Endovenous Laser Treatment of the Incompetent Greater Saphenous Vein

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PURPOSE: To assess the safety and preliminary efficacy of endovenous laser treatment (EVLT), a novel percutaneous technique for occlusion of the incompetent greater saphenous vein (GSV).

MATERIALS AND METHODS: Ninety GSVs in 84 patients with reflux at the saphenofemoral junction (SFJ) into the GSV were treated endovenously with pulses of laser energy and evaluated in a prospective, nonrandomized, consecutive enrollment multicenter study. Patients were evaluated at 1 week and at 1, 3, 6, and 9 months to determine efficacy and complications.

RESULTS: Eighty-seven of 90 GSVs (97%) were closed 1 week after initial treatment with endovenous laser. The remaining three GSVs were closed after repeat treatment. Eighty-nine of 90 GSVs (99%) remained closed for as long as 9 months according to serial duplex ultrasonography. Sonographic evaluation demonstrated 73% reduction in GSV diameter at 6 months (61 patients) and 81% reduction in GSV diameter at 9 months (26 patients) after EVLT. One patient developed a transient localized skin paresthesia. There have been no other minor or major complications.

CONCLUSIONS: EVLT of the incompetent GSV appears to be an extremely safe technique that yields impressive short-term results. Long-term follow-up is awaited.

Index terms: Saphenous vein • Varicose veins • Veins, extremities • Veins, lasers

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Abbreviations: EVLT = endovenous laser treatment, GSV = greater saphenous vein, SFJ = saphenofemoral junction

IT IS estimated that approximately 25% of women and 15% of men have lower extremity superficial venous insufficiency (1). Underlying greater saphenous vein (GSV) incompetence is commonly found in patients with surface varices. In addition to being unsightly, varicose veins are usually associated with symptoms (2). Chronic venous insufficiency, including venous ulceration, is often caused solely by superficial venous disease (3,4). During the past decade, increased interest in venous disorders and the development of new noninvasive diagnostic tests and minimally invasive treatment options have led to tremendous advancement in the understanding and management of varicose veins.

The GSV is the major vein of the superficial venous system. GSV reflux is often associated with large superficial varices. When incompetence of the saphenofemoral junction (SFJ) is detected, treatment should first be directed toward eliminating this source of reflux with ablation of the incompetent venous segments. The traditional approach to treating SFJ incompetence with GSV reflux has been surgical ligation and stripping. The drawbacks of surgery include risks associated with general anesthesia, surgical complications (paresthesia, bleeding, infection, scars), increased in-hospital costs, and prolonged recovery periods.

In recent years, less invasive alternatives to surgical treatment of the incompetent GSV have been explored. The newest minimally invasive technique to be developed is endovenous laser treatment (EVLT). EVLT allows delivery of laser energy directly into the blood vessel lumen to produce endothelial and vein wall damage with subsequent fibrosis. An institutional review board-approved study was undertaken to evaluate the safety and short-term efficacy of EVLT for treatment of GSV reflux.

MATERIALS AND METHODS

Patient Selection

The study was designed as a prospective, nonrandomized, consecutive enrollment multicenter trial. No controls were used. All patients presenting to the office (either by physician or self-referral) with incompetence of the SFJ associated with GSV reflux and

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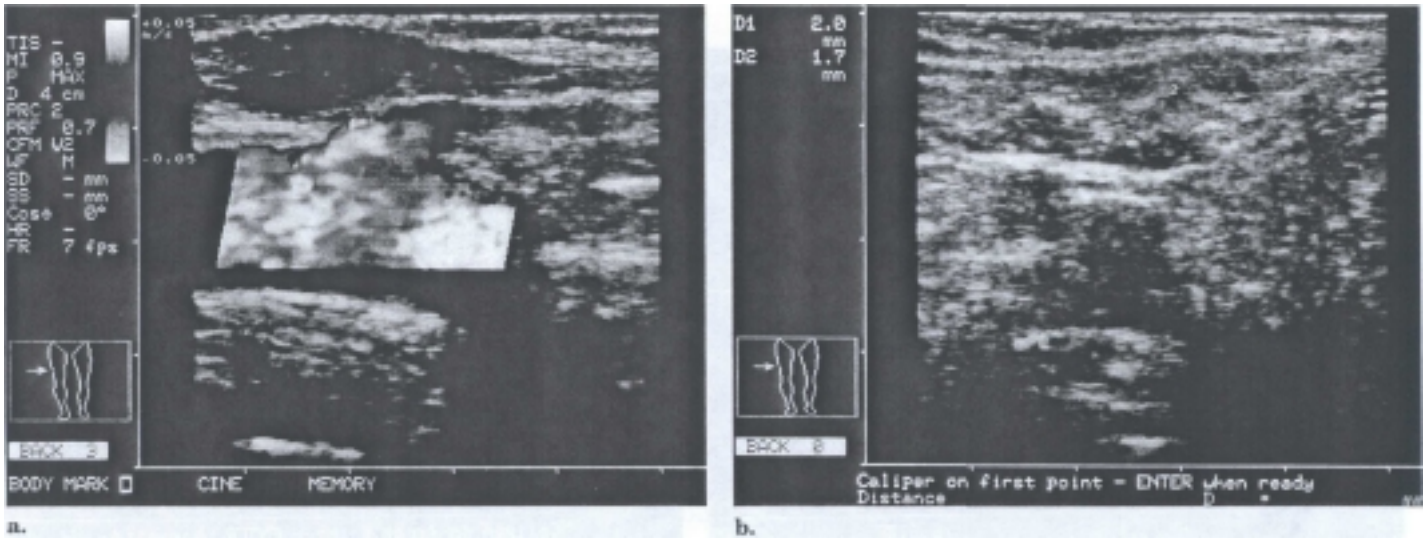

Figure 4. Six-month follow-up color Doppler examination demonstrating (a) absence of flow within the treated GSV segment (longitudinal view) and (b) significant reduction in GSV diameter, now measuring 2.0 mm X 1.7 mm in the transverse dimension.

Figure 5. Posttreatment photograph of the right lower extremity showing marked improvement in the varices previously seen in Figure 2.

trial have demonstrated an overall recanalization rate of 10% at a mean follow-up of 4.7 months (13% in patients treated with Closure alone and 5% in patients treated with Closure plus high ligation of the GSV). Complications included paresthesias (thigh, 9%; leg, 51%), three skin burns, three deep venous thromboses (occurring in the 86 patients treated without high ligation), and one pulmonary embolus (15).

Although the number of patients treated with EVLT to date is relatively small and only short-term follow-up results are available for this new technique, the combined early experience with EVLT of varicose veins has been extremely favorable. Compared to existing minimally invasive endovenous techniques such as transcatheter sclerotherapy or radiofrequency energy ablation, EVLT has the following potential advantages:

• Transmission of energy through a small-diameter, flexible fiber allows minimal access site size.

• Shallow depth of penetration of laser energy may result in less damage to surrounding nontarget tissue compared to energy sources that rely entirely on heat.

• Patients with pacemakers are not excluded from EVLT

• Avoidance of the risk of intraarterial injection and minimal risk of anaphylaxis compared to US-guided sclerotherapy.

• Precise control of vein wall damage may lead to lower rates of recanalization compared to chemical closure (ie, sclerotherapy).

EVLT appears to be a safe, well-tolerated, in-office technique, which allows people to return to their normal daily activities immediately. Our early results with EVLT have been similar to those of Navarro, Min, and Bone (16), who reported on 40 GSVs treated with endovenous laser, which have remained closed after 2-12 months of follow-up. In their study, an additional 80 cases of isolated branch varices not associated with saphenous vein reflux were also treated with endovenous laser with 100% success. No paresthesias, skin burns, or other significant side effects were noted in either group of patients (16).

In our study, we did not exclude patients with duplicated GSVs or those with incompetent Hunter's canal perforators if SFJ incompetence was contributing to GSV reflux. In the latter group, the GSV was entered below the incompetent Hunter's perforator and treated from 1-2 cm below the SFJ to the entry site. In fact, treating the entire incompetent GSV segment from groin to knee in all cases may prove to be best because it will likely reduce the possibility of recurrence of GSV reflux caused by Hunter's perforator incompetence. In cases of duplicated GSVs, the incompetent GSV is easily distinguished from the normal GSV with duplex US (with or without color Doppler interrogation). Therefore, when duplication is noted, the abnormal GSV trunk should be treated and the normal competent GSV trunk should be preserved.

Despite the limitations of small numbers and only short-term data, early results with EVLT have been impressive, with very effective occlusion of incompetent GSV segments. We

await longer-term follow-up results from patients already treated with EVLT and additional evaluation of this promising new technique, which may offer a good alternative to ligation and stripping for those patients wishing to avoid surgery.

References

1. Callam MJ. Epidemiology of varicose veins. Br J Surg 1994; 81:167-173.
2. Fischer H. Socio-epidemiological study on distribution of venous disorders among a residential population. Int Angiol 1984; 3:89.
3. Labropoulos N, Delis K, Nicolaides AN, et al. The role of the distribution and anatomic extent of reflux in the development of signs and symptoms in chronic venous insufficiency. J Vasc Surg 1996; 23:504-510.
4. Shami SK, Sarin S, Cheatle TR, et al. Venous ulcers and the superficial venous system. J Vase Surg 1993; 17:487-490.
5. Sarin S, Scurr JH, Coleridge Smith PD. Assessment of stripping of the long saphenous vein in the treatment of primary varicose veins. Br J Surg 1992; 79:889-893.
6. Dwerryhouse S, Davies B, Harradine K, Earnshaw JJ. Stripping the long saphenous vein reduces the rate of reoperation for recurrent varicose veins: five-year results of a randomized trial. J Vasc Surg 1999; 29:589-592.
7. Politowski M, Zelazny M. Complications and difficulties in electrocoagulation of varices of the lower extremities. Surgery 1966; 59:932-934.
8. Watts GT. Endovenous diathermy destruction of internal saphenous. Br Med J 1972; 4:53.
9. O'Reilly K. Endovenous diathermy sclerosis of varicose veins. Aust N Z J Surg; 1977; 47:393-395.
10. Kanter A, Thibault P. Saphenofemoral incompetence treated by ultrasound-guided sclerotherapy. Dermatol Surg 1996; 22:648-652.
11. Myers KA, Wood SR, Lee V. Early results for objective follow-up by duplex ultrasound scanning after echosclerotherapy or surgery for varicose veins. Aust N Z J Phleb 2000; 4:71-74.
12. Min RJ, Navarro L. Transcatheter duplex ultrasound-guided sclerotherapy for treatment of greater saphenous vein reflux: preliminary report. Dermatol Surg 2000; 26:410-414.
13. Parsi K, Lim AC. Extended long line echosclerotherapy. Aust N Z J Phleb 2000; 4:6-10.
14. Cabrera J, Cabrera J Jr, Garcia-Olmedo MA. Treatment of varicose long saphenous veins with sclerosant in microfoam form: long-term outcomes. Phlebology 2000; 15:19-23.
15. Manfrini S, Gasbarro V, Danielsson G, et al. Endovenous management of saphenous vein reflux. J Vase Surg 2000; 32:330-342.
16. Navarro L, Min R, Bone C. Endovenous laser: a new minimally invasive method of treatment for varicose veins-preliminary observations using an 810 nm diode laser. Dermatol Surg 2001; 27:117-122.