

Andreas M. Lazaris and George Geroulakos

Abbreviations

ASVAL	Ambulatory selective varices ablation under local anesthesia
CFV	Common femoral vein
CHIVA	Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire
GSV	Great saphenous vein
HL	High ligation
SFJ	Saphenofemoral junction
SPJ	Saphenopopliteal junction
SSV	Short saphenous vein
VVs	Varicose veins

Clinical Pearls

1. Consider open ligation and stripping of large saphenous veins with size ≥ 25 mm at the junction.
2. To prevent recurrence after open surgery, all branches close to the saphenofemoral junction and draining into the femoral vein should be ligated.

3. To prevent cutaneous nerve injuries, avoid stripping the distal portions of the veins in the calf region.

History

The history of treatment of lower limb varicosities goes back thousands of years. The papyrus of Ebers at about 1550 BC mentioned varicose veins, but the authors described against operation [1]. The first illustration of a varicose vein was discovered in the Acropolis of ancient Athens back to the fourth century BC. It was supposed to be a gift from Lysimachides to the hero-physician Amynos. However, Hippocrates did not recommend excision of the varicose veins; instead, he suggested compression after multiple punctures. Later (25 BC to 15 AD), Roman physician Celsus wrote a medical document describing ligation surgery and the surgical excision of varicosities, as well as their possible complications. A few years later, the Greek physician Galen described a technique similar to the saphenous stripping. In his technique varicosities were directly irritated by a hooked tool wire, aiming to extract as much of the vein as possible.

The era of surgical treatment of varicose vein disease begins at the end of nineteenth century when Friedrich Trendelenburg [2] performed the first ligation of the great saphenous vein (GSV)

A.M. Lazaris, MD, FACS, FEBVS (✉)
G. Geroulakos, FRCS, DIC, PhD
Department of Vascular Surgery, Attikon University Hospital, National and Kapodistrian University of Athens, 1, Rimini Str Haidari, Athens 12462, Greece
e-mail: andreaslazaris@hotmail.com;
amlazaris@med.uoa.gr; g.geroulakos@imperial.ac.uk

with a transverse incision in the middle of the thigh. The Mayo brothers [3] thought about the additional benefit of the excision of GSV additionally to its ligation and accomplished it with a long incision from the groin to the knee. This concept was improved, in terms of lesser wound injury, by the introduction of the endovenous stripping by Babcock [4], which allowed a complete excision of the GSV from the ankle to the groin. Later on, Homans [5] described the ligation of GSV on a higher level close to the saphenofemoral junction (SFJ). Additionally, to GSV excision, phlebectomies with large incisions in the area of varicosities became the gold standard. Later on, a few refinements of the procedure were presented. The invagination stripping claimed to reduce the perivenous bleeding during GSV excision. In 1966 Muller [6] described the stab or hook or mini-phlebectomies through tiny skin incisions using specially designed hooks and forceps that offered better cosmetic results. This allowed the ambulatory phlebectomies done under local anesthesia in an office-based setting. In the twenty-first century, new less invasive techniques have been introduced leading to thermal or nonthermal ablation of the GSV, aiming to minimize the operative trauma and permit an almost instant mobilization of the patient with minimal cosmetic defects. Although the current guidelines propose the ablation techniques as the first treatment option of the superficial vein incompetence, open techniques remain an excellent solution, their proper use offering great and long-standing results.

Pathophysiology

The development of varicose veins is historically based on the descending theory. According to the descending theory, reflux begins at the saphenous junctions and progresses downward through the saphenous axes leading to venous hypertension and subsequently wall dilation and dilation of tributaries which become varicose veins [7]. Various studies have shown various anatomical defects in patients with varicose veins such as lower number of valves or alterations in structure of valves [8]. Nevertheless, various publications challenge the

descending theory, mainly based on duplex and clinical data suggesting the concept of ascending or multifocal evolution of varicose veins. According to this concept, progression of the disease begins in subcuticular veins, outside the saphenous compartment, creating a dilated and refluxing venous network. When this network becomes large enough, it creates a filling effect in the saphenous vein, leading to decompensation of the saphenous vein wall, moving on to reflux of the saphenofemoral or saphenopopliteal junction [7].

Based on the different pathophysiologic approaches, two different treatment philosophies exist. Based on the descending theory, the high ligation (HL) usually with main vein stripping, followed by phlebectomies, is suggested. Based on the ascending pathophysiologic concept, saphenous sparing techniques such as the ambulatory selective varices ablation under local anesthesia (ASVAL) method and the Cure conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire (CHIVA) method have been proposed.

Indications

Varicose vein surgery using either endovenous or open techniques is indicated in the following situations:

1. Symptomatic venous insufficiency (leg pain associated with varicosities, leg pain and heaviness after prolonged standing, leg edema)
2. Complications related to varicose vein disease (lipodermatosclerosis, leg ulceration of venous etiology, superficial thrombophlebitis, history of bleeding from the varicosities)
3. Cosmetic reasons

However, there are conditions that the endovenous techniques are contraindicated. In these cases open surgery has a primary role. These situations include:

1. The distance of the target vein (GSV, SSV) from the skin is less than 1 cm, or adheres closely to it, or it is not possible to create a 1 cm zone between the vein and the skin with

the tumescent anesthesia. In these cases, the risk of skin thermal injury during thermal ablation is increased.

2. Dilated or aneurysmal saphenous vein greater than 2.5 cm, as they may not ablate effectively increasing the risk of local thrombotic complications with the endovenous techniques.
3. Tortuosity of the GSV or partial occlusion of the GSV not allowing the advance of endovenous ablation catheter. In these cases, the rigid stripper can more easily pass through the occlusion, and in cases this is not possible, the ligation of the saphenofemoral junction and phlebectomies may be appropriate.
4. The presence of a large visible saphenous varix adjacent to the SFJ greater than 2 cm in diameter. Such a saphenous vein cannot be treated by endovenous ablation as the technique spares the proximal 2 cm of GSV distal to the SFJ.
5. Acute thrombosis of the target vein, which increases the risk of thromboembolic events during the retrograde passage of the endovenous catheter. Additionally, thrombus reduces the effect of the endovenous ablation procedure.
6. Economic reasons related to the use of the disposable endovenous ablation systems.

Pitfalls and Danger Points

1. *Recurrence.* The most common reason for recurrence is an incomplete ligation of the GSV. To avoid this a complete dissection of the common femoral vein adjacent to the saphenofemoral junction is necessary. Apart from the branches directly from the GSV, all branches found from the CFV close to the GSV junction should be ligated. It is worth noting that there are reports in the literature supporting that overdissection of the groin region may result in neovascularization and thus recurrence [9]. Finally, inadequate preoperative duplex evaluation may not identify segments that contribute to venous reflux or the presence of a duplicate GSV that could be responsible for residual or recurrent varicosities.
2. *Nerve injuries.* Surgery of the superficial venous system may be complicated and this must always be kept in mind. The saphenous nerve accompanies the GSV along its way on the calf, and there is always risk of injury during stripping, especially when it involves the total length of GSV from the ankle to the groin [10]. Injury of the saphenous vein leads to sensory deficit to the medial lower leg and foot. Saphenous nerve injury may be prevented avoiding stripping the portion of the GSV at the calf region. Additionally, invagination stripping, as well stripping at a caudal direction from the groin to the calf, may decrease risk [10]. The sural nerve, respectively, is in low anatomic relation to the short saphenous vein. Careful dissection in the popliteal fossa and avoidance of stripping SSV to the ankle level may reduce the possibility of injuring. During the saphenopopliteal junction dissection in the popliteal fossa, several motor nerves may arise or course through, thus been susceptible to injury. These include the tibial nerve, the common peroneal nerve, and occasionally a low-lying sciatic nerve. Surgical magnification during short saphenous vein surgery may assist the surgeon on the recognition of the various anatomic elements. Finally, there is risk of injury of the common peroneal nerve during stab vein avulsions, especially on the lateral area of the calf close to the head of the fibula. Surgeon should be very cautious when performing hook phlebectomies in this area as an injury of the nerve may cause the dreadful complication of foot drop.
3. *Arterial injury.* Ligation and stripping of the posterior tibial artery has been reported when it is mistaken for the great saphenous vein at the ankle.
4. *Venous injury.* Ligation of the common femoral vein may occur if it is mistaken for the great saphenous vein. To avoid this the surgeon should always recognize apart the great saphenous vein and the common femoral vein superiorly and inferiorly to the saphenofemoral junction. An increased risk of venous injury and hemorrhage exists during reoperation in the groin area for local recurrence. This can be avoided by using the lateral approach to the femoral vein and saphenofemoral junction. Meticulous technique and surgical magnification are necessary prerequisites for a safe procedure.

5. *Great saphenous vein stump.* Ligation and division of the great saphenous vein leaving a substantial blind stump may lead to thrombus formation with risk of deep vein thrombosis and pulmonary embolism. A stump less than 0.5 cm long is considered safe.
 6. *Hematoma, extensive ecchymosis, and pain.* A diffuse ecchymosis and moderate hematomas are relatively common, especially on the route of the GSV and on the areas of phlebectomies. A piece of lidocaine- and epinephrine-soaked gauze attached to the vein stripper can be left in place temporarily to provide compression of avulsed tributary veins, absorb blood, and deliver epinephrine and anesthesia to the traumatized area. The gauze is then removed before wound closure. Invaginating, stripping, and compression bandaging may decrease their incidence. Special care must be given to the groin hematoma. A groin hematoma may be due to common femoral vein injury or slipping of ligatures but also to blood accumulating in the area from the saphenous canal after stripping. The latter may be avoided by closing the entrance to the canal in the groin with an absorbable suture just before the groin wound closure. In any case a low threshold for re-exploration must exist for quickly expanding groin hematomas.
 7. *Calf compartment syndrome.* This rare complication may exist after a very tight rapping of the calf at the end of the procedure. Thus, patient's toe capillary refilling time and toe sensation and motion must be always assessed after the procedure.
1. *Identification of the saphenofemoral or the saphenopopliteal junction.* This minimizes skin incisions and decreases the dissections during the procedure, improving the cosmetic result of the procedure.
 2. *Recognition of various anatomic variations.* There are lots of variations in the lower limb's superficial vein anatomy. GSV normally lies between the superficial and the deep fascia (saphenous sheath) all the way down to the upper third of the knee where it is divided in two major branches, the great saphenous vein going straight down to the medial malleolus and the posterior arcuate branch (vein of Leonardo), which lies more posteriorly on the medial aspect of the cuff. Occasionally, the GSV can come to a superficial level close to the skin just after a short distance into the saphenous sheath. The GSV may also be duplicated [11].
 3. *Identification of incompetent perforating veins.* This can facilitate their complete removal during the procedure, with a minimal skin incision.
 4. *Identification of the source of reflux in cases of varicose veins recurrence.* This is especially useful when the source is from the common femoral vein. Whether the reflux is from the CFV or not is crucial as it regards the proper treatment needed. Reflux from the CFV needs surgical treatment with ligation usually through a lateral approach while recurrent VVs without CFV involvement may be treated with simple phlebectomies or other less invasive techniques such as foam sclerotherapy.

Preoperative Duplex Ultrasound Scan

An ultrasound scan performed preoperatively either by the surgeon or by a technician in close communication to the surgeon is useful. The ultrasound scan is accomplished with proper marking of certain points of interest, which could be useful during the procedure. The benefits of the ultrasound scan are the following:

Nowadays, it is quite common to use a portable duplex ultrasound scan in the operating theater. It is a prerequisite in all types of thermal and nonthermal ablations, but it can be also used in open procedures. It can be used after phlebectomies for the identification of remnants of varicosities after the avulsions, achieving a better cosmetic result as well as reducing recurrent varicose veins.

Operative Procedure

Preoperative Vein Marking

Before the procedure it is necessary to skin mark the areas of varicosities as well as the points of the skin incisions. This is done with the patient on an upright position, using a permanent skin marker. There are various types of skin marking. We prefer marking the outline of the varicose veins, as well as the point of most emerging varicosities as the points of skin incisions (Fig. 7.1). To avoid any tattooing after skin incision, it is better not to make the skin incision exactly on the marked skin. To minimize the size of the groin incision, it is useful to also mark the point of saphenofemoral junction using the duplex scan, although SFJ is in a relatively stable anatomic location as opposed to the frequently varying location of the SPJ.



Fig. 7.1 Varicose vein preoperative skin marking: the outline of the varicose vein and the most emerging points are marked with a permanent skin marker

Great Saphenous Vein High Ligation

An oblique incision 3–4 cm long on the saphenofemoral crease is made, just above the saphenofemoral junction, as this has been defined with the preoperative ultrasound scan. If an ultrasound scan and a great saphenous vein marking have not been done before the procedure, the skin incision starts at the point of the femoral pulse and extends medially at a length of about 6–8 cm length. Using electrocautery, the subcutaneous tissue is divided. The superficial femoral fascia (saphenous fascia) is divided with the electrocautery as well. At this level a self-retainer retractor can be inserted across the skin incision under the fascial layers, and this usually reveals the great saphenous vein underneath, lying over the deep femoral fascia. Alternatively, a swab may be used to wipe away the adipose tissue from the great saphenous vein. Once the saphenous vein is identified, it is dissected free using forceps and scissors. A blunt grasp of the saphenous vein with the forceps facilitates its handling and dissection, minimizing the possibility of vein tear. Alternatively, two pairs of forceps can be used, one holding the vein and the other one grasping the surrounding tissues and pulling them away.

All the branches of the great saphenofemoral junction should be double ligated and divided, until the identification of the saphenous opening of the deep femoral fascia (fascia lata). Normally, there are six tributaries of the GSV close to its junction to the common femoral vein. However, this number may vary, and therefore it is necessary to dissect not only the GSV but the common femoral vein above and below the saphenous confluence. All the additional tributaries found directly from the common femoral vein should also be ligated. The common femoral vein can be clearly seen through the saphenous opening, and its course upward and downward underneath the fascia lata can be identified (Fig. 7.2). The recognition of the common femoral vein at the level of saphenofemoral junction “going up and going down” underneath the fascia lata should always precede the division of great saphenous



Fig. 7.2 SFJ dissection: note the common femoral vein is totally dissected and the GSV confluence is clearly seen

vein. This is a critical step during the procedure. It is possible, especially in thin patients where the subcutaneous tissue is minimal and when the saphenous junction lies on a lower level than the inguinal crease, to dissect straight the common femoral vein instead of the great saphenous vein. In this rare case, if the surgeon does not recognize correctly the anatomy, it can result in the catastrophic complication of dividing and stripping the femoral vein instead of the great saphenous vein. On the contrary, this will never happen if the three main venous components are identified: the common femoral vein “going up,” the common femoral vein “going down,” and the great saphenous vein “going anteriorly” above the fascia lata.

After the proper recognition of the great saphenous vein emerging from the common femoral vein, the surgeon may double clamp and divide the GSV. This can be done by inserting two vascular clamps, the first one at about 0.5 cm from the SFJ and the second one about 4 to 5 cm distally. The vein is divided with scissors, and

the proximal stump of the GSV is ligated with a 2.0 silk suture. We use to double-ligate the saphenous vein stump with a suture ligature 3.0 silk. This is achieved with a simple maneuver: when the surgeon ties the first knot of the GSV stump, the assistant releases temporarily the vascular clip, moves it 2–3 mm proximally, and reattaches this on the vein. Then, the surgeon may set the transfixion stitch under the vascular clip but at the same time above the first knot of the 2.0 silk suture.

Before going on to the next step, the surgeon must give a final look at the saphenous stump and around the CFV nearby. First, he/she must check whether the stitches are securely set on the GSV stump. Second, an inspection on both sides of the common femoral vein must be done laterally and medially. As explained previously, if any small branch directly from the common femoral vein is identified, it should be double-tied and divided. This is necessary when the branch is found on the medial side of the CFV as this can be a remaining branch of the SFJ, and this could be a reason for an early recurrence.

If only ligation of the SFJ and not stripping of the GSV is planned, the dissection should be extended caudally for about 10 cm to ensure division of any hidden tributaries, as lateral and medial accessory saphenous veins may enter the main saphenous trunk at a varying distance from the confluence.

GSV Stripping

The distal end of the divided GSV is grasped with two mosquito clips (Fig. 7.3) and the stripper is inserted. We prefer using a metallic Oesch® pin stripper although a plastic stripper can be used as well. Occasionally there is some difficulty in advancing the stripper due to the existing venous valves of the GSV, but with slight massaging on the skin over the stripper, the surgeon can assist the stripper go through the valves all the way down the GSV to the upper third of the calf. We usually avoid to get the stripper lower close to the ankle level for various reasons. First, the part of the GSV on the calf is usually competent; thus,



Fig. 7.3 After GSV division, its distal part is grasped with two pairs of hemostatic clips, ready to accommodate the stripper

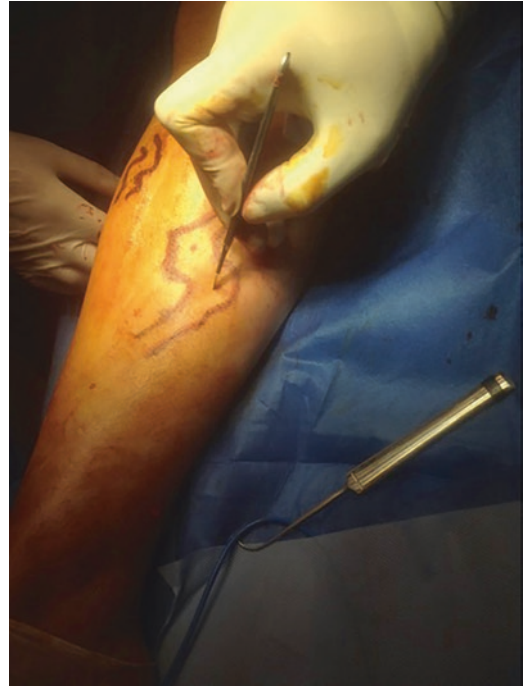


Fig. 7.4 Using a 11-blade a stab is made on the most emerging point of varicosities as it has been identified pre-operatively. Note the longitudinal direction of the skin incision. On the right one can see an Oesch® phlebectomy hook instrument

there is no need to remove it. In cases where the GSV is incompetent all way down to the ankle level, this part of the GSV can be stripped-out as well. Second, the saphenous nerve is in close relation to this part of the GSV, thus a stripping of this part of the vein could result in saphenous nerve injury, causing permanent sensory disturbances on the patient's medial part of the foot. Last but not least, the various perforating veins in the calf do not emerge from the GSV but instead from the vein of Leonardo; thus, a removal of this part of GSV would not offer the benefit of perforating veins removal (Fig. 7.4).

At the upper part of the calf, the stripper is taken out after a stab of the skin just above the end of the stripper. In case where a metallic stripper like the Oesch® pin stripper is used [12], the exit point of the stripper is clearly identified with a slight push of the stripper. In case where a plastic stripper is used, its end is palpated with the fingers and a stab is done just above it. Using a mosquito clip, the end of the stripper is grasped

usually together with the vein and pulled out of the skin. After the tip of the stripper is outside the skin, it is grabbed with heavy hemostatic forceps. Its proximal part in the groin is secured on the GSV with a heavy tie which is left as long as the length from the groin to the exit site of the stripper on the upper calf. Then, the stripper is pulled out distally. We prefer performing an eversion stripping as this can minimize the damage of the surrounding tissues of the vein, thus reducing the postoperative bleeding inside the saphenous canal. In case where the GSV is torn during stripping and there is a doubt whether it has been totally removed or not, a second stripper is tied on the long remnant of the heavy suture and passed again through the saphenous canal to the same exit point. In this case, we prefer performing a classic stripping using the suitable stripper head, avoiding another eversion stripping. After the GSV has been removed, the assistant pressures

the area of GSV canal using big surgical pads for about 5 min, to reduce any post-stripping intracanal hemorrhage.

Phlebectomies

Stab phlebectomies follow stripping. Using an 11-blade or even a 14G needle, small incisions are done at the more emerging points of varicosities. For better cosmetic results, the directions of the skin incisions must follow the Langer's lines (Fig. 7.4). Generally, the incisions should be longitudinal everywhere except the areas around joints, such as the knee or ankle, where they would better be transverse. Through the incision, a suitable vein hook is inserted and the vein is hooked (Fig. 7.5). To hook the vein, the surgeon performs a slight semicircular or circular motion; this varies depending on the specific instrument used. Special care should be taken to avoid hooking other elements than veins, such as muscle fibers, adipose tissues or more serious elements like nerves and arteries. After the vein is hooked,



Fig. 7.5 Using a specially designed vein hook, the vein is pulled through the tiny skin incision



Fig. 7.6 Using hemostatic clips the varicose vein is avulsed away from the skin

it is pulled out of the skin with slight small pendulum motions. When a part of the vein has been pulled out of the skin, it is grasped with a pair of forceps, and using subsequent forceps, the vein is pulled out of the skin as much as possible (Fig. 7.6). Finally, the vein either is totally removed or more often is torn with a part of it remaining in the leg. Obviously, it is the best to remove as many veins as possible and avoid leaving even small remnants. However, if the main tract has been removed, then usually, the remaining part is thrombosed and generally becomes invisible after the procedure. If there is continuous bleeding from the stab avulsion site after vein removal, then a slight local pressure for a couple of minutes will eliminate it. In case of persistent hemorrhage, a further exploration of the wound for remaining large venous branches using a hook is necessary. Perforating veins are removed using the same techniques. However, due to their connection with the deep vein system, persistent bleeding after vein removal may be noted. This is treated with local digital pressure for some minutes. Special attention must be paid on the

areas of possible damage of underlying anatomic elements. Mainly these are the area around the head of the fibula, on the upper lateral calf, where there is danger of damaging the deep peroneal nerve, a complication that can be devastating as it can lead patient to a drop foot. Similarly, care should be given on avulsions around the ankle area, where there is danger of damaging the posterior tibial artery (medially), the dorsalis pedis artery (dorsal area of the foot), or the sural nerve (laterally).

Closure

After saphenectomy and phlebectomies, the skin is closed. There are two types of wounds: the small phlebectomy wounds and the larger groin crosssectomy wound. Generally, the skin incisions for the phlebectomies do not require formal suture closure. Just using adhesive tapes like Steri-Strips of ¼" or ½" wide is sufficient (Fig. 7.7). The larger groin wound needs formal closure in two layers, first layer consisting of the superficial fascia with isolated 2.0 Vicryl sutures and the second layer consisting of the skin, either isolated skin stitches or usually with an absorbable continuous subcutaneous suture Vicryl 3.0. Before closing the superficial fascia, we prefer closing the opening of the saphenous canal, from within the wound using an absorbable 2.0 suture. This way we minimize the possibility of groin hematoma from any blood and clots coming to the groin from the saphenous canal, after the saphenectomy. After the skin is closed, the whole leg is cleaned and covered with either an elastic stocking up to the groin or wrapped by elastic bandaging to the same level starting from the foot. The elastic support of the leg is continuous for 2–3 weeks, the first week on a 24-h basis, and then only during the standing hours.

Post-procedure Care

After the procedure and for the first 3–6 h after the procedure, the patient is checked for three possible complications: bleeding from either



Fig. 7.7 No skin sutures are necessary. Skin adhesive tapes of ¼" or ½" wide can achieve a cosmetically satisfying skin closure

the groin or the phlebectomy sites, impaired perfusion of the foot, and altered sensation of the foot. When the bleeding exists on the areas of the skin avulsion, the limb can be wrapped with an elastic bandage, and the patient remains with the limbs elevated on 30–45° for 2–3 h. In case of bleeding from the groin, this can be treated with local pressure. However, due to a potential risk of any damage on the femoral vein, a low threshold for groin re-exploration may exist, especially in case of persisting hemorrhage or an expanding hematoma despite local pressure. Impaired perfusion or altered sensation of the foot may exist from severe wrapping of the leg with elastic bandaging. This can be treated with loosening of bandaging.

Generally, the patient is asked to mobilize as soon as possible and definitely within the day of the procedure. Most of the times, the procedure is performed as outpatient, and the patient can be discharged home a few hours after the procedure. After the procedure, our practice is to prescribe a low-dose aspirin for 5 days, until the patient is

considered as fully mobilized. Any removable stitches are removed 1 week after the procedure. The patients are instructed that bruises will remain for around 3 weeks after the operation and advised to be as mobile as possible.

Lateral Approach of the Saphenofemoral Junction

Occasionally, when there is recurrence of varicose veins due to reflux from the common femoral vein or from an existing saphenofemoral junction, a re-exploration of the groin incision may be necessary. In these cases, an approach through the previous incision may be annoying and even troublesome, as the recurrent varicosities may be fragile, and severe bleeding from the common femoral vein may exist. In the cases where a new exploration of the saphenofemoral junction is necessary, a lateral approach to the common femoral vein can be used [13–15].

A duplex scan must be performed before the procedure to ensure the existence of a reflux from

common femoral vein into a large vein branch or the saphenofemoral junction itself.

The incision is oblique, about 1–2 cm higher and parallel to the previous incision. This way, the scar tissue of the previous operation over the saphenofemoral junction can be avoided, thus minimizing the danger of a common femoral vein injury. The incision is carried out down to the external oblique muscle aponeurosis, the lower border of which forms the inguinal ligament. Just below the inguinal ligament, the common femoral artery can be palpated. The common femoral vein is dissected on its lateral border, and the common femoral vein is recognized and dissected free. By using a Farabeuf retractor and with careful sharp dissection, the common femoral vein is dissected downward until the saphenofemoral junction or the refluxing branch is visualized (Fig. 7.8). Careful dissection is followed around the branch which is double tied and divided. This maneuver must be done carefully and as precisely as possible to avoid injury on the femoral vein. If the femoral vein inadvertently gets injured, this can be

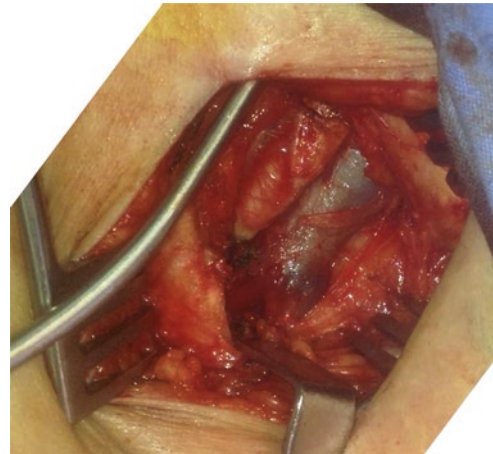
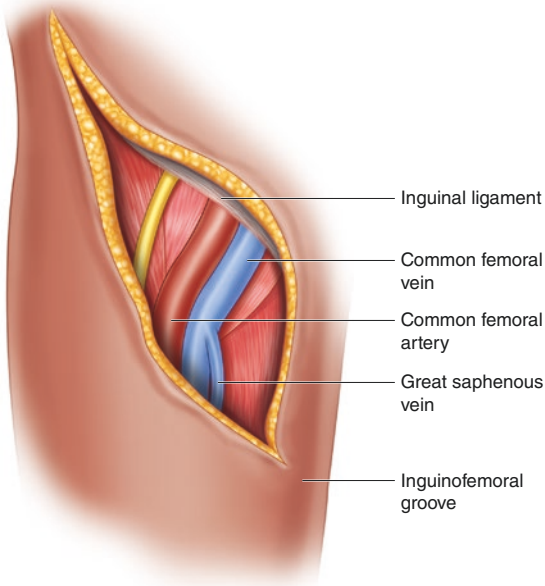


Fig. 7.8 Lateral approach to the common femoral vein. Through an oblique incision about 1 fingerbreadth above the inguinofemoral groove, the CFV and the GSV are

found, medial to the common femoral artery, just below the inguinal ligament

repaired primarily with a 5.0 prolene suture. Following the ligation of the large femoral branch, phlebectomies of any varicose veins are performed with the described technique of stab avulsions. The femoral wound is closed in two layers (subcutaneous and the skin). Occasionally a relatively extensive dissection is necessary during this procedure, which can result in injury of lymphatic vessels. As a consequence, a varying degree of lymphedema can be observed after the procedure in about 30% of the patients, a complication that must have been explained to the patient in advance. A class II knee stocking (22–25 mm Hg) for at least 3 months may be used to reduce the edema. Alternatively, to the oblique incision, a longitudinal incision along the course of the femoral artery can be done, but the cosmetic result lacks this of the oblique incision. Following the skin incision, the femoral vein is dissected free, and the saphenofemoral junction or any other refluxing branch is identified and ligated.

Small Saphenous Vein Incompetence

When incompetence of the small saphenous vein is responsible for the varicose vein, a saphenopopliteal disconnection is necessary. A duplex scan is always necessary before the procedure as there is significant variation at the level of the junction in the popliteal fossa. Duplex scan can identify precisely the location of the SPJ, which must be marked on the skin with permanent dye. The course of the small saphenous vein is close in relation with the sural nerve which must be always identified and preserved. Also, deep vein branches from the soleus muscle may emerge from the short saphenous vein at a higher level than the femoropopliteal junction, as well as an existing saphenofemoral vein (Giacomini vein). These branches must be recognized and securely divided before the ligation of the saphenopopliteal junction.

Position

We prefer performing the procedure with the patient in a prone (face-down) position although a supine position can also be used.

Incision

A transverse incision is done at about 2 finger-breadths below the saphenopopliteal junction as this has been defined using the preoperative duplex scan. The superficial fascia is incised, and the short saphenous vein is identified. The vein is carefully dissected from the surrounding tissues ensuring that the sural nerve which adheres to the vein is not injured. The vein is divided between two hemostatic clips. The proximal stump of the small saphenous vein is carefully dissected using Metzenbaum scissors and a pair of forceps down to the saphenopopliteal junction. All the vein branches are divided after proximal and distal ligation. The gastrocnemial veins and the Giacomini vein, if present, are similarly divided. The popliteal vein should be recognized inside the popliteal fossa, and the small saphenous vein should be doubly ligated at a distance of about 0.5 cm from the junction.

It is not necessary to strip the small saphenous vein at its total length. A full stripping puts in danger the sural nerve especially at the area of the lateral ankle. Alternatively, we prefer to excise a long segment of the small saphenous vein around 10 cm in length after it has been visually dissected away from the sural nerve. After the mobilization of the abovementioned length of the SSV, a deep stab incision is made at the level of distal mobilization and a closed hemostatic clip inserted from the point of stab incision toward the popliteal wound taking care to avoid the sural nerve. The proximal end of the divided end of the SSV is grasped and taken out from the stab wound. There the SSV is ligated and divided. This way, a long enough segment of the SSV is excised eliminating the risk of recanalization, and injury of

the sural nerve from blind stripping is avoided. The procedure is completed with phlebectomies of all varicosities using the stab avulsion technique described above.

Closure

Special care is taken to securely close the fascia, using an absorbable 2.0 suture. If the popliteal fascia is not sutured properly, a hernia in the popliteal fossa may develop later, leading to an annoying bulging on the area. Stab avulsions are usually closed using Steri-Strip adhesive tapes, while the popliteal wound skin is closed with a subcuticular suture. After the procedure, the patient is rotated in the supine position on a different operating table and the limb is wrapped with elastic bandages from the toes to knee. The patient is mobilized after recovery from anesthesia and can be discharged typically the same day.

Other Surgical Approaches

Ambulatory Selective Varices Ablation Under Local Anesthesia (ASVAL) Technique

The ASVAL method consists of phlebectomies with the preservation of the saphenous trunk. This method is based on the concept of ascending or multifocal evolution of varicose veins. An abolition of GSV reflux using this treatment concept has been described in 50% of patients that received ASVAL in a prospective study, with a significant reduction of GSV diameter and an improvement in quality of life [16].

Cure Conservatrice et Hemodynamique de l'Insuffisance Veineuse en Ambulatoire (CHIVA)

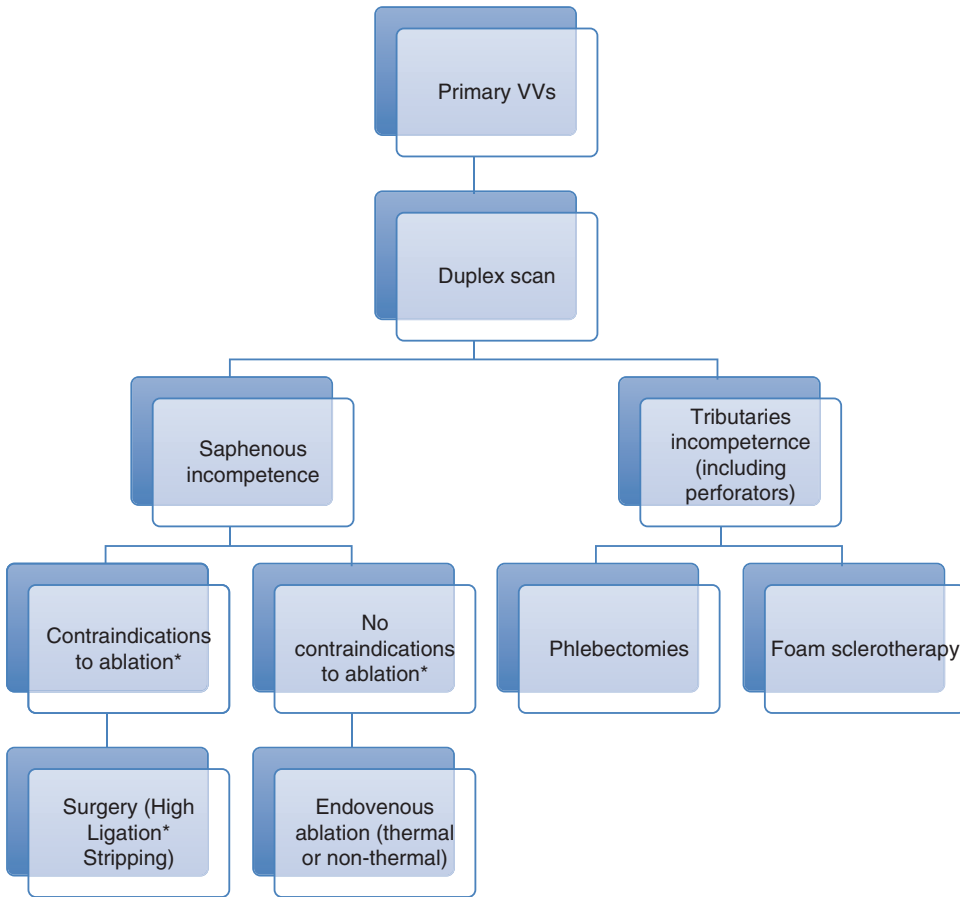
CHIVA is a surgical technique that aims to improve hemodynamics of the superficial venous network by interrupting the column of hydrostatic

venous pressure at strategic levels. The points of interruption are located on a precise preoperative vein duplex evaluation and involve either the main venous trunk or its tributaries. The procedure is supposed to achieve finally a well-drained superficial venous system with high flow and low pressure [17].

Role of Open Procedures in the Endovenous Era: Treatment Algorithm

The incorporation of the various endovenous techniques in the treatment of the superficial vein incompetence has limited the space for the open techniques. According to the Clinical Practice Guidelines of the European Society of Vascular Surgery, the thermal ablation techniques primarily (laser, radiofrequency) and the nonthermal ablation techniques secondarily (foam sclerotherapy; mechanochemical ablation, MOCA; and cyanoacrylate glue ablation) have been proposed as the main treatment options [7]. Nevertheless, open surgical procedures (high ligation with or without stripping and phlebectomies) still remain an equal alternative. It is worthy of note that a recent review from the Cochrane Database [18] which includes 13 trials and 3081 randomized patients emphasized that foam sclerotherapy, radiofrequency ablation, and endovenous laser ablation are at least as effective as surgery in treatment of great saphenous vein incompetence. Based on published data, the surgical option seems a consistent and logical approach, and this should be obvious as part of treatment guidelines [19]. Additionally, as described previously, there are specific situations where the ablation techniques cannot be used. In these cases, the standard surgical treatments remain a prudent alternative. Based on current guidelines, suggested treatment algorithms of the primary and recurrent superficial vein incompetence are presented in Figs. 7.9 and 7.10.

For the primary varicose vein disease (Fig. 7.9), the duplex scan will reveal whether



VVs: Varicose Veins

* **Contraindications to ablation:** A. Excessive tortuosity of the target vein (GSV or SSV) not allowing the passage of the catheter. B. Inability to create a layer of at least 1 cm between the target vein and the skin. C. Vein diameter > 2.5 cm. D. Acute target vein thrombosis. E. Economical reasons

Fig. 7.9 Treatment algorithm of primary varicose vein disease

there is an axial (GSV or SSV) reflux together with reflux of the corresponding proximal junction or not. If axial reflux is confirmed, a closure or stripping of the main target vein (GSV or SSV) is mandatory, with the open techniques left for the cases when the ablation techniques are contraindicated. For the local varicosities, stab mini-phlebectomies or sclerotherapy can be used alternatively.

The scope of traditional open surgery for the management of recurrent varicose veins has been significantly limited by the development of the

endovenous techniques. However, in the unusual circumstances where the endovenous techniques are either unavailable or contraindicated, a re-exploration of the groin with a modified technique through the lateral approach may be considered [20]. Such circumstances can be due to the occurrence of a large single lumen recurrent varicosity directly from the common femoral vein, or the presence of a large varix at the level of SFJ, and generally the situations where endovenous techniques cannot be used due to the significant risk of complications. As it regards the

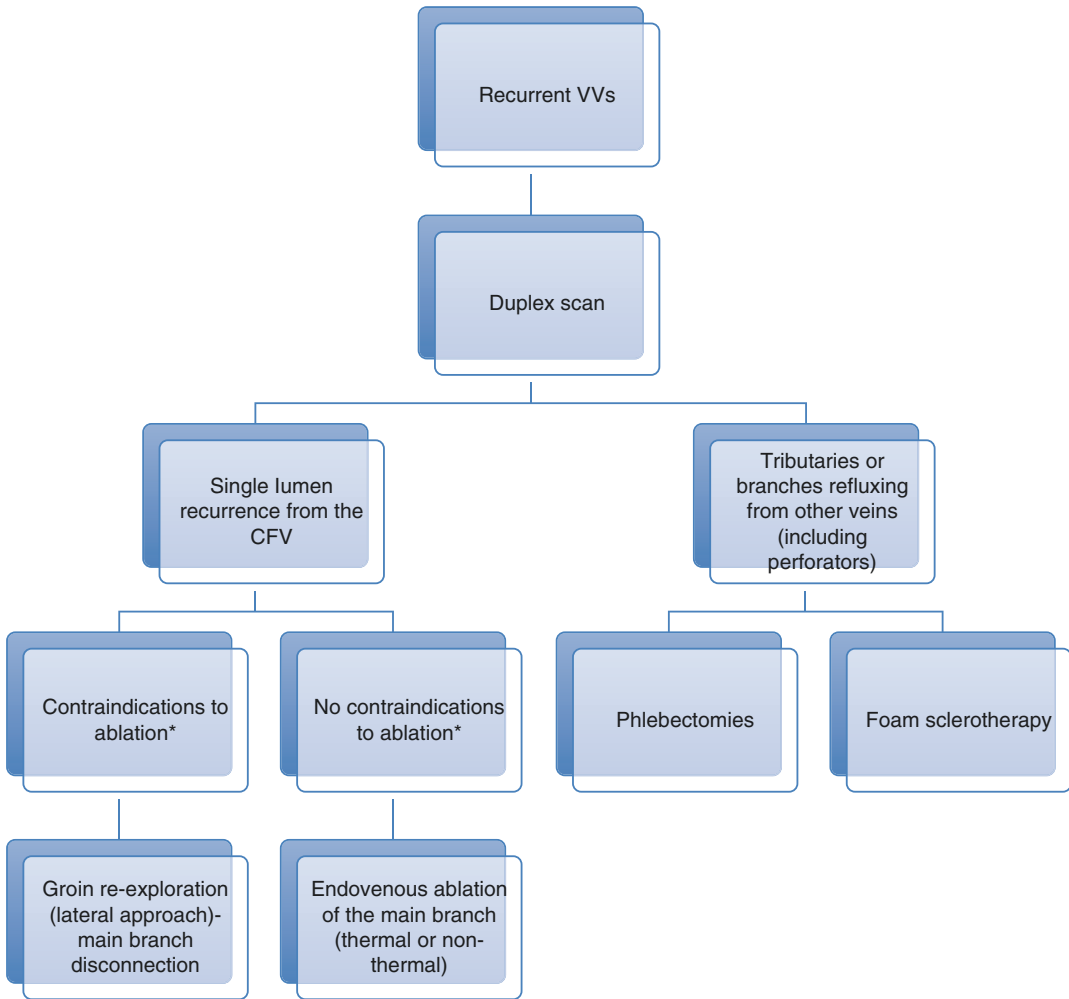


Fig. 7.10 Treatment algorithm of recurrent varicose vein disease

recurrent tributaries, recurrence from the popliteal vein or from perforator veins should be treated either with foam sclerotherapy or phlebectomies (Fig. 7.10).

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