38 Treating incompetent perforating veins

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A venous leg ulcer (VLU) represents a serious problem in our society because of its high frequency and huge impact on the quality of life (QoL) of the people suffering from it. Studies show that chronic venous disease (CVD) is present in 5% to 39% of the general adult population and 63.9% of them have important clinical manifestations.[1] A 1.5% of the general population suffers or has suffered from a VLU.[2] The relationship between incompetent posterior tibial perforating veins (IPTPVs) and skin damage of the leg has been recognized for a long time.

The perforating veins (PV)s connect the superficial with the deep venous system and usually flow from the posterior accessory saphenous vein (PASV) to one of the posterior tibial veins (PTVs). There are other PVs that are also related to skin damage such as the lateral gastrocnemius PV, medial gastrocnemius PV, soleus PV or anterior tibial PV; but their frequency is much less than the PTPVs. There are many PVs along the extremity, but they do not have the same clinical importance.

Enthusiastic surgeons, once they understood the relationship between leg PVs and VLUs, they spared no efforts in treating them. Over time many techniques were adopted. From large incisions in the leg, dissecting the fascia for direct ligation of PVs even with big dissections of the skin and fascia, to direct or blinded subfascial ligation, assisted by optical fiber or with laparoscopy, sclerotherapy or other possibilities. All methods were the result of the creativity of the surgeons at that time. The biggest problems were the recovery time and the secondary discomfort due to the invasiveness of the procedures. Similarly, fascia resections produced a negative effect on the function of the calf muscle pump. Finally, although it was possible to heal the leg ulcer after a long period, the cosmetic results were unfavorable. These were even worse than the results obtained with a medical healing of the ulcer. In many cases, the autologous grafts applied to the bed and the granulation obtained after skin and fascial resection were lost because of the condition of the tissues.

The increase of percutaneous endo-ablation systems of the PVs, the development of high resolution ultrasound (US) ideal for detecting structures of the leg and modern compression systems for VLUs or treated patients have allowed us to obtain excellent results with minimal invasion. Therefore, patients experience, fewer side effects and minimal recovery time since these procedures are performed in a simple and ambulatory way and with great ease and comfort for the patient.

The analysis of the venous anatomy, its adjacent structures and the blood flow by duplex US have allowed us to design highly specific treatments with minimal invasion, largely due to the accurate diagnostics and the optimal visualization during the procedures.

The PVs thermo ablation, powered by radiofrequency (RF) is one of the least minimally invasive and simplest techniques to date. The fulfillment of the procedure requires a radiofrequency generator (RFG), a bipolar catheter, duplex US and a lot of practice.

The history of the RF catheter for treatment of the IPVs started in 2005 when Chang and associates [3] presented to the society for clinical vascular surgery (SVCS) four configurations for a RF catheter showing their initial results. The following year, Lumsden *et al.*[4] presented to the same society a bigger number of cases showing their method and their results. Other researchers continued with this treatment.[5-8] The long term results of RF have also been presented.[9]

The author's group started early percutaneous thermo ablation with LASER, and subsequently changed the method to RF. Their experience and analysis of the results, led them to perform a slightly different technique to the traditional procedure.

The author's radiofrequency experience

The catheter consists of a semi rigid shaft with a bipolar electrode, a hub with lumen for flushing, a

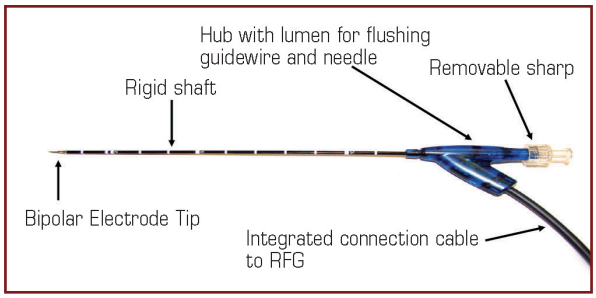

FIGURE 38.1 - Structure of the catheter.

guide wire and needle, a removable sharp and an integrated cable to RFG. The structure of the body is semi rigid, which greatly favors the mobilization of the vein to solve the problems produced by the venous anatomy; it is even feasible to manually model its structure, prior to the introduction, to fit the anatomy in the best possible way (Figure 38.1).

The device is a bipolar system, delivering energy from one electrode to the other. Treatment consists of applying a 85 ºC stimulus inside the vein to occlude it by damaging the wall. The system allows one to measure and maintain the set temperature by modifying the power. In addition, it measures the impedance, which is an extremely useful source to evaluate the status of the vein, thus having an objective measurement of the result of the treatment.

I. The patients are classified according to the C of the CEAP classification. In the past the author treated mainly C_5 and C_6 patients. However, currently the criteria are extended and patients ranging from C_2 to C_6 are included.

II. The second key element for the treatment of the IPVs of the leg is the assessment with duplex US. With this test the aim is to define:

1. incompetence of the PTV, which is defined by the time of reflux ≥500 msec and a diameter of ≥3.5 mm or more;
2. its origin and drainage, usually from the PASV of the leg draining into the PTVs;
3. its condition of direct PVs or recirculation and its degree of participation in some venous shunts;
4. the "surgical anatomy" of the vein in order to design a strategy optimizing the results, including prediction of technical difficulties.

Generally the most frequent presentation corresponds with a PV from the PASV of the leg which ends in the PTV developing an inverted arch. This entails adopting certain strategies that facilitate the treatment. For example the fact that, for right handed surgeons, it is advisable to catheterize on the left side of the patient from proximal to distal. The procedure is performed in an outpatient basis, with local tumescent anesthesia and is duplex US guided.

Tips and tricks specifically related to the procedure:

1. does not require general blood sample testing since it is performed under local anesthesia. The patient should be asked about allergies. Does not require fasting. On the contrary normal eating habits are recommended as well as standard drug regimen, thus avoiding blackouts or metabolic decompensation. The procedure must be explained in detail to the patient to reassure him or her.
2. The patient should be positioned at a 30° anti-Trendelenburg and should be comfortable and under ambient room temperature. Clorhexidine 2% is used for antisepsis.
3. An anesthetic papule is done with a 50% solution of 2% lidocaine and 8.4% sodium bicarbonate with a 27 G needle avoiding contact with the PV in order not to cause venous spasm.
4. The puncture is done with the catheter bevel up and from cephalic to caudal if the tributary is proximal, or from caudal to cephalic in the rare cases where the vein comes from distal. In the case of tortuous anatomy, it is recommended to shape the catheter previous to its introduction according to the venous morphology that is found. In case of a venous spasm it is feasible to slightly transfix the top wall of the vein, lift it with the tip of the needle and then insert the rest of the needle. This manoeuvre no doubt requires high resolution duplex US. It is very important considering that the catheterization of the vein should include as much of the tributary vein as possible, thus closing a substantial segment of the vein. This may be limited by the tortuous anatomy, the proximity of the PV to the skin or the deep venous system. It is always preferable to puncture the skin in the healthiest site possible so as to avoid skin lesions, which will cause an additional problem with management difficulties. Fortunately the RF catheter is long enough to access the vein from a reasonable distance (Figure 38.2).
5. Once the catheter is positioned according to the strategy designed by analyzing the duplex US, tumescence is done with Klein solution using a 21 G needle above and under the vein in order to separate it from the deep veins and skin and to obtain the desired anesthetic effect for which no more than 40cc is needed. Similarly, it is essential to collapse the vein through the tumescence so that its walls are in intimate contact with the RF catheter. According to the recommendations in the vascular literature, the time of thermo abla-

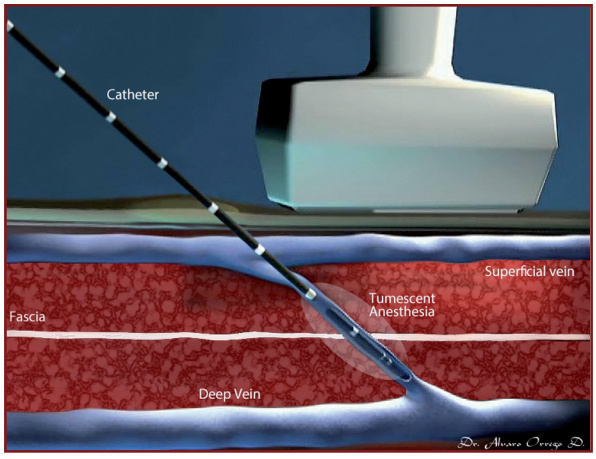

FIGURE 38.2 - Procedure.

tion is 1 minute in each centimeter of the vein, but the author prefers to be guided by the impedance; when it reaches 150-350 Ohms it indicates that the wall is damaged, that being the signal for advancing the catheter. The procedure is repeated cm by cm guided by the marks on the catheter. It is of great importance to respect the margins of safety in the procedure, which consist of a distance of 0.5 cm from the skin and 0.5 cm distance from the deep venous system veins. In this way the possibilities of deep venous system injuries or skin damage are reduced (Figure 38.3).

6. Once the procedure has been completed the punctured skin is protected with an adhesive film dressing with non-adherent pad, taking care not to apply it widely over the area of lipodermatosclerosis and avoiding any skin lesion. Usually the film dressings are soaked with blood from the tumescence; this situation should be explained in detail to the patient so that he is not disturbed. It is possible to remove the dressings the next day.
7. After finishing the procedure a class 2 graduated elastic compression (GEC) stocking is applied, which should be worn for 2 weeks in cases without any skin damage and at least 6 months for cases with skin damage.
8. The author does not use antithrombotic drugs because he relies on the procedure's minimal invasion, early ambulation and the use of GEC stockings.
9. The author checks the patient clinically and with US at 1 week and 3 months after the procedure. The treated and adjacent veins are examined with US in order to confirm the occlusion of the PVs and the status of the PTVs.
10. Two weeks after the procedure is done the author starts treatment of the incompetent superficial veins belonging to the anomalous circuit. Remember that the ITPVs are not isolated, but are part of a circuit so complex and extensive that it produces a large impact in the local hemodynamics of the leg and can have as serious consequences as VLUs. For the treatment of superficial veins, foam sclerotherapy with 0.5% polidocanol is used. The author avoids phlebectomies, unless the quality of the skin is excellent.

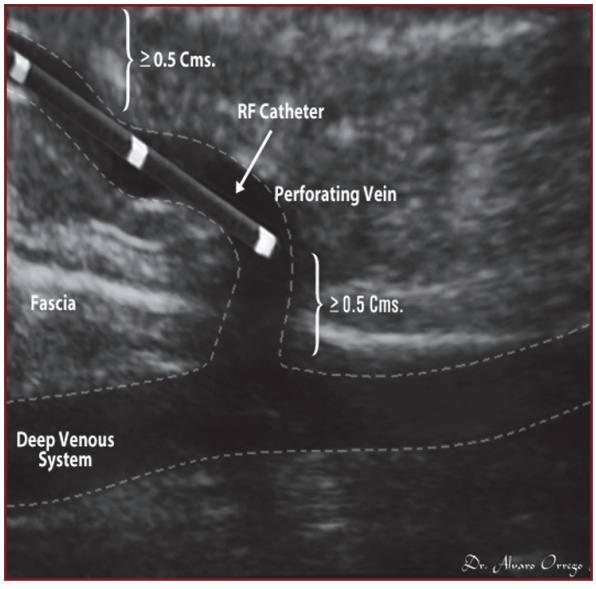

FIGURE 38.3 - Safety margins.

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