American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Radiologic Management of Lower-Extremity Venous Insufficiency**

Variant 1: **Asymptomatic bilateral great saphenous venous insufficiency with visible varicose veins. Patient desires treatment for cosmesis.**

Treatment/Procedure	Rating	Comments
Endoluminal laser therapy	8	
Endoluminal radiofrequency therapy	8	
Surgical vein stripping	4	Traditional treatment, but more invasive than endoluminal treatments, and scarring may be an issue.
Injection sclerotherapy	4	May be appropriate for specific patient populations. Typically used for smaller veins or telangiectasias. Adjunctive to GSV ablation if necessary. May cause hyperpigmentation changes which may be of cosmetic concern.
Compression stocking therapy only	2	Unlikely to provide cosmesis by itself.
No therapy	1	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 2: **Left small saphenous venous insufficiency resulting in intermittent pain and swelling without skin discoloration or ulceration.**

Treatment/Procedure	Rating	Comments
Endoluminal radiofrequency therapy	8	
Compression stocking therapy only	7	Most conservative approach. Patients may find it difficult to live with, which may lead to noncompliance with therapy.
Endoluminal laser therapy	8	
Surgical vein stripping	5	
Injection sclerotherapy	4	May be appropriate for specific patient populations.
No therapy	2	Depends on symptomatology.
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Clinical Condition: **Radiologic Management of Lower-Extremity Venous Insufficiency**

Variant 3: **Left great saphenous venous insufficiency with associated lower leg skin ulceration.**

Treatment/Procedure	Rating	Comments
Endoluminal laser therapy	8	
Endoluminal radiofrequency therapy	8	
Surgical vein stripping	5	More invasive than endoluminal techniques. May be appropriate in certain clinical situations.
Injection sclerotherapy	4	May be appropriate for specific patient populations.
Compression stocking therapy only	1	Compression stockings alone would usually be inadequate.
No therapy	1	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 4: **Symptomatic bilateral great saphenous venous insufficiency and large visible varicose veins during pregnancy.**

Treatment/Procedure	Rating	Comments
Compression stocking therapy only	9	Compression stocking therapy should be sole therapy during pregnancy. Patient can be reassessed following delivery.
No therapy	4	Depends on symptomatology.
Surgical vein stripping	2	Treat only if signs/symptoms persist after delivery.
Endoluminal laser therapy	2	Treat only if signs/symptoms persist after delivery.
Endoluminal radiofrequency therapy	2	Treat only if signs/symptoms persist after delivery.
Injection sclerotherapy	2	Treat only if signs/symptoms persist after delivery.
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Clinical Condition: **Radiologic Management of Lower-Extremity Venous Insufficiency**

Variant 5: **Chronic left femoral venous thrombosis with left great saphenous venous insufficiency and lower-extremity swelling.**

Treatment/Procedure	Rating	Comments
Compression stocking therapy only	9	
Venous recanalization	6	May not be definitive therapy for superficial venous insufficiency. Few data to document success rates.
Anticoagulation	6	May not be definitive therapy for superficial venous insufficiency.
Surgical vein stripping	1	
Endoluminal laser therapy	1	
Endoluminal radiofrequency therapy	1	
Injection sclerotherapy	1	
No therapy	1	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 6: **Symptomatic bilateral great saphenous venous insufficiency with remote history of deep venous thrombosis with no residual thrombus present.**

Treatment/Procedure	Rating	Comments
Compression stocking therapy only	8	
Endoluminal laser therapy	7	At increased risk for recurrent deep venous thrombosis.
Endoluminal radiofrequency therapy	7	At increased risk for recurrent deep venous thrombosis.
Surgical vein stripping	5	More invasive than endoluminal techniques. May be appropriate in certain clinical situations.
Injection sclerotherapy	4	May be appropriate for specific patient populations.
No therapy	2	Depends on symptomatology.
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 7: **Right great saphenous venous insufficiency status post vein stripping 1 year ago with persistent lower-extremity swelling. Reflux is noted in the below-knee greater saphenous vein measuring up to 5 mm.**

Treatment/Procedure	Rating	Comments
Compression stocking therapy only	5	
Endoluminal laser therapy	8	
Endoluminal radiofrequency therapy	8	
Repeat surgical vein stripping	4	
Injection sclerotherapy	4	
No therapy	2	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

RADIOLOGIC MANAGEMENT OF LOWER-EXTREMITY VENOUS INSUFFICIENCY

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Summary of Literature Review

Introduction/Background

Lower-extremity venous insufficiency is a common medical condition [1,2]. Venous insufficiency typically results from primary valvular incompetence or less commonly from previous deep venous thrombosis (DVT) [3]. Venous insufficiency may result in varicose veins that may be of cosmetic concern or cause symptoms such as discomfort, extremity swelling, skin discoloration, skin induration, or ulceration [4,5]. Affected veins may thrombose or bleed.

Venous insufficiency most commonly results from reflux originating from the great saphenous vein (GSV). Other sources of venous insufficiency include superficial veins, such as the small saphenous vein (SSV), the anterior thigh circumflex vein, the posterior thigh circumflex vein, and the anterior accessory GSV.

Treatment of venous insufficiency is intended to alleviate symptoms and reduce the risk of complications. Conventional management of GSV reflux has been surgical removal of the saphenous vein from the level of the saphenofemoral junction to the level of the knee or ankle (stripping), along with ligation of the saphenous branches in the groin [6,7]. An alternative to ligation and stripping of the saphenous vein is endovenous ablation of the vein using laser energy, radiofrequency-generated thermal energy, or a chemical sclerosing agent. Treatment is aimed at relief of symptoms, prevention of progression of venous insufficiency, prevention of complications, and improvement in cosmesis.

History and Physical Examination

Venous disease of the legs can be categorized according to the severity, cause, site, and specific abnormality using the CEAP classification (Table 1) [8-10]. The elements of the CEAP classification are: Clinical severity (grade 0-6, asymptomatic, symptomatic), Etiology (congenital, primary, secondary), Anatomical distribution (superficial, deep, perforator veins), and Pathophysiological dysfunction (reflux, obstruction).

Noninvasive Evaluation

Noninvasive studies are used to confirm the presence of venous insufficiency, define the anatomical distribution of venous insufficiency, and identify the presence of venous anomalies and venous thrombosis [11]. Duplex ultrasonography (US) can be used for initial evaluation and evaluation of treatment adequacy [12-14]. Real-time US guidance is commonly used during endovenous treatment. Other diagnostic modalities that can be used to evaluate extremity veins include plethysmography, computed tomography (CT), magnetic resonance imaging (MRI), and conventional contrast venography [15-17].

Treatment Options

Compression Stockings

Graduated compression stockings are routinely used to control venous insufficiency symptoms [18,19]. They provide external support that can constrict dilated veins and restore competence to incompetent valves. Compression stockings are particularly helpful during pregnancy [20], and they are frequently used following venous ablation treatment [21].

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Surgery

GSV stripping with branch ligation had historically been the primary treatment option for venous insufficiency [22-24]. The GSV is ligated near the groin. Ligation alone can preserve the vein for subsequent harvesting in case of arterial bypass; however, ligation alone has proven unsatisfactory for preventing the occurrence of reflux, so it is often supplemented by vein stripping [25,26]. Saphenous vein stripping may additionally reverse the derangement in lymphatic flow associated with venous reflux [27], and it has been proven to be cost-effective while improving health-related quality of life [28]. However, surgery comes with the added risk of peroneal nerve injury [29].

Ambulatory phlebectomy is primarily used to treat surface varicose veins. It can be performed as an isolated procedure [30], or as an adjunct to endovenous ablation or stripping [31-35]. This procedure involves making tiny punctures or incisions through which the varicose veins are removed. Other surgical methods to treat venous insufficiency have been described, including subfascial endoscopic perforator surgery (SEPS) for treating venous ulcers, valvular surgery for treating reflux caused by incompetent valves of the deep veins [36-38], and conservative hemodynamic management of varicose veins (CHIVA) which preserves the greater saphenous vein by ligating the refluxing saphenous trunks and diverting blood flow to the competent deeper veins [39].

Injection Sclerotherapy

Injection sclerotherapy is a common treatment for telangiectasias and can be used to treat smaller varicose veins. The sclerotherapy solution can be in liquid form or can be injected as "foam" (mixed with a gas such as air) [40-42]. Sclerotherapy has not been shown to have long-term effectiveness for large veins, such as the GSV [43].

Endovenous Ablation

Endovenous ablation is a minimally invasive alternative to surgery [32,44-49]. It is a percutaneous procedure that can be used to treat the GSV, SSV, and other superficial veins. Endovenous ablation uses radiofrequency (RFA) or laser energy (EVLA) applied inside the vein to cause occlusion [41,50-61].

Small prospective trials comparing EVLA and RFA with conventional surgery in patients with GSV reflux have shown favorable results. Darwood et al [62] demonstrated that EVLA is comparable to surgery in abolishing reflux and improving disease-specific quality of life and that it allows earlier return to normal activity. Follow-up in this study was only at 3 months. Since then, there have been larger randomized control trials over a 1- to 2-year year period demonstrating that endovenous ablation is as effective as surgery with similar occlusion rates [63-66]. Helmy et al [64] showed shorter hospital stays and lower overall complication rates with endovenous treatment. However, when compared to surgery, EVLA patients experienced more pain [65], and RFA was more expensive [64]. Rasmussen et al [66] demonstrated similar improvements in clinical severity scores and quality of life when comparing EVLA to surgery. Recent systematic literature reviews comparing the safety and efficacy of endovenous therapy and surgery involving saphenous ligation and stripping as treatments for varicose veins showed few differences in clinical effectiveness outcomes; however, consistent long-term follow-up was lacking [67,68]. A literature meta-analysis by van den Bos et al [69] suggested that EVLA and RFA are at least as effective as surgery in treating lower-extremity varicose veins. After 3 years, the estimated pooled success rates for treatment were 78% for surgical stripping, 77% for foam sclerotherapy, 84% for RFA, and 94% for laser therapy. In a prospective study by Subramona and Lees [70], RFA took longer than conventional surgery, but resulted in a significantly better early outcomes, where patients returned to their normal activities earlier, experienced less postprocedure pain, and reported higher overall satisfaction.

Adjunctive Treatments

Adjunctive treatments may be required to help eliminate venous insufficiency. Patients with venous insufficiency and associated venous occlusion or stenosis of the common iliac vein (eg, May-Thurner syndrome) may require venous recanalization with angioplasty and stenting to achieve a patent conduit for venous return [71-74]. Patients with pelvic venous insufficiency may require percutaneous embolization of the ovarian veins [75,76]. Patients with DVT are typically treated with anticoagulation to reduce the risk of thrombus propagation, embolization, and post-thrombotic syndrome [77]. Puggioni et al [78] suggested that endovenous ablation of the saphenous vein can be considered as a viable treatment alternative in patients with venous insufficiency and previous DVT.

Complications

All forms of lower-extremity venous insufficiency treatment are subject to recurrence [12,13,79-83]. Additional risks of vein ligation and stripping surgery include anesthetic risk, scarring, pain, bleeding, deep venous injury or thrombosis, nerve injury, and infection [7,84]. Complications of the endovenous ablation procedure include

bruising, swelling, transient numbness, and rarely DVT [48,50,85]. The DVT rates for RFA and EVLA are less compared to those published for saphenous vein stripping [86]. Among patients undergoing endovenous treatment, pain and bruising are less in RFA compared to EVLA [87].

Treatment for Recurrence

Recurrence following both primary varicose vein surgery and endovenous treatment has been described. Treatment options for recurrence include both surgery and endovenous therapy. Neither approach has been proven more effective. Conventional surgical treatment for varicose recurrence involves removing sources of reflux from the deep venous system to the superficial network. This is invariably a complex and aggressive approach. Pittaluga et al [88] compared conventional surgery to a more conservative surgical approach for recurrent greater saphenous vein reflux (which only focuses on the varicose reservoir) and found a reduction in postoperative complication rates with improvement in symptoms and lower costs. Van Groenendael et al [89] retrospectively compared surgical retreatment for recurrent small saphenous varicosities and EVLA. They reported that technical success and patient satisfaction in both groups were comparably high and that complications were minor. However, the incidence of sural nerve injury was more frequent in the surgically treated patients. Additional studies have demonstrated the effectiveness of EVLA for recurrence. Anchala et al [90] reported the effectiveness and safety of EVLA after recurrent symptoms following saphenous vein stripping and ligation, Nwaejike et al [91] prospectively followed patients who developed recurrent varicose veins and who were retreated with endovenous ablation. They concluded that EVLA is useful, technically feasible, and can be safely performed.

Summary

- Several treatment options are available for managing lower-extremity venous insufficiency.
- Long-term randomized prospective studies comparing endovenous obliteration of the saphenous vein with surgical ligation and stripping demonstrate that endovenous ablation is as effective as surgery and results in similar occlusion rates. Differences between the two procedures relate to complications, postprocedure pain, length of hospital stay, and costs.
- Recurrent varicose veins can be treated by either surgery or endovenous therapy. Neither approach has been proven superior to the other.

Supporting Documents

- ACR Appropriateness Criteria® Overview
- Evidence Table

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Table 1. Basic CEAP Classification of Chronic Venous Disease [9]

Clinical classification

C0: no visible or palpable signs of venous disease
C1: telangiectasies or reticular veins
C2: varicose veins
C3: edema
C4a: pigmentation or eczema
C4b: lipodermatosclerosis or atrophie blanche
C5: healed venous ulcer
C6: 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 classification

Ec: congenital
Ep: primary
Es: secondary (post-thrombotic)
En: no venous cause identified

Anatomic classification

As: superficial veins
Ap: perforator veins
Ad: deep veins
An: no venous location identified

Anatomic classification

Pr: reflux
Po: obstruction
Pr, o: reflux and obstruction
Pn: no venous pathophysiology identifiable