Chapter 27
Varicose Vein

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Evaluating Patient

What should be evaluated on physical exam?	Physical exam should include inspection and palpation of both legs for asymmetry, edema, varicose veins, pigment changes, or ulcerations. These features help classify the severity of venous insufficiency.
What should be ruled out on physical exam?	Pedal pulses should be evaluated to exclude peripheral arterial disease as the etiology of the patient's clinical presentation and symptoms. Any signs of cellulitis or other infection are contraindications to treatment.

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What are different physical exam tests that can be done to evaluate for venous reflux?	Physical exam maneuvers to evaluate for venous reflux include the tap test, Perthes test, cough test, and Trendelenburg test. However, the use of duplex ultrasound has largely replaced the need of these maneuvers, which are now rarely performed.
How is venous reflux measured?	Evaluation for venous insufficiency is often performed either with the patient standing and supporting their weight with the contralateral leg or lying in reverse Trendelenburg. These maneuvers distend the veins and allow for measurement of reflux, usually with duplex ultrasound. The most routinely evaluated areas for reflux are the great saphenous vein (GSV), small saphenous vein (SSV), intersaphenous vein (ISV), any major tributary veins, popliteal fossa, saphenofemoral junction (SFJ), and any areas of symptoms.
What is the most frequently used imaging modality?	Duplex ultrasonography is most frequently used, which combines B-mode grayscale images, color Doppler images, and Doppler spectral waveform analysis. Air plethysmography is another commonly used modality that measures changes in limb venous volume with different maneuvers. This gives information about reflux, calf muscle pump function, ambulatory calf venous pressure, and venous obstruction.

What findings indicate reflux on ultrasound examination?	A linear ultrasound probe is most commonly used for evaluation of vascular structures. A normal venous waveform should be relatively uniform, unidirectional, and nonpulsatile with phasicity (variation in flow related to respiration). Provocative maneuvers are used during the exam, such as distal venous compression with release (usually performed with an inflatable cuff) or Valsalva maneuver. If reflux (reversal of blood flow) is present during these maneuvers, there will be a transient inversion of the waveform on the velocity scale, indicating blood flow in the opposite direction. The duration of reflux is recorded. Incompetent perforating veins can have bidirectional flow.
What is the definition of venous reflux?	The definition varies in the literature. When referring to superficial veins, the most commonly accepted definition for delayed flow is flow reversal lasting at least 0.5 seconds. Greater than 1 second of reflux is abnormal. Perforating veins are considered abnormal if the diameter is over 4 mm or if normal in diameter with evidence for reflux lasting at least 0.35–0.5 seconds.
What additional details should be evaluated during ultrasound examination?	1. Deep vein thrombosis (DVT) must be excluded, as the superficial venous system likely provides an important alternate drainage pathway (see below) 2. Variant superficial venous anatomy (see below) including the level of the SFJ 3. Superficial thrombosis 4. Diameter of GSV, SSV, or other target vein, including ≤2 cm from the deep vein junctions (femoral or popliteal) 5. Localization of incompetent perforating veins

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What is the utility of computed tomography (CT) and magnetic resonance venography (MRV) in the evaluation of venous disease?	CT and MRV are rarely needed for the evaluation of superficial venous disease as duplex ultrasonography is an adequate diagnostic modality. These modalities are more appropriate for patients with venous disease from suspected underlying proximal (iliofemoral) obstruction or iliac vein compression (May-Thurner syndrome). MRV is helpful for evaluation of vascular malformations from congenital venous disease.
What are complications of superficial venous insufficiency?	Infection, alterations in skin pigmentation, eczema, superficial thrombophlebitis, venous ulcers, loss of subcutaneous tissue, changes in lower leg circumference, lipodermatosclerosis, external perforation causing bleeding, edema, and atrophie blanche
How can chronic venous insufficiency be categorized?	The *CEAP* (*C*linical objective signs, *E*tiology of insufficiency, *A*natomical distribution, *P*athophysiology) classification aids in categorizing disease (Table 27.1). The Venous Clinical Severity Score is an additional scale more geared toward classifying the severity of disease (Table 27.2). These tools can be used during the initial and follow-up patient evaluations.

Table 27.1 CEAP classification of chronic venous disease

Classification	Symptom
Clinical	
C_0	No visible or palpable signs of venous disease
C_1	Telangiectases or reticular veins
C_2	Varicose veins
C_3	Edema
C_{4a}	Pigmentation or eczema
C_{4b}	Lipodermatosclerosis or atrophie blanche
C_5	Healed venous ulcer
C_6	Active venous ulcer
S	Symptomatic, including ache, pain, tightness, skin irritation, heaviness, and muscle cramps, and other complaints attributable to venous dysfunction
A	Asymptomatic
Etiologic	
E_c	Congenital
E_p	Primary
E_s	Secondary (postthrombotic)
E_n	No venous cause identified
Anatomic	
A_s	Superficial veins
A_p	Perforator veins
A_d	Deep veins
A_n	No venous location identified
Pathophysiologic	
P_r	Reflux

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Table 27.1 (continued)

Classification	Symptom
P_o	Obstruction
$P_{r,o}$	Reflux and obstruction
P_n	No venous pathophysiology identifiable
Level of investigation	
Level I	Office visit, with history and clinical examination, which may include the use of a handheld Doppler scanner
Level II	Noninvasive vascular laboratory testing, which now routinely includes duplex color scanning, with some plethysmographic method added as desired
Level III	Invasive investigations or more complex imaging studies, including ascending and descending venography, venous pressure measurements, computed tomography, or magnetic resonance
Example	A patient has painful swelling of the leg, and varicose veins, lipodermatosclerosis, and active ulceration. Duplex scanning shows axial reflux of the great saphenous vein above and below the knee, incompetent calf perforator veins, and axial reflux in the femoral and popliteal veins. There are no signs of postthrombotic obstruction. Classification according to basic CEAP: $C_{6,S,}$ E_p,$A_{s,p,d}$, P_r. Classification according to advanced CEAP: $C_{2,3,4b,6,S}$, E_p,$A_{s,p,d}$, $P_{r2,3,18,13,14}$ (2004-05-17, L II)

Table 27.2 Venous Clinical Severity Score

Attribute	Absent = 0	Mild = 1	Moderate = 2	Severe = 3
Pain	None	Occasional, not restricting activity or requiring analgesics	Daily, moderate activity limitation, occasional analgesics	Daily, severe limiting activities or requiring regular use of analgesics
Varicose veins	None	Few, scattered branch varicose veins	Multiple: GSV varicose veins confined to the calf or thigh	Extensive: thigh and calf or GSV and SSV distribution
Venous edema	None	Evening ankle only	Afternoon edema, above the ankle	Morning edema above the ankle and requiring activity change, elevation
Skin pigmentation	None or focal, low intensity (tan)	Diffuse, but limited in area and old (brown)	Diffuse over most of gaiter distribution (lower 1/3) or recent pigmentation (purple)	Wider distribution (above lower 1/3), recent pigmentation
Inflammation	None	Mild cellulitis, limited to marginal area around ulcer	Moderate cellulitis, involves most of the gaiter area (lower 2/3)	Severe cellulitis (lower 1/3 and above) or significant venous eczema

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Table 27.2 (continued)

Attribute	Absent = 0	Mild = 1	Moderate = 2	Severe = 3
Induration	None	Focal, circum-malleolar (<5 cm)	Medial or lateral, less than lower 1/3 of the leg	Entire lower 1/3 of the leg or more
Active ulcers, n	0	1	2	>2
Active ulcer, duration	None	<3 months	>3 months but <1 year	Not healed >1 year
Active ulcer, size	None	<2 cm diameter	2–6 cm diameter	>6 cm diameter
Compressive therapy	Not used or not compliant	Intermittent use of stockings	Wears elastic stockings most days	Full compliance: stockings + elevation

High Yield History

What are symptoms of lower extremity superficial venous insufficiency?	Symptoms include pain, burning, itching, aching, fatigue, swelling, restless legs, cramps, and heaviness. Symptoms are often worse at the end of the day, especially after periods of prolonged standing. Lower extremity elevation can alleviate symptoms.
What pertinent history should be collected?	Pertinent history to collect includes pregnancy status, family history, allergies, prior or current DVT or pulmonary embolism, recent diagnosis of malignancy, prior treatments for venous disease, and presence of known right-to-left heart shunt such as a patent foramen ovale (PFO), which increases the risk of complications.

What are risk factors for developing lower extremity varicose veins?	Family history of venous disease (genetic predisposition), female sex, obesity, older age, pregnancy, prolonged standing, occupations associated with orthostasis, high estrogen levels, presence of an arteriovenous shunt, lower extremity trauma, ligamentous laxity (e.g., flatfeet), and smoking
What are some lifestyle modifications that can improve the symptoms of superficial venous insufficiency?	Exercise, leg elevation, weight loss, and avoidance of prolonged standing
What are rare congenital syndromes that involve venous insufficiency?	Klippel-Trenaunay syndrome is characterized by deep vein hypoplasia with aberrant venous pathways such as sciatic veins or persistent embryonic veins. Parkes-Weber syndrome is characterized by extensive lower extremity varices and arteriovenous malformations. These patients should be evaluated with both duplex ultrasound and MRV.

Indications/Contraindications

What are the indications for nonconservative treatment?	Any symptoms or complications attributed to superficial venous insufficiency refractory to conservative measures. Treatment can also be offered for asymptomatic cosmetic concerns.

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What are absolute or relative contraindications for treatment of superficial venous insufficiency?	DVT, pregnancy, lactation, immobility, uncorrectable coagulopathy, arterial insufficiency, infection, May-Thurner syndrome, arteriovenous fistula, congenital venous malformation, superficial thrombosis, presence of implanted pacemaker or nerve stimulator (only applies to first-generation radiofrequency ablation devices due to potential for signal interference), extreme tortuosity of the target vein for catheter-based ablation, severe edema for phlebectomy, inability to comply with post-procedural instructions, and allergy to local anesthetic or sclerosing agent
Why is it contraindicated to intervene on superficial venous insufficiency when there is an obstruction of the deep venous system?	Varicosities in the setting of deep venous system obstruction are hemodynamically useful collaterals for venous return. When they are treated or removed, the patient can experience significant pain and swelling of the extremity, recurrence of superficial varicose veins, and increased risk of soft tissue changes such as ulcers.

What should be considered prior to the use of compression therapy?	Evaluation for coexisting arterial insufficiency should be performed including lower extremity pulse exam and ankle-brachial index (ABI), as needed. In patients with arterial insufficiency, compression therapy can worsen their symptoms/disease by limiting blood inflow. Therefore, it is contraindicated in patients with severe arterial insufficiency. Modified low-compression or nonelastic compression therapy (e.g., Unna boot) can be considered in patients with moderate arterial insufficiency, if tolerable and closely monitored for developing signs of limb ischemia. Compression therapy must also be used with caution in patients with peripheral neuropathy (contraindicated if severe), as they are prone to iatrogenic compression wounds or worsening pain, and in patients with heart failure, since therapy can increase cardiac preload.
What are the indications for ambulatory phlebectomy?	This minimally invasive procedure is often performed as an adjunctive therapy on varicosities that are palpable and closer to the skin surface, after the GSV or other main feeding vein is treated with endovenous therapy. It can also be used as isolated therapy for local disease. It can be performed on many different types of veins ranging from truncal veins (other than GSV/SSV) to reticular veins and perforators. Depending on user preference, phlebectomy can be used as an alternative to sclerotherapy. A potential complication of sclerotherapy is hemosiderin skin staining when used on varicosities closer to the skin.

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What is the overall treatment approach?	Practice varies but conservative measures are commonly prescribed for at least 3 months. This is often required by many insurance payors before nonconservative therapies are approved. In some patients, if compliant, compressive therapy is sufficient and can be continued long term. However, if there are persistent complications or unsatisfactory relief of symptoms on follow-up evaluation(s), nonconservative interventions can be pursued with typically one leg treated at a time. Clinical practice guidelines are available from various sources such as the Society of Interventional Radiology (SIR) and Society for Vascular Surgery (SVS) that can help direct treatment planning.
When should adjunctive therapy be performed?	Depending on operator preference, adjunctive phlebectomy or sclerotherapy can be performed during the same procedural visit as truncal ablation which can potentially decrease the overall number of visits, provide faster relief of symptoms, and decrease risk of superficial phlebitis. Alternatively, adjunctive therapy can be performed a few weeks or months after truncal ablation. This allows assessment for interval improvement and avoids a potentially unneeded procedure, since, in many cases, truncal ablation may be sufficient alone. This also allows the remaining varicosities to shrink in size which makes later adjunctive procedures easier and more effective to perform, if needed.

Relevant Anatomy

What are the superficial veins of the lower extremities?	The venous system of the lower extremities is divided into the superficial and deep venous compartments. Superficial veins of the lower extremities are those located between the deep fascia (which covers the muscles) and the skin. The two main superficial veins are the GSV and SSV. The SSV is also referred to as the lesser saphenous vein (LSV).
What is the saphenofemoral junction (SFJ)?	This is an important anatomical landmark which denotes the junction between the great saphenous vein (superficial system) and the common femoral vein (deep venous system). Within this region, there is also a confluence of multiple superficial inguinal and thigh veins including the external pudendal, inferior epigastric, and external circumflex iliac veins, among others.
What are varicose veins?	Varicose vein (also known as a varicosity) is a general term referring to a permanently dilated and tortuous subcutaneous vein ≥3 mm in diameter in the upright position.
What are truncal, tributary, and perforating veins?	Truncal veins are the major superficial veins such as the GSV, SSV, and large primary tributary veins. Tributary veins are branches of the major superficial veins. Perforating veins connect the superficial and deep venous systems and pass through the deep fascia that separates the superficial and deep compartments.
What are telangiectasias and reticular veins?	Telangiectasias (also known as spider veins) and reticular veins are dilated intradermal and subdermal veins, respectively. Telangiectasias are less than 1 mm in size. Reticular veins are 1–3 mm in size.

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What are some important anatomical variations?	Anatomical variations to consider include tortuosity of the target vein, atresia, accessory veins, variable course and termination of the SSV, duplications, and changes related to prior interventions (e.g., neovascularization or recanalization). For example, 1% of the population is estimated to have a duplicated GSV. Variations in the tributary veins of the GSV are also important. For example, many patients have an accessory anterior saphenous vein, which may also demonstrate reflux and need treatment. These different types of variations should be considered in preprocedural planning and may change approach to treatment.

Relevant Materials

What are the overall treatment options for superficial venous disease?	Conservative (compression therapy and lifestyle modifications), external laser, endovenous (thermal and nonthermal) including catheter-based techniques and sclerotherapy, and open/surgical including phlebectomy
How does compression therapy work?	Although there are many types of compression therapies, stockings are the most routinely used. They exert the greatest compression distally at the ankle with the degree of compression gradually decreasing up the garment as the limb circumference increases. This graduated compression helps blood to move up toward the heart and decreases pooling. Throughout the treated lower extremity, compression reduces venous hypertension, by augmenting the calf muscle pump, and decreases the vein diameter, which increases blood flow velocity. Overall, there is improved venous return and lymphatic drainage.

What is the recommended degree of pressure for compression stockings?	Practice varies but frequently used is 15–20 mmHg for mild varicosities and symptoms, 20–30 mmHg for moderate-to-severe varicosities and symptoms, and 30–40 mmHg and above for severe varicosities with chronic complications of long-standing venous insufficiency. Degree of compression can also be increased if there is lack of clinical improvement.
Why is compression therapy used following superficial venous interventions?	Compression therapy decreases recovery time and post-procedural bruising/hematoma formation, swelling, and pain. This also ensures collapse/occlusion of the treated vein to prevent recanalization after endovenous therapy. There are variations in clinical practice and in data regarding the appropriate length of time or type (e.g., waist high or above the knee) of compressive therapy that should be used. Treatment varies depending on operator preference, but one common practice is for patients to have compression 24/7 for at least 1 week. Patients are also encouraged to ambulate after the procedure to prevent deep venous thrombosis, which is why immobility is a relative contraindication.

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What are the different types of endovascular therapies?	Therapy includes thermal endovenous ablation, most commonly for large tributary and truncal veins, and sclerotherapy, often a subsequent adjunctive treatment for the remaining small- to medium-sized veins. Endovenous therapy can also be classified into thermal techniques and nonthermal techniques. Thermal ablation includes endovenous laser therapy (EVLT), radiofrequency ablation (RFA), and steam vein sclerosis. Nonthermal ablation includes chemical sclerotherapy, combined mechanochemical ablation (MOCA), and injection of cyanoacrylate glue. EVLT and RFA are catheter-based ablation techniques which have largely replaced traditional surgical ligation and stripping.
What are the open/surgical treatment options?	Traditional surgical ligation/stripping (includes the Linton procedure), cryostripping, ambulatory phlebectomy, powered phlebectomy, CHIVA technique, ASVAL technique, and subfascial endoscopic perforator surgery (SEPS)
What is tumescent anesthesia?	A liquid local tumescent anesthetic (often comprised of 0.1% lidocaine after dilution with saline) is administered around the target vein during thermal ablation or phlebectomy. This protects the perivenous tissue from the heat created during thermal ablation, partially compresses the vein to reduce the distance thermal energy must travel to the endothelium, dissects the vein free from surrounding tissues, and reduces pain during the procedure. The solution is usually buffered with sodium bicarbonate to reduce discomfort during initial injections of the anesthetic.

General Step by Step

What is external laser therapy?	This refers to non-endovascular laser therapy used externally along the skin surface. This therapy is usually used on telangiectasias and smaller reticular veins for cosmetic purposes. Different types of laser machines are available, which deliver different wavelengths of light that penetrate through the skin and into the blood vessels where it is absorbed by hemoglobin leading to thermocoagulation.
What is sclerotherapy?	This is also referred to as chemical endovenous ablation. This is performed either with ultrasound guidance or direct visualization if injecting smaller veins along the skin. The lumen of the target vein is injected with a sclerosing substance. The sclerosing substance displaces blood and reacts with the endothelium which collapses and scars the vein. Different types of sclerosing agents are available such as hyperosmotic solutions (e.g., hypertonic saline), detergents (e.g., sodium tetradecyl sulfate), and corrosive/alcohol solutions (e.g., glycerin). Only a few detergents are approved by the Food and Drug Administration (FDA). Although it can be used to treat larger truncal veins, sclerotherapy is most routinely used on small- to medium-sized veins such as tributary veins, smaller truncal veins, accessory veins, perforators, reticular veins, and telangiectasias. The concentration and volume of agent used should correlate with the size of the targeted vein.

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What is foam sclerotherapy?	This refers to a method in which the sclerosing agent is combined with air to form a foam consistency. This is usually performed with the Tessari method via a three-way stop cock with about a 4:1 air to sclerosant agent ratio. Compared to simple liquid sclerotherapy, this causes an expansile effect with increased displacement of blood and contact with the endothelium for a suggested greater sclerosing effectiveness. Foam sclerotherapy is usually performed under ultrasound guidance.
How is the patient positioned during GSV ablation?	The patient is placed supine or oblique on a table with external rotation of the extremity at the hip and slight flexion at the knee. When access is obtained, the patient is placed in the reverse Trendelenburg position to distend the veins. When ablation is performed, the patient is placed in the Trendelenburg position to decrease intravascular volume and facilitate contact of the catheter tip with the vein wall for optimal ablation results.
What is the target zone for thermal endovenous ablation of the GSV?	Most commonly, the target zone extends from about 2 cm distal to the SFJ (or just distal to the origin of the superficial epigastric vein) to around the level of the knee. If needed, an extended treatment of the below-knee segment of the GSV can also be performed (although less frequently performed due to risk of damage to the adjacent saphenous nerve) with a target zone extending down to the inferior most point of reflux that is accessible by the catheter length.

How is thermal endovenous ablation of the saphenous vein performed?	Using ultrasound guidance, antegrade access is obtained at the distal aspect of the targeted vein with a micropuncture set which is exchanged for a vascular sheath. The ablation catheter is threaded distal to proximal along the target zone. This is because it is easier to pass a catheter in the same direction of valve opening. Tumescent anesthesia is administered with ultrasound guidance. The catheter tip emits energy (radiofrequency waves or laser), and the catheter is continuously withdrawn at a rate dependent on the targeted segment of vein and the device and settings used (e.g., 2 mm per second, with most targeting an energy density of 80–100 J). As the catheter is withdrawn endothelial damage and thrombosis of the vein occurs.
How does the mechanism of action differ between EVLT and RFA?	In RFA, the electrode directly contacts the vein endothelium releasing radiofrequency energy and causing resistive heat-induced venous spasm, thrombosis, and denaturation of the wall collagen network leading to fibrosis. Laser (EVLT) induces a photothermolytic process which releases thermal energy both to the blood, causing blood to coagulate and form steam bubbles, and to the venous wall, causing transmural vein wall damage including microperforations. This inflammatory process causes thrombosis and fibrosis of the vein.

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How is ambulatory phlebectomy performed?	Ambulatory phlebectomy, also known as stab phlebectomy, involves removal/avulsion of varicose veins. With the patient standing, the target vein(s) is(are) mapped and marked on the skin using visual skin changes or ultrasonography. With the patient supine, tumescent anesthesia is administered. With a small blade, a series of 1–2 mm stab incisions are made several centimeters apart in the soft tissues overlying the targeted vein. Avulsion of the vein is performed with hooks or forceps that pull the vein to the surface at each incision site. This releases the vein from the surrounding tissues and severs any connections. The targeted vein is then removed. Since the incisions are small, they are closed with Steri-Strips and dressings.

Complications

What are complications of external laser therapy, sclerotherapy, endovenous ablation, and/or ambulatory phlebectomy?	Most complications overlap among the different therapies and include skin pigmentation changes such as bruising or hemosiderin staining (usually temporary), temporary or permanent nerve injury/paresthesia (most commonly affecting the saphenous, sural, common peroneal, and cutaneous nerves), superficial thrombophlebitis, burns, deep venous thrombosis, pulmonary embolism, telangiectatic matting, hematoma/bleeding, pain, allergic reaction to the sclerosing agent or anesthetic, recanalization/recurrence of veins, infection, and tightness along the course of the treated vein.

What are additional rare complications of sclerotherapy?	Complications include pulmonary embolism, headache, visual changes, transient ischemic attack or stroke, heart attack, loss of limb (arterial stick), and death. These can be attributed to unintended embolization of the sclerosing agent. There is a greater chance of some of these complications if the patient has a PFO.
What are complications more specific to ambulatory phlebectomy?	Skin changes at the incision sites (blisters, keloid formation, dimpling, induration), hematoma, seroma, lymphocele, thrombophlebitis of the remaining vein if incompletely removed, telangiectatic matting, and nerve damage
What are complications of compression therapy?	Complications include limb ischemia, contact dermatitis/allergic reaction, pain, and skin necrosis/wound. These complications can be prevented or treated with local wound care, adjustments in wrapping technique, reduction in compression strength, or termination of therapy.

Landmark Research

Brittenden J, Cotton SC, Elders A, Ramsay CR, Norrie J, Burr J, et al. A randomized trial comparing treatments for varicose veins. *N Engl J Med*. 2014;371(13):1218–27.

- Comparison of Laser, Surgery, and Foam Sclerotherapy (CLASS) trial
- 798 participants with varicose veins were randomized to foam sclerotherapy, endovenous laser ablation, or surgery.
- The primary outcomes included disease-specific quality of life measures and generic quality of life measures at

6 months. Secondary outcomes included complications and measures of clinical success.
- Quality of life measures were similar among the three study groups except for a slightly worse disease-specific quality of life measure in the foam treatment group but similar outcomes in the laser and surgery groups.
- The frequency of complete successful ablation of the great saphenous vein was similar in the surgery (84.4%) and laser treatment (83.0%) groups but lower in the foam treatment group (54.6%).
- The frequency of procedural complications was similar in the foam (6%) and surgery groups (7%) but lower in the laser group (1%).

Nesbitt C, Bedenis R, Bhattacharya V, Stansby G. Endovenous ablation (radiofrequency and laser) and foam sclerotherapy versus open surgery for great saphenous vein varices. *Cochrane Database Syst Rev*. 2014;(7):CD005624.

- 13 randomized controlled trials of 3081 patients were included to determine the efficacy of endovenous ablation (radiofrequency and laser) and ultrasound-guided foam sclerotherapy compared to open surgical saphenofemoral ligation and stripping of GSV varices.
- Primary outcomes included recurrent varicosities, recanalization, neovascularization, technical procedure failure, patient quality of life scores, and complications.
- Ultrasound-guided foam sclerotherapy and endovenous ablation (radiofrequency and laser) are at least as effective as surgery in the treatment of great saphenous varicose veins.

van der Velden SK, Biemans AA, De Maeseneer MG, Kockaert MA, Cuypers PW, Hollestein LM, et al. Five-year results of a randomized clinical trial of conventional surgery, endovenous laser ablation and ultrasound-guided foam sclerotherapy in patients with great saphenous varicose veins. *Br J Surg*. 2015;102(10):1184–94.

- 224 legs were randomized to conventional surgery (69), EVLT (78), and ultrasound-guided foam sclerotherapy (UGFS) (77).
- The rates of great saphenous vein obliteration/absence were 85%, 77%, and 23% in the conventional surgery, EVLT, and UGFS groups, respectively, at 5 years.
- EVLT and conventional surgery were more effective than UGFS in obliterating the great saphenous vein 5 years after intervention.

Common Questions

What is the pathophysiology of venous insufficiency?	Incompetent valves allow blood to flow in the opposite direction (reflux). This leads to pooling of blood, weakened vein walls (in part due to changes in wall collagen/elastin composition), failure of the calf muscle pump, and dilated superficial veins due to high pressure in a normally low-pressure system (venous hypertension). Along with subsequent leakage of fluid into surrounding soft tissues, this overall process gives rise to the physical manifestations of venous insufficiency (see above). Etiology is either primary or may be secondary to an occlusion in the deep venous system with subsequent reflux via the deep-to-superficial venous junctions or perforating veins. The secondary etiology causes the superficial venous network to function as a collateral flow system.
What are some benefits of endovascular treatment over surgery?	Reduced number and size of incisions, performed outpatient with no need for hospital stay, quicker recovery and return to work, less post-procedural pain, and decreased procedural time

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As a part of post-procedural clinical follow-up, what specific tools can be used to assess outcomes after therapy other than history and physical exam?	Revised Venous Clinical Severity Score Disease-specific quality of life (QOL) questionnaire Duplex ultrasound (see below)
What should you see on follow-up ultrasound evaluation after successful endovenous therapy?	Short-term ultrasound evaluation should demonstrate an occluded vein (absent flow), thickened venous wall, and decreased vessel diameter. Long-term ultrasound evaluation may show absence of the treated vein or a small residual scarred down cord. Practice varies, but ultrasound follow-up is commonly performed at 3 days, between 1 and 6 months, and 1 year after the procedure.
Why are specific safety precautions taken during EVLT?	If laser therapy is used, state laws and regulatory agencies often require specific safety measures. These include the use of appropriate eye protection and postage of warning signs at entry ways during the procedure, among several other precautions. The wavelength of light emitted from the laser can otherwise damage the eyes and vision, especially the retina.

How are complications of venous insufficiency treated?	Treatment of the underlying refluxing veins with the methods described above should be performed for more definitive results. However, there are many complications of venous insufficiency (see above) that require separate management other than compression therapy: Acute bleeding from vein perforation will require leg elevation, a pressure hold to achieve hemostasis, and a hemostatic suture, if needed. Superficial thrombophlebitis is most frequently treated with supportive care, such as warm compress application, oral NSAIDs, and topical therapies. If affecting a longer segment of the vein (at least 5 cm) or if located less than 3 cm from the SFJ, short-term anticoagulation can be considered. Soft tissue infections, such as cellulitis, require antibiotic therapy. Patients with venous ulcers or other chronic soft tissue changes related to venous insufficiency will need regular wound care follow-up for advanced wound dressings and compression therapy with specialized wraps/bandages such as an Unna boot. Venous ulcers are most frequently located along the medial malleolus. Oral medications (e.g., phlebotonics or pentoxifylline) can be considered. Ulcers may need surgical debridement or skin grafting. Ulcers are prone to superimposed infections which can even lead to osteomyelitis of the underlying bone, requiring long-term antibiotic therapy.

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