

Duplex Examination before, during, and after Saphenous Vein Ablation: How to Do It and How Helpful It Is

NOTES

Jose I. Almeida, MD, Miami, FL; Jeffrey Raines, PhD, Miami, FL

Duplex ultrasonography has changed the landscape of venous disease. Color flow duplex imaging, has enabled the accurate evaluation of chronic venous disease (CVD) and enhanced our understanding of its development.¹⁻⁴ Reflux is most often a local process that develops in any part of the lower limb venous system, particularly in the superficial veins and in the below-knee segment of the GSV. This suggests reflux is characterized by ascending progression, multicentric progression, or both, in addition to or separate from gravitational retrograde development.⁵

It should be emphasized that ultrasound technicians are often unfamiliar with superficial venous anatomy and its many variations. The treating physician must therefore be self-sufficient with duplex scanning techniques and recognize the nuances of venous anatomy prior to entering the endovenous arena.⁶ Caggiati and Min and colleagues have written comprehensive reviews of contemporary venous nomenclature,^{7,8} which was standardized at a consensus conference in Rome.

A normal GSV is typically 3 to 4 mm in diameter and ascends from the medial ankle along the anteromedial aspect of the calf, knee and thigh to terminate at the saphenofemoral junction (SFJ). The GSV is usually contained within the saphenous compartment, which is bounded superficially by a hyperechoic saphenous fascia and deeply by the muscular fascia. Visualization of this fascial envelope is an important landmark in identifying the GSV with duplex ultrasonography. Accessory saphenous veins are venous segments that ascend parallel to the saphenous veins. They may exist anterior, posterior, or more superficial to the main saphenous trunk. The small saphenous vein (SSV) originates in the lateral foot and passes posterolaterally in the lower calf. The SSV lies above the deep fascia in the midline as it reaches the upper calf, where it pierces the two heads of the gastrocnemius muscle and enters the popliteal space. In approximately two-thirds of patients, the SSV drains entirely into the popliteal vein just above the knee via the saphenopopliteal junction (SPJ). In as many as one-third of patients, the cranial extension of the SSV drains into a posterior medial tributary of the GSV or directly into the GSV (vein of Giacomini) or into a deep vein in the thigh via a perforator.

Duplex imaging is critical to establish vein competency and is the best method for evaluating reflux in individual vein segments. Retrograde flow of blood is identifiable using pulsed-wave Doppler or color-flow duplex. The cutoff value for reflux in the superficial veins, deep femoral veins, and deep calf veins is > 500 ms. However, the reflux cutoff value for the femoropopliteal veins should be > 1,000 ms. Outward flow in the perforating veins should be considered abnormal if > 350 ms. Reflux testing in patients in the supine position should be avoided, and should be performed only in standing patients.⁹

Intraoperatively, duplex ultrasonographic imaging is used for percutaneous venous access, catheter placement and positioning, and placement of tumescent anesthesia.

Postoperatively, duplex scans should be obtained at 2 days, 1 month, 6 months, and annually to ensure adequate vein closure and absence of deep vein thrombosis. Ultrasonic disappearance of the GSV trunk marks complete vein wall involution. There is no tendency to recanalize once this stage is reached.

Since duplex imaging plays a vital role for preoperative planning, intraoperative treatment, and postoperative follow-up treating physicians should not rely on studies performed at outside laboratories.

References

1. Neglèn P, Raju S. A comparison between descending phlebography and duplex Doppler investigation in the evaluation of reflux in chronic venous insufficiency: a challenge to phlebography as the "gold standard." *J Vasc Surg* 1992;16:687-93.
2. Welch HJ, Faliakou EC, McLaughlin RL, et al. Comparison of descending phlebography with quantitative photoplethysmography, air plethysmography, and duplex quantitative valve closure time in assessing deep venous reflux. *J Vasc Surg* 1992; 16:913-20.
3. Valentin LI, Valentin WH, Mercado S, Rosado CJ. Venous reflux localisation: comparative study of venography and duplex scanning. *Phlebology* 1993;8:124-7.
4. Baker SR, Burnard KG, Sommerville KM, et al. Comparison of venous reflux assessed by duplex scanning and descending phlebography in chronic venous disease. *Lancet* 1993;341:400-3.
5. Labropoulos N, Giannoukas AD, Delis K, et al. Where does venous reflux start? *J Vasc Surg* 1997;26:736-42.
6. Almeida JI. Update on endovenous treatments for varicose veins: new data support the trend toward this less-invasive treatment for varicose veins. *Endovascular Today* 2004;3:33-41.
7. Caggiati A. Nomenclature of the veins of the lower limbs: an international interdisciplinary consensus statement. *J Vasc Surg* 2002;36:416-22.
8. Min RJ, Khilnani NM, Golia P. Duplex ultrasound evaluation of lower extremity venous insufficiency. *J Vasc Interv Radiol* 2003;14:1233-41.
9. Labropoulos N, Tionson J, Pryor L, et al. Duplex ultrasonography in the diagnosis of venous reflux in lower-extremity veins. *J Vasc Surg* 2003;38:793-8.