%)**	57.0 ± 18.1	**29 ± 15.1 -31%**
3 y. after surgery	141 ± 42.5 (-16%)	5.35 ± 2.03 (-5.92%)	54.0 ± 14.3 (+12%)	**22.5 ± 14.7 -35%**
Ulcer recurrence	136.5 ± 6.3 (+2%)	7.9 ± 4.0 (+21%)	40.0 ± 14.1 (-24.5%*****)	**65.5 ± 6.3 +14%**

251 Zamboni P, Cisno C, Marchetti F, Mazza P, Fogato L, Carandina S, De Palma M, Liboni A. Minimally invasive surgical management of primary venous ulcers vs. compression treatment: a randomized clinical trial. *Eur J Vasc Endovasc Surg*. 2003 Apr;25(4):313-8.

252 Zamboni P, Cisno C, Marchetti F, Quaglio D, Mazza P, Liboni A. Reflux elimination without any ablation or disconnection of the saphenous vein. A haemodynamic model for venous surgery. *Eur J Vasc Endovasc Surg*. 2001 Apr;21(4):361-9.

270 :Zamboni P., M.G. Marcellino, L.Pisano, M. Cappelli, V. Bresadola, G. Vasquez, A. Liboni: Saphenous vein sparing surgery: indications, techniques and results. *J Cardiovasc Surg* 1998;39: 151-162

Duplex analysis of the pattern of recurrence is particularly interesting (Figure 11.10). We identified five different haemodynamic patterns of recurrences, differently distributed in the two treatment groups. The presence of combined patterns was the rule in the stripping group, while in the CHIVA group a single pattern of recurrence was more common.

1) ***Type 1 recurrence*** consists of sapheno-femoral recurrence. We found 2 patients out of 70 corresponding to 2.9% in the CHIVA group, and 3 patients out of 54, corresponding to 5.5 % in the stripping group (NS Student's t test).

2) ***Type 2 recurrence:*** consists of reflux coming from the pelvis, through a venous pathway located or in the groin or the perineum, with no associated sapheno-femoral reflux (21). This was present in 1/70 pts, 1.4 % in the CHIVA group vs 2/54 pts, 3.7 % in the Stripping group, NS (Student's t test).

3) ***Type 3 recurrence:*** consists of duplex ultrasound evidence of incompetent thigh perforators not present at the time of the first procedure. This development was not found after ten years in the CHIVA patients (0/70 pts, 0%); while in the Stripping group we have seen 4 patients out of 54 with this pattern (P value NS, Student's t test).

4) ***Type 4 recurrence:*** comprises reflux from the proximal saphenous vein (thigh section) to a varicose tributary. This was only found in the CHIVA group and it is typical of the saphenous vein sparing surgery (13/70 pts., 18.5 % in the CHIVA group vs 0/54 pts, 0% in the stripping group with P value <0.01, Student's t test).

5) ***Type 5 recurrence:*** consists of recurrences from varicose veins greater than 5 mm without any demonstrable escape points or change of compartments. This haemodynamic pattern, in contrast to the previous 4 patterns, is exclusive to the stripping patients and not found in the CHIVA group (0/70 pts, 0% in the CHIVA group vs 12/54 pts, 22% in the stripping group; P<0.01, Student's t test). All the

Duplex results with pattern of reflux in each group are given in figure 11.10.

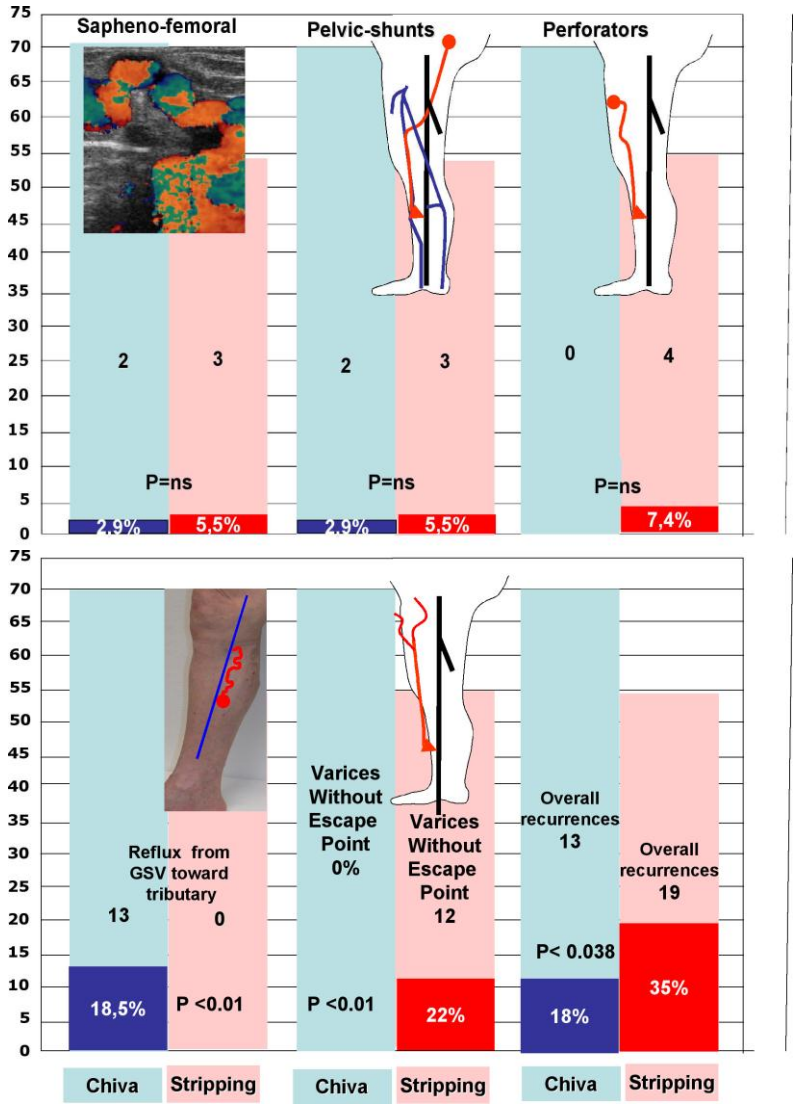


Figure 11.10. Pattern of recurrences after 10 years. Patterns of recurrences find respectively in the CHIVA and stripping group; number of cases and relative rate are reported. Type 1 compares SF recurrences; type 2 recurrences feed by pelvic reflux; type 3 recurrences from perforators. Type 4 reports recurrences due to reflux from the GSV toward a varicose tributary; type 5 varicose veins greater than 0.5 cm in the absence of any detectable reflux point. The last section of the figure summarized total number of patients with recurrences, and the relative rate in both groups.

The main difference between the two groups after 10 years, is the 22% of newly formed varicose veins found in the stripping group, without any detectable reflux point. We believe that this type of recurrence is attributable to the lack of a draining saphenous system [66]. The maintenance of drainage seems to be a decisive factor in avoiding neo-angiogenesis after varicose vein surgery. This observation is confirmed when CHIVA treatment is not correctly performed leading to post-operative GSV thrombosis and occlusion. A non-draining GSV, despite conservative surgery, increases the number of recurrences in comparison to draining GSV systems [45,47,55,270

Duplex analysis of the pattern of recurrence is particularly interesting (Figure 11.10). We identified five different haemodynamic patterns of recurrences, differently distributed in the two treatment groups. The presence of combined patterns was the rule in the stripping group, while in the CHIVA group a single pattern of recurrence was more common.

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Duplex results with pattern of reflux in each group are given in figure 11.10.

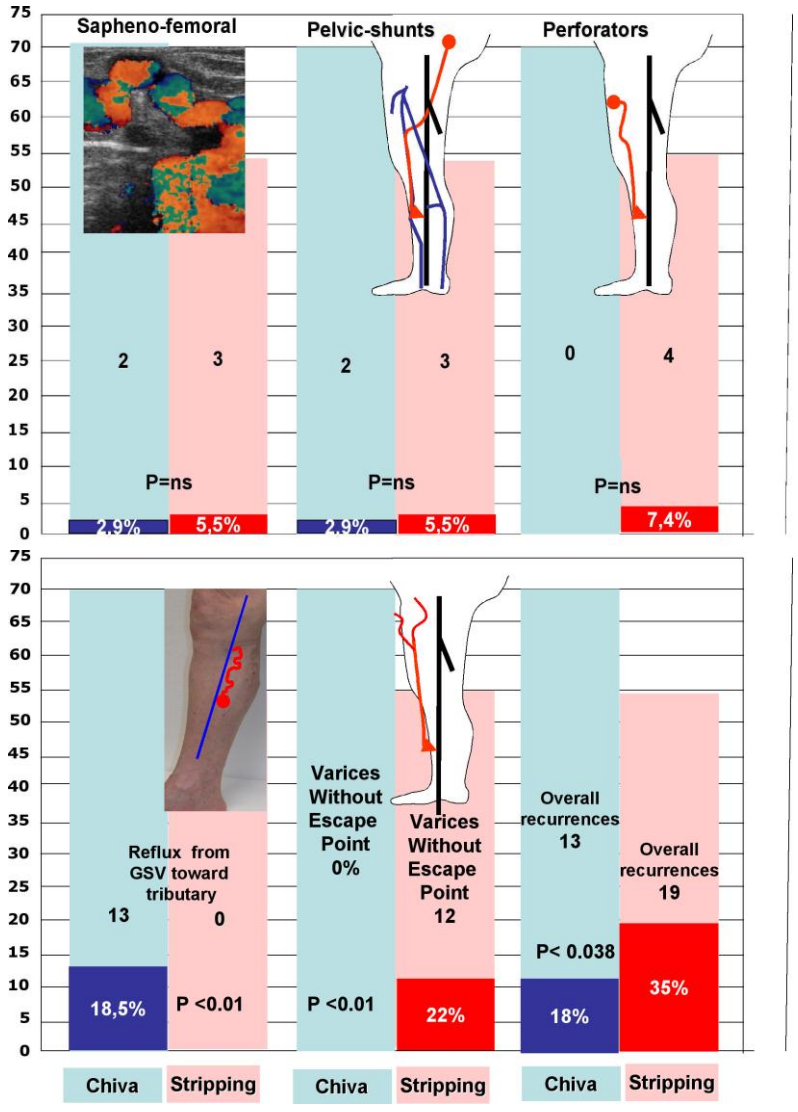

Figure 11.10. Pattern of recurrences after 10 years. Patterns of recurrences find respectively in the CHIVA and stripping group; number of cases and relative rate are reported. Type 1 compares SF recurrences; type 2 recurrences feed by pelvic

reflux; type 3 recurrences from perforators. Type 4 reports recurrences due to reflux from the GSV toward a varicose tributary; type 5 varicose veins greater than 0.5 cm in the absence of any detectable reflux point. The last section of the figure summarized total number of patients with recurrences, and the relative rate in both groups.

The main difference between the two groups after 10 years, is the 22% of newly formed varicose veins found in the stripping group, without any detectable reflux point. We believe that this type of recurrence is attributable to the lack of a draining saphenous system [66]. The maintenance of drainage seems to be a decisive factor in avoiding neo-angiogenesis after varicose vein surgery. This observation is confirmed when CHIVA treatment is not correctly performed leading to post-operative GSV thrombosis and occlusion. A non-draining GSV, despite conservative surgery, increases the number of recurrences in comparison to draining GSV systems [45,47,55,270