Current techniques to treat pathologic perforator veins

Kathleen Ozsvath, MD,[a] Eric Hager, MD,[b] Michael Harlander-Locke, MPH,[c] Elna Masuda, MD,[d] Steve Elias, MD,[e] *and* Ellen D. Dillavou, MD,[f] *Albany, NY; Pittsburgh, Pa; Bradenton, Fla; Honolulu, Hawaii; Englewood, NJ; and Durham, NC*

Pathologic perforating veins have become an interest to the venous specialist caring for patients with CEAP 4 to 6 disease. Historically, open perforator ligation and then subdermal endoscopic perforator ligation was described. These methods had clear shortcomings. More recently, thermal ablation techniques, including radiofrequency ablation and laser ablation, have been described. Ultrasound-guided sclerotherapy has also been used as a possible means to treat pathologic perforator veins. This report describes and summarizes the updated techniques to treat perforating veins in a challenging patient population. (J Vasc Surg: Venous and Lym Dis 2016;■:1-4.)

Venous disease is underdiagnosed and undertreated worldwide. Although advances in ablation techniques effectively treat axial venous disease, patients with advanced venous disease (CEAP class 4 to 6) can be difficult to treat. Current Society for Vascular Surgery and American Venous Forum guidelines are summarized in Table I.

Pathologic perforating veins are known to play a role in advanced venous disease.[1] Linton[2] initially described open perforator ligation, a procedure that proved to be morbid, painful, and ultimately unsuccessful for functional recovery in many patients. Subfascial endoscopic perforator surgery was a less invasive method to interrupt perforators with lower morbidity but without significant success at healing ulcers.[3] Subfascial endoscopic perforator surgery has a steep learning curve, and more distal pathologic perforators at the malleolar level can be hard to access.

Newer techniques, including thermal ablation and ultrasound-guided (USG) sclerotherapy, have emerged as techniques to treat pathologic perforator veins. This facilitates ulcer healing and decreases recurrence while overcoming some of the negative aspects of previous options.[4,5] Ablation and injection techniques fall under the general category of percutaneous ablation of perforators.[6] This report describes those techniques in detail. All patient images were obtained from the authors with the written, informed consent of patients.

From the Division of Vascular Surgery, Albany Medical College/Albany Medical Center Hospital, Albany[a]; the Division of Vascular Surgery, University of Pittsburgh Medical Center, Pittsburgh[b]; the Lake Erie College of Osteopathic Medicine, Bradenton[c]; the John A. Burns School of Medicine, Division of Vascular Surgery, University of Hawaii, Honolulu[d]; the Division of Vascular Surgery, Englewood Hospital and Medical Center, Englewood[e]; and the Division of Vascular Surgery, Department of Surgery, Duke University Medical Center, Durham.[f]

Author conflict of interest: K.O. is on the Medtronic Physician Advisory Board and the Speakers Bureau. E.M. is on the Pfizer, Bristol-Meyer Squibb, and Janssen Speakers Bureaus. S.E. is on the Medtronic Scientific Advisory Board. E.D.D. is a consultant for BTG Corp.

Correspondence: Ellen D. Dillavou, MD, Vascular Surgery, Duke University Medical Center, Durham, NC 27710 (e-mail: ellen.dillavou@duke.edu).

The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2213-333X

http://dx.doi.org/10.1016/j.jvsv.2016.10.085

TECHNIQUES

Radiofrequency ablation of refluxing perforator veins in the lower extremity. A radiofrequency ablation (RFA) catheter (Medtronic, Minneapolis, Minn; Fig 1) is available specifically to treat perforator disease. This 6F, 12-cm rigid catheter is packaged mounted on a stylet that can be used to directly puncture a perforating vein, or the catheter can be advanced over a 0.035-inch guidewire. The patient is placed in an appropriate position to access the vein, and the leg is sterilely prepared from the toes to the hip. Duplex ultrasound imaging is used to identify the incompetent perforator(s) to assess the optimal access point before local anesthesia is infiltrated. For any perforator closure, ultrasound mapping is a difficult and key step to procedural success. Time should be taken to ensure that the optimal venous angle and visualization is achieved.

The rigidity of the RFA stylet makes navigation of tortuous veins difficult, and therefore, the goal should be to access a straight, shallow portion of the perforating vein (Figs 2 and 3). Local anesthesia is injected in the skin, and a trocar and stylet are introduced as a unit. Most patients with venous ulceration can be treated successfully with access through the wound or tangentially through healthier skin. The trocar is removed after puncture, and the stylet is advanced within the perforator to 1 to 2 mm below the fascia. Intravascular access is confirmed with the aspiration of blood. The entire perforating vein is then surrounded with lidocaine under USG. Copious anesthesia should be infiltrated in the angle between the perforator and the deep veins to push the deep veins away from the treating catheter tip to minimize the chance of vascular or nerve injury. It is often useful to have an assistant stabilize the catheter and watch the infiltration of anesthesia under USG because the catheter can become dislodged if not protected. Each quadrant (0°, 90°, 180°, and 270°) of the perforator is treated for 30 to 45 seconds while radial pressure is applied against the vein (Fig 3).

Table I. Current Society for Vascular Surgery and American Venous Forum guidelines for treatment of perforating veins[a]

Patient selection (all should apply)	• CEAP 4, 5 or 6 disease localized to area near perforating vein
	• Axial reflux treated
	• Failed compressive management
Diameter	>3.5 mm at the fascia
Reflux	>0.5 seconds

[a]There is currently no support perforator ablation in CEAP 1 to 3 disease.[1]

The energy used peaks at ~30 W and is generated by the machine to reach the target temperature of 120°C. During treatment the appropriate impedance (<400 Ω) is monitored to ensure that the catheter is not covered in coagulum and that it is still intravascular. If impedance rises, the catheter may be rotated and restarted. If impedance is still high, a wire can be passed into the catheter under USG to ensure that the catheter is in good position and to clear the tip.

The catheter is withdrawn 1 to 2 mm, and the perforating vein is treated at this level in the same manner. Once the entire perforating vein has been treated, usually at two to three levels, the catheter is removed, gentle pressure is held for 30 to 60 seconds, and compression is applied. The treated vein is no longer visible. The direct puncture technique requires a facile interventionalist because multiple unsuccessful attempts with this relatively large catheter can cause spasm in the perforator and make access difficult or at times impossible.

Veins that are smaller or tortuous may require alternate techniques for RFA ablation. Before the procedure, a sterile angled hydrophilic 0.035-inch wire can be cut to a length of ~18 inches that will be used to navigate the difficult anatomy. After infiltration with lidocaine, the vein can be punctured with a standard 19-gauge needle and the angled hydrophilic wire advanced through the needle into the perforating vein. Ideally, the tip of the wire is positioned into the deep system, and a 2-mm skin incision made. The tract is dilated with a 6F or 7F dilator. The catheter is then advanced

Fig 1. The ClosureRFS Endovenous Radiofrequency Ablation Stylet. (Courtesy of Medtronic, Minneapolis, Minn. Used with permission.)

Fig 2. Insertion of the radiofrequency ablation (RFA) stylet through the fascia into the perforating vein.

over the wire to the fascial layer. The wire is removed, and the ablation procedure can be performed as outlined above.

Endovenous laser ablation of perforator veins. Endovenous laser ablation of perforator veins has also been described.[7] The technique is similar to RFA. Unlike RFA, many laser fibers can be used for ablation and can be advanced through a 5F sheath once access has been obtained using the Seldinger technique, as described for RFA. There is a laser fiber that uses a 400-nm flexible fiber (Angiodynamics, Latham, NY; Fig 4). The following procedure description uses that catheter.

The patient is prepared as described for RFA. The vein is accessed with a 21-gauge needle. An 0.018-inch guidewire is placed through the needle, the needle is removed, and the 4F micropuncture sheath is advanced. The wire and dilator are removed, and the 400-µm fiber fits through the sheath and is advanced within it. Once in position, the compression clamp engages with the Luer hub on the sheath. The fiber is then unsheathed. A simpler method is to use a 21-gauge micropuncture needle to access the perforator and then to pass the 400-µm fiber directly through the needle (Fig 4).

Once the fiber is in place inside the perforator vein, the needle is withdrawn above the skin to minimize skin damage by heat conduction through the needle. Lidocaine is administered surrounding the perforator, leaving the tip of the laser fiber in the appropriate position, 1 to 2 mm below the fascia layer. If using an 810-nm laser wavelength, the laser is enabled at 15 W