CHIVA REVIEW

CHIVA cure and sclerotherapy

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Abstract Sclerotherapy is, by definition, a destructive treatment and, as such, it is conceptually long far away from the basic principles of the conservative hemodynamic cure for venous insufficiency (CHIVA cure). Accordingly, Phlebologists and Vascular Surgeons who practice the CHIVA cure at most acknowledge the use of sclerotherapy after the CHIVA cure for the aesthetical refinement or for the control over time of small calibre recurrences. However, intraoperative sclerotherapy can be used in association with the CHIVA cure in those cases in which the surgical gesture foreseen by the CHIVA cure would not be able to flush disconnect escape points at the level of the deep venous system and, as a consequence, it would leave non-draining stumps, which are a source of recurrences. Further, under some particular circumstances, sclerotherapy can be used instead of the CHIVA cure for the treatment of type II shunts or as the 1st step of the CHIVA 2 strategy for the treatment of type III shunts. This paper describes the use of intraoperative sclerotherapy for the treatment of escape points from the deep venous system difficult to treat by surgery, such as perforator veins, some anatomic presentations of the saphenous-popliteal junction and some pelvic shunts. This paper also describes the use of sclerotherapy alone for the treatment of type II shunts or for modelling saphenous hemodynamics in type III shunts before completing the treatment by surgery.

Keywords CHIVA cure, sclerotherapy, perforator veins, saphenous-popliteal junction, pelvic shunts.

Introduction

This report addresses the intriguing, and somehow contradictory, question on whether and how sclerotherapy, which is basically a destructive treatment, can be used in the context of the conservative hemodynamic cure for venous insufficiency (CHIVA cure)[1].

Intuitively, sclerotherapy can be used after the CHIVA cure for the aesthetical refinement, i.e. for the treatment of those vessels that have been correctly disconnected but that are still visible, or to control over time the occurrence of small calibre recurrences due to the natural evolution of the varicose disease. However, under some particular circumstances, which will be described further below, sclerotherapy can also be used instead of, or in association with the surgical gestures foreseen by the CHIVA cure.

The aim of the CHIVA cure is to reduce the trans-mural pressure in the incompetent venous network ensuring, at the same time, a good flow in the preserved saphenous trunk, which originates from tributaries and represents the tissue drainage[1]. To achieve this goal, the CHIVA cure entails planning a strategy, i.e. the choice of the disconnection points of the incompetent superficial venous network able to produce the desired result, and implementing a tactic, i.e. the choice of the technical procedure able to carry out the planned strategy[2,3].

Surgery is currently considered as the best tactic means to carry out the CHIVA strategy. It allows to perform venous disconnections exactly where they need to be done and, mainly, to perform the ligation of the incompetent tributary flush with the competent vessel, which avoids leaving non-draining stumps. This type of stump is, in fact, a source of recurrences as blood stasis within the stump triggers an inflammatory response, due to leukocyte adhesion and activation, which results in neo-vascularization.

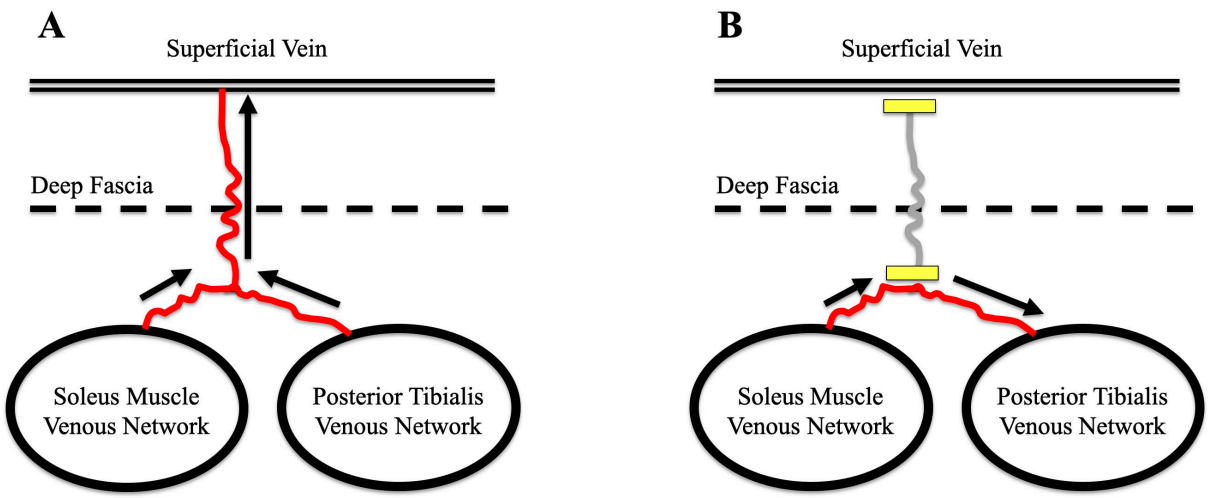

Figure 1

Fig. 1 shows a multitroncular incompetent perforator vein located in the context of a pump collector connecting the posterior tibialis venous network to the soleus muscle venous network (A). The sub-fascial ligation of the perforator vein flush with the collector (B) does not interrupt the collector and preserves the drainage of the soleus muscle venous network into the posterior tibialis venous network.

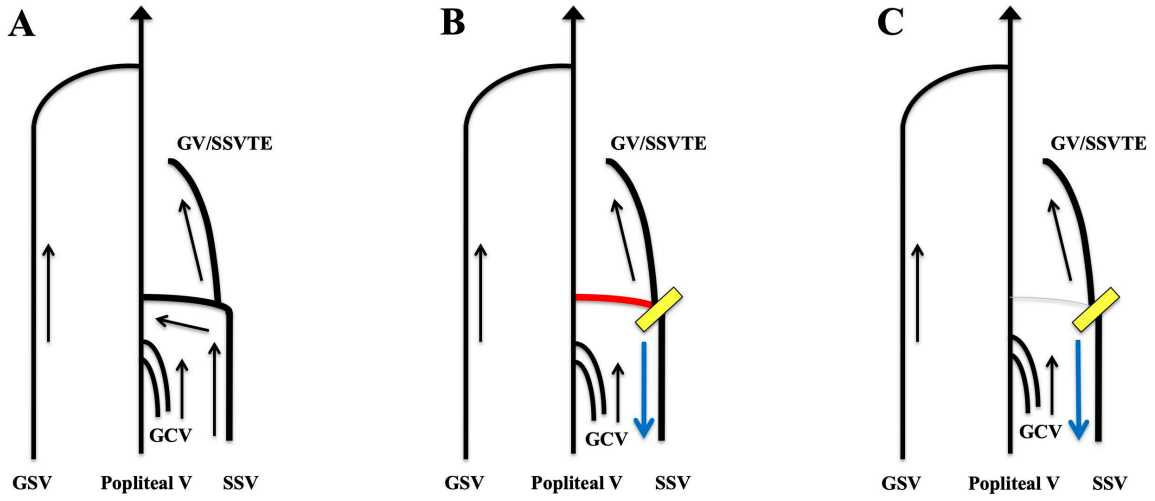

Figure 2

Fig. 2 shows the anatomy of the saphenous-popliteal junction with the physiological upward drainage of the convex side collaterals and with the direct outlet of the gastrocnemius veins into the popliteal vein (A) and the effects of the classical procedure foreseen by the CHIVA cure alone, which results in a non-draining stump (B) or associated with intraoperative sclerotherapy, which results in stump fibrosis/closure (C). GSV, Greater Saphenous Vein, SSV, Smaller Saphenous Vein, GV/SSVTE, Giacomini's vein or SSV Thigh Extension, GCV, Gastrocnemius Veins.

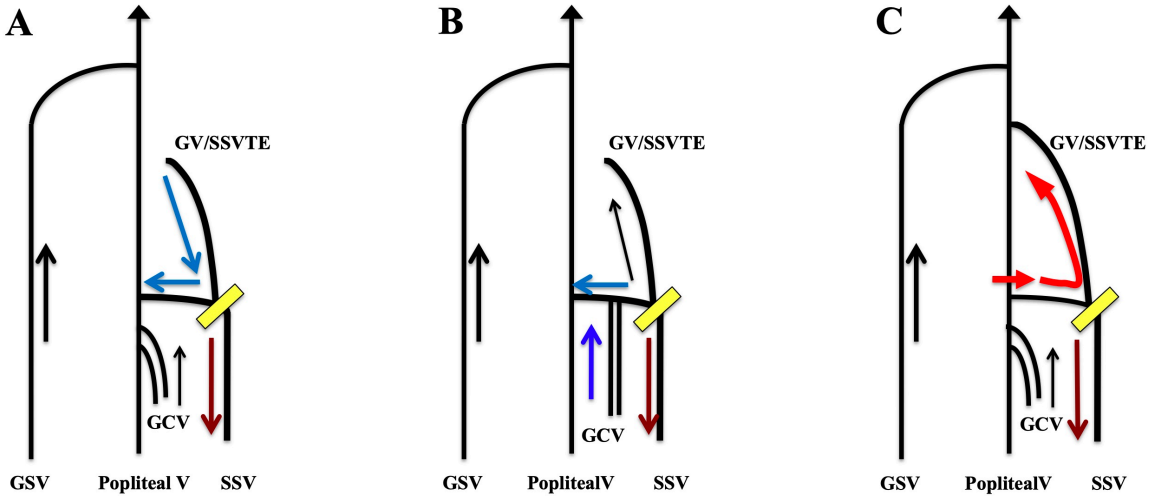

Figure 3

Fig. 3 shows the three circumstances under which the classical procedure foreseen by the CHIVA cure results in a draining stump. A – The incompetence of a collateral of the convex side of the saphenous-popliteal junction; B – The common outlet of gastrocnemius veins and of the shorter saphenous vein into the popliteal vein; C - The presence of a vicarious shunt involving the saphenous-popliteal junction and one collateral vein of the convex side. GSV, Greater Saphenous Vein, SSV, Smaller Saphenous Vein, GV/SSVTE, Giacomini's vein or SSV Thigh Extension, GCV, Gastrocnemius Veins.

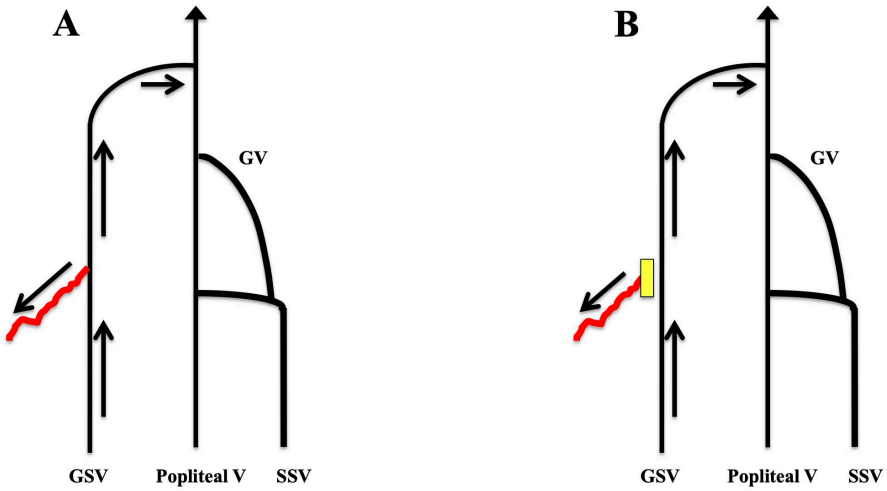

Figure 4

Fig. 4 shows a type II shunt (A) and its treatment (B), which can be performed either by surgery or, under special circumstances, by sclerotherapy (see text for technical details). GSV, Greater Saphenous Vein, SSV, Smaller Saphenous Vein, GV, Giacomini's vein.

Moreover, the increase of the venous calibre at the level of the stump on one side it reduces the speed and increases the pressure, and on the other it induces the formation of vortexes, both further contributing to neo-vascularization As a consequence, the use of sclerotherapy instead of, or in association with surgery is indicated in all those cases in which the flush ligation of the escape point is not easily viable and there is a consistent risk of leaving non-draining stumps.

Sclerotherapy is a chronic, iatrogenically induced inflammatory process. When using liquid sclerosing agents, sclerotherapy extends flush with the junction of the original deep vein without involving it, thanks to its high flow which immediately dilutes and removes the sclerosing agent. The limitation of sclerotherapy is the possible recanalization of the treated vessel: however, when the calibre of the recanalized vessel is small, due to the parietal fibrosis induced by the inflammatory process triggered by the sclerosing agent, it may not be a problem.

In fact, the volume of the reflux, which, obviously, occurs only in the presence of a re-entry point, is decreased so that the hydrodynamic energy is also decreased. As a consequence, both the axial and the lateral components of the hydrodynamic energy are reduced, so that, provided the extra-venous pressure remains unchanged, the trans-mural pressure is also reduced. This, along with the decreased compliance of the venous wall due to the fibrosis, will further reduce the tendency to dilatation of the treated vessel.

Hereafter, the circumstances under which the use of sclerotherapy can be considered as a tactic means in the context of the CHIVA cure

Escape points N1-N2 or N1-N3 difficult to treat by surgery.

Before addressing the treatment of escape points from the deep venous system, independent of the tactic means, it is worth reminding that escape points must not absolutely be treated when they are a part of a vicarious shunt, i.e. a shunt from the deep venous system to the superficial venous system with proximal re-entry into the deep venous system due to an obstacle to the flow in deep veins.

a) Perforator veins.

The choice between surgery and sclerotherapy, alone or associated with surgery, depends on whether or not incompetent perforator veins are centred on the saphenous trunks, on the length of the subfascial course and on the type of their multitroncularity. Perforator veins are, in fact, the main collectors of a widespread trans-compartmental network which accounts for the fact that most perforator veins are multitroncular.

Perforator veins not centred on the saphenous trunks are treated by sclerotherapy, carefully evaluating the contiguity of the perforating artery and/or the proximity of nervous structures.

In the case of perforator veins centred on the saphenous trunks, sclerotherapy must avoid the extension of the sclerosing agent into the saphenous veins, so that before sclerotherapy the perforator vein must be surgically disconnected from the saphenous trunk.

With regard to the length of the subfascial tract, for instance, the surgical disconnection of a hunter perforator flush with the femoral vein entails the displacement of the sartorius muscle and the opening of the vastus-adductor membrane. As this is a quite invasive surgical gesture, sclerotherapy should be used instead. On the contrary, short direct perforator veins can be easily treated by surgery, particularly in thin patients.

Even the ligation of each branch of a multitroncular perforator vein flush with the deep venous system entails an invasive surgical gesture, so that, as a general rule, multitroncular perforator veins are treated by sclerotherapy. There is, however, a relevant exception, i.e. when the multitroncular perforator vein is located in the context of a pump collector connecting the posterior tibial veins network to the veins of the soleus muscle[4]. In this case the sub-fascial surgical disconnection of the perforator vein allows to perform a ligation flush with the collector, which absolutely must not be interrupted. [fig. 1]

Intraoperative sclerotherapy must be performed using liquid sclerosing agents as mousses slow down the wash out of the sclerosant agent by the deep venous flow, increasing the risk of deep venous thrombosis[5,8]. Once the sclerosing agent has been injected, the limb must be actively and passively mobilized and antithrombotic prophylaxis for 7 days must be prescribed

b) Saphenous-popliteal junction

The tributaries of the convex side of the saphenous-popliteal junction, i.e. the Giacomini's vein and the thigh extension of the smaller saphenous vein, physiologically drain upward and the gastrocnemius veins flow directly into the popliteal vein [fig. 2-A].

As a consequence, the classical surgical procedure foreseen by the CHIVA cure, i.e. the ligation of the saphenous arch distally with respect to the confluence of collaterals, will leave a non-draining stump [fig. 2-B], unless at least one tributary of the convex side of the saphenous-popliteal junction is incompetent and shows a downward flow able to adequately drain the stump [fig.3-A] [6-8].

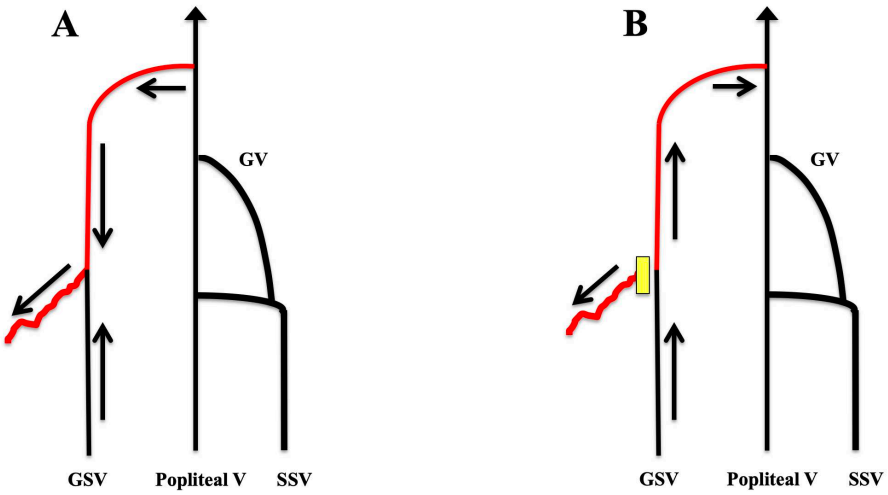

Figure 5

Fig. 5 shows a type III shunt (A) and the 1st step of the CHIVA 2 strategy (B), which can be performed either by surgery or, under special circumstances, by sclerotherapy (see text for technical details). GSV, Greater Saphenous Vein, SSV, Smaller Saphenous Vein, GV, Giacomini's vein.

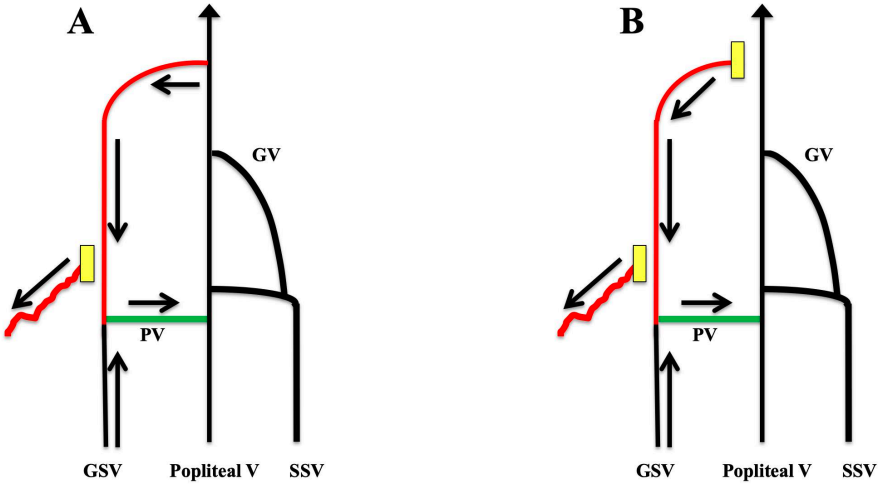

Figure 6

Fig. 6 shows the 2nd step of the CHIVA 2 strategy. Once the type III shunt has been transformed into a type I shunt (A), the saphenous-femoral junction can be disconnected (B). GSV, Greater Saphenous Vein, SSV, Smaller Saphenous Vein, GV, Giacomini's vein, PV, re-entry Perforator Vein centred on the GSV.

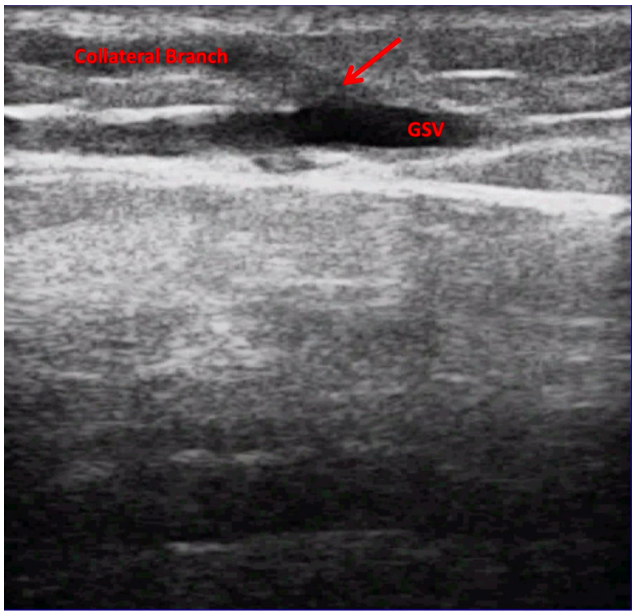

Fig. 7 shows the sclerosis of a collateral branch flush with the Greater Saphenous Vein (GSV) using a high viscosity dry mousse.

Other circumstances under which the classical surgical procedure foreseen by the CHIVA cure can be performed without leaving a non-draining stump are those cases in which the gastrocnemius veins and the smaller saphenous vein show a common outlet into the popliteal vein [fig. 3-B], and those cases in which a vicarious shunt involves the stump and one tributary of the convex side of the saphenous-popliteal junction [fig. 3-C].

In the absence of the aforementioned circumstances that are able to ensure a drainage of the stump, the surgical procedure should foresee the disconnection of the saphenous-popliteal junction flush with the popliteal vein to avoid leaving a non-draining stump.

Such a surgical gesture may not always be easily viable, given the great anatomic variability of the smaller saphenous outlet into the popliteal vein, with a consistent risk of deep venous thrombosis and neurological damage, due not only to a direct lesion of a nerve, but also to the presence of scar tissue, given the richness of innervation in the area. Accordingly, there is a strong indication for associating an intraoperative sclerotherapy with a liquid sclerosing agent to the classical procedure foreseen by the CHIVA cure [fig. 2-C]. That way, stump recanalization occurs very seldom and in most of the cases the stump disappears over time.

Even in this case, intraoperative sclerotherapy must be performed using liquid sclerosing agents as mousses slow down the wash out of the sclerosant agent by the deep venous flow, increasing the risk of deep venous thrombosis[5]. Once the sclerosing agent has been injected, the limb must be actively and passively mobilized and antithrombotic prophylaxis for 7 days must be prescribed.

Pelvic shunts

The choice between surgery and sclerotherapy depends on the site of the escape point[9], on the calibre and the rate of flow of the shunt and on the degree of tortuosity of the vessels connected with the escape point.

With regard to the site of the escape point, upper and lower gluteal points and the clitoral point must be exclusively treated by sclerotherapy. In the case of a shunt with small calibre, with low rate of flow and with tortuous vessels, sclerotherapy with a liquid sclerosing agent will be adequate to perform the sclerosis flush with the escape point, as these vessels are very sensitive to the action of sclerotherapy.

An aggressive sclerosis should be avoided as it results in an excessive acute inflammatory reaction that delays the evolution towards the chronic inflammation which is essential to obtain the fibrosis of the vessel[10].

Sclerotherapy for the treatment of type II shunts or for modelling saphenous hemodynamics in type III shunts.

Type II shunts are those venous-venous shunts in which an incompetent tributary originates from the greater saphenous vein that shows a competent saphenous-femoral junction [fig. 4-A]. In these cases, the aim of the CHIVA cure is simply to disconnect the incompetent branch from the saphenous trunk. [fig. 4-B]

Type III shunts are those venous-venous shunts in which the saphenous-femoral junction is incompetent and the re-entry perforator vein is located along the course of the incompetent tributary [fig. 5-A] In these cases, the CHIVA cure foresees a two-step strategy (CHIVA 2)[11], in which the 1st step consists in the disconnection of the incompetent tributary [fig. 5-B] and is aimed at re-modelling the saphenous hemodynamics by promoting the development of a re-entry perforator vein centred along the course of the saphenous trunk. In other words, the 1st step of the CHIVA 2 strategy is aimed at transforming a type III shunt into a type I shunt [fig. 6-A]. Once this goal has been achieved, the 2nd step of the CHIVA 2 strategy, which consists in the disconnection of the saphenous-femoral junction, can be performed [fig. 6-B].

In both the aforementioned circumstances, when the incompetent tributary shows a small calibre, is tortuous or originates deeply, particularly in adipose limbs or in limbs with cellulitis, the use of sclerotherapy can be considered. As the incompetent tributaries are connected with the main trunk, the action of the sclerosing agent must not involve

the saphenous vein but, at the same time, sclerosis must be flush with the saphenous vein to avoid leaving non-draining stumps. The procedure, to be performed under ultrasound guide, must be very careful as the injection must be calibrated until the arrival of the sclerosing agent flush with the saphenous vein, without any further progression into the saphenous trunk. The sclerosing agent must be a dry mousse with small, homogeneous polygonal bubbles and hence with a high viscosity of viscose-elastic type, able to result in a high resistance to the progression of the flow with consequent slowing of the progression speed [12, 13]. That way, by using small discontinuous injections along with dedicated intra-procedure compression techniques, it is possible to drive the mousse flush with the saphenous vein, without entering the saphenous trunk [fig. 7].

Finally, a few notes on the use **sclerotherapy after the CHIVA cure** for **controlling over time small calibre recurrences** or for **aesthetical refinement**.

The CHIVA cure makes the hemodynamics of the preserved saphenous trunks stable over time as it produces an increased flow in the re-entry perforator vein and, sometimes, the development of further re-entry perforator veins along the course of the saphenous trunk, so that recurrences occur seldom. In any case, small calibre recurrences due to the natural evolution of the varicose disease can be treated by sclerotherapy using the same technique described for the treatment of type II and type III shunts.

Aesthetical refinement concerns those vessels that have been correctly disconnected but are still visible after the CHIVA cure. Actually, the huge majority of disconnected vessels are no more visible a few months after the procedure, due to the reduction of the trans-mural pressure produced by the procedure and to the use of elastic compression after the intervention. However, those vessels that have developed a peri-vascular fibrosis before the CHIVA cure, whose course is visible with the limb in elevated position, i.e. with the vessel collapsed, tend to remain visible over time, even if with a reduced calibre. In these cases, a “mild” sclerosis with a liquid sclerosing agent will be able to fix the aesthetic problem. Of course, in the case the vessel to be treated somehow communicates with a re-entry point located in the saphenous trunk, once its course has been identified and marked on the skin, an assistant must apply a digital compression to occlude the saphenous trunk during the sclerotherapy procedure to prevent the sclerosing agent from entering the saphenous vein.

As a general rule, whenever any sclerotherapy treatment is performed, it is essential to apply an eccentric compression with the addiction of an elastic compressive device, either bandage or socks.

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