Chronic Venous Insufficiency: Novel Management Strategies for an Under-diagnosed Disease Process

OMAR N. HYDER, MD; PETER A. SOUKAS, MD, FACC, FSVM, FSCAI, FACP

ABSTRACT

Chronic venous insufficiency is an often-missed diagnosis that results in a variety of clinical manifestations that may severely compromise quality of life. Prompt recognition is important to provide symptomatic relief and prevent disease progression. Most patients can be treated with a comprehensive plan of conservative measures. However, it is important for providers to recognize those patients who require referral to a vascular specialist for more invasive therapies. Over the past 2 decades, a variety of endovenous strategies have demonstrated effective and lasting results in treatment of severe symptomatic venous insufficiency.

KEYWORDS: Venous insufficiency, venous ulcer, radiofrequency ablation, endovenous laser therapy, phlebectomy

BACKGROUND

Chronic venous disease is often underdiagnosed and consequently undertreated in a variety of healthcare settings. An estimated 25 million Americans are affected by some degree of chronic venous insufficiency. Manifestations of chronic venous disease range from asymptomatic varicose veins in 30% of screened individuals, to more advanced disease in 10% of patients[1]. Varicose veins have an estimated prevalence of 5-30% in adults with a female-to-male preponderance of 3:1[2]. Non-healing and healed venous ulcers occur in approximately 1% of the US adult population[3]. Risk factors associated with chronic venous disease including increasing age, female gender, family history of venous insufficiency, obesity, pregnancy and prior leg injury or surgery. Furthermore, occupations that require prolonged standing predispose individuals to development of chronic venous insufficiency. Disability secondary to severe venous ulcers results in 2 million workdays lost. Moreover, an estimated $1 billion are spent annually in the treatment of chronic venous ulcers[5].

The superficial venous system above the muscular fascial layer is composed of the great saphenous vein (GSV), the small saphenous vein (SSV) as well as several accessory veins. Along with the superficial venous system, the deep venous system and perforating veins serve as both a reservoir and conduit to return blood to the heart. Normal venous return depends on patency of the venous system as well as proper functioning of a series of 1-way bicuspid valves. In addition, lower extremity muscular function must be adequate in order to ensure central venous return. When the venous system is functioning correctly, every movement of the lower extremity moves blood inward and upward past competent valves that ensure that the hydrostatic pressure is near zero. In patients with venous insufficiency, incompetent valves remain in an open configuration, resulting in an unbroken column of blood from head to foot with a subsequent high hydrostatic pressure.

Failure of superficial venous valves occurs most commonly from weak vein walls that dilate under normal venous pressures, resulting in secondary valve failure. In addition, direct injury from superficial phlebitis, as well as congenital abnormalities, can result in primary valve failure. Finally, normal valves can be excessively distensible under the influence of hormones as in pregnancy. The common pathway of these states leads to an inability to prevent backflow and venous pooling.

The CEAP classification (**Figure 1**) is commonly utilized to reliably and reproducibly grade severity of venous insufficiency. Furthermore, therapy can be tailored to the severity of venous insufficiency.

Figure 1. CEAP classification

Clinical	C_0 – No clinical signs C_1 – Small varicose veins C_2 – Large varicose veins C_3 – Edema C_4 – Skin changes without ulceration C_5 – Skin changes with healed ulceration C_6 – Skin changes with active ulceration
Etiology	E_C – Congenital E_P – Primary E_S – Secondary
Anatomy	A_S – Superficial A_D – Deep A_P – Perforating
Pathophysiology	P_R – Reflux P_O – Obstruction

PRESENTATION

Early clinical manifestations of chronic venous insufficiency include the reporting of subjective symptoms. The characteristic ache of venous insufficiency comes on after prolonged standing and is described as pain, pressure, burning, itching or heaviness in the affected limb. Importantly, episodic symptoms may occur temporally, related to hormonal changes during pregnancy. Symptoms are alleviated by walking and leg elevation unlike in peripheral arterial disease. As the disease process advances, damage to the capillary basement membrane results in leg edema. The characteristic appearance of lipodermatosclerosis results from the breakdown of red blood cells and the subsequent deposition of hemosiderin in the skin. In the most advanced cases, non-healing ulcers are noted around the medial malleolus where venous pressure is maximal. Unlike typical arterial ulcers, the wound of chronic venous insufficiency is shallow, superficial, irregular in shape and associated with painful edema.

DIAGNOSIS

Venous duplex imaging is the simplest and most commonly used technique for establishing the diagnosis of venous insufficiency. Furthermore, duplex imaging is usually sufficient enough to guide therapy and management. Presence of venous reflux is confirmed by determining direction of blood flow. This is evaluated by placing the patient in reverse Trendelenburg position, and assessing blood flow direction during a Valsalva maneuver or after augmenting blood flow with more proximal limb compression. An alternative method requires venous duplex interrogation following a rapid cuff inflation-deflation technique while the patient is standing. The presence of significant reflux is determined by the presence of reverse flow towards the feet for a significant amount of time: $\geq$ 0.5 seconds for superficial veins and $\geq$ 1.0 seconds for deep veins. A longer duration of reflux corresponds with more severe disease but not necessarily with clinical manifestations.

Venous duplex imaging is often more than sufficient in diagnosing and managing patients with venous insufficiency. Air plethysmography is utilized occasionally to determine the relative contribution of venous reflux, as opposed to venous obstruction or muscle pump dysfunction, to the clinical syndrome. Computed tomography (CT) and magnetic resonance (MR) are rarely utilized to evaluate venous disease. The utility of advanced imaging modalities is mainly to diagnose both intrinsic and extrinsic compression of the venous system by surrounding structures. Invasive contrast venography is very rarely utilized if surgical intervention is considered.

TREATMENT OF CHRONIC VENOUS INSUFFICIENCY

Compression therapy between 20–50 mmHg remains the cornerstone of any treatment plan for chronic venous insufficiency. Graded external compression to the leg opposes the hydrostatic pressure that results in venous hypertension. The presence of compression grades is essential as non-graded ACE wraps and stockings cause a tourniquet effect that in turn exacerbates venous insufficiency. Compliance with 30-50 mmHg compression therapy is sufficient in the vast majority of patients to alleviate symptoms of chronic venous insufficiency as well as improve mobility. Even in more severe disease, compression therapy has been associated with complete venous ulcer healing at 5 months.

The most common compression stocking prescribed is for knee-high garments. A general rule of tension prescription that correlates with disease severity would be 20–30 mmHg for C2-C3 disease, 30-40 mmHg for C4-C6 and 40–50 mmHg for recurrent ulcers. Stockings should be worn daily and removed only at night for maximal benefit. Any compression garment should be replaced every 6 to 9 months.

In addition to compression therapy, calf muscle exercises should be performed as part of any treatment plan. In very small studies, coumarins, flavonoids, saponosides and other plant extracts have demonstrated mild improvement in edema-related symptoms[6,7]. However, currently, there are no pharmacological agents approved in the United States for treatment of chronic venous insufficiency. Although diuretics are commonly used to treat edema for short periods of time, it is important to understand that chronic venous insufficiency is not a state of volume overload. As a result, the benefit of temporary relief must be balanced with the metabolic and renal side effects of long-term diuretic usage.

Interventional therapy of chronic venous insufficiency includes both venous ablation as well as sclerotherapy. Endovenous ablation involves the application of thermal energy, either radiofrequency (RF) or laser (EVLT), to the vein wall which in turn leads to thrombosis followed by fibrosis of the treated segment. In the case of GSV ablation, both RF and EVLT procedures involve ultrasound-guided placement of a 7 Fr sheath in the GSV with subsequent passage of a catheter to the level of the saphenofemoral junction. Radiofrequency ablation of the greater saphenous vein has resulted in successful venous closure in 85% of patients with a 10% rate of recanalization at 2 years[8]. A very rare complication (< 1%) of RF is deep-vein thrombosis and subsequent pulmonary embolism[8]. Laser treatments have reported rates of closure as high as 95% at 2 years with no major complications[9]. At present venous ablation, by either laser or RF, has a higher rate of success compared to sclerotherapy and lower rate of co-morbidity compared to traditional surgical ligation and stripping[10]. Endovenous ablation is performed almost exclusively with local tumescent anesthesia which prevents skin burns and reduces any pain associated with the procedure. Although most commonly utilized in the treatment of GSV insufficiency, endovenous ablative techniques have also been utilized in treatment of perforator reflux in the case of non-healing ulcers.

A variety of sclerosing agents have been utilized to treat

telangiectasias, varicose veins and smaller segments of venous reflux. In addition, sclerotherapy has been used to treat spider veins, bleeding varicosities and cavernous hemangiomas. Currently in the United States, the only approved sclerosing agents are detergents including sodium tetradecyl sulfate, polidocanol, glycerin and sodium morrhuate. Generally, all agents have to be diluted with air or saline in order to avoid tissue inflammation and necrosis. The most common complication of any sclerotherapy is skin hyperpigmentation of surrounding tissue from hemosiderin degradation.

Endovenous deep-system therapy has become an important part of restoring venous outflow from the lower extremities. In the case of deep venous insufficiency from obstruction, venous balloon angioplasty followed by stenting has evolved as an alternative to surgical venous bypass surgery which is now very infrequently performed. Primary patency rates of 80% at 6 years for non-thrombotic and 60% for thrombotic disease have been reported[11]. The success of iliac stenting for venous ulcers has proved to be effective with 90% of patients free from recurrent ulceration at 5 years[12].

Surgical therapy is reserved for those individuals with venous insufficiency symptoms refractory to compression and endovenous therapy. High ligation at the level of the saphenofemoral junction followed by excision of the GSVs ameliorate symptoms and possibly improves ulcer healing[13]. Following vein stripping or endovenous ablation, symptomatic varicose veins can be removed with stab phlebectomy. Surgical intervention on incompetent perforator veins for non-healing ulcers can be especially challenging, given pre-existing tissue damage. However, when performed, endoscopic perforator surgery is associated with a high rate of ulcer healing and low rate of recurrence at 2 years when performed in conjunction with GSV ablation[14].

SUMMARY

Chronic venous insufficiency is a common medical problem. Adequate screening and recognition of its various manifestations are important to appropriately treat patients. Conservative measures including compression therapy, leg elevation and calf exercises are usually sufficient for most patients. In cases refractory to conservative therapy, interventional modalities including radiofrequency and laser ablation as well as sclerotherapy are effective at alleviating symptoms and venous ulcer healing. Rarely, surgical therapy may be required if ablation is ineffective.

References

1. McLafferty RB, Passman MA, Caprini JA, Rooke TW, Markwell SA, Lohr JM, Meissner MH, EklöfBG, Wakefield TW, Dalsing MC. Increasing awareness about venous disease: the American Venous Forum expands the National Venous Screening Program. J Vasc Surg. 2008;48:394–399.
2. Ruckley CV, Evans CJ, Allan PL, Lee AJ, Fowkes FG. Chronic venous insufficiency: clinical and duplex correlations: the Edinburgh Vein Study of venous disorders in the general population. J Vasc Surg. 2002;36:520–525.
3. Fowkes FG, Evans CJ, Lee AJ. Prevalence and risk factors for chronic venous insufficiency. Angiology. 2001;52:S5–S15.
4. Da Silva A, Navarro MF, Batalheiro J. The importance of chronic venous insufficiency: various preliminary data on its medico-social consequences [in French]. Phlebologie. 1992;45:439–443.
5. Rice JB, Desai U, Cummings AK, Birnbaum HG, Skornicki M, Parsons N. Burden of venous leg ulcers in the United States. J Med Econ. 2014:May 17 (5):347-6.
6. Nicolaides AN. From symptoms to leg edema: Efficacy of Daflon 500 mg. Angiology. 2003;54:S33–S44.
7. Vanscheidt W, Rabe E, Naser-Hijazi B, Ramelet AA, Partsch H, Diehm C, Schultz-Ehrenburg U, Spengel F, Wirsching M, Götz V, Schnitker J, Henneicke-von Zepelin HH. The efficacy and safety of a coumarin-/troxerutin-combination (SB-LOT) in patients with chronic venous insufficiency: a double blind placebo-controlled randomised study. Vasa. 2002;31:185–190.
8. Merchant RF, DePalma RG, Kabnick LS. Endovascular obliteration of saphenous reflux: a multicenter study. J Vasc Surg. 2002;35:1190–1196.
9. Min RJ, Khilnani N, Zimmet SE. Endovenous laser treatment of saphenous vein reflux: long-term results. J Vasc Interv Radiol. 2003;14:991–996.
10. Rasmussen LH, Lawaetz M, Bjoern L, Vennits B, Blemings A, Eklof B. Randomized clinical trial comparing endovenous laser ablation, radiofrequency ablation, foam sclerotherapy and surgical stripping for great saphenous varicose veins. Br J Surg. 2011;98:1079–1087.
11. Neglén P, Raju S. In-stent recurrent stenosis in stents placed in the lower extremity venous outflow tract. J Vasc Surg. 2004;39:181–188.
12. Raju S, Darcey R, Neglén P. Unexpected major role for venous stenting in deep reflux disease. J Vasc Surg. 2010;51:401–408.
13. MacKenzie RK, Allan PL, Ruckley CV, Bradbury AW. The effect of long saphenous vein stripping on deep venous reflux. Eur J Vasc Endovasc Surg. 2004;28:104–107.
14. Barwell JR, Davies CE, Deacon J, Harvey K, Minor J, Sassano A, Taylor M, Usher J, Wakely C, Earnshaw JJ, Heather BP, Mitchell DC, Whyman MR, Poskitt KR. Comparison of surgery and compression with compression alone in chronic venous ulceration (ESCHAR study): randomised controlled trial. Lancet. 2004;363:1854–1859.

Authors

Omar N. Hyder, MD, Cardiologist, Lifespan Cardiovascular Institute, Providence, RI; Assistant Professor of Medicine, The Warren Alpert Medical School of Brown University.

Peter A. Soukas, MD, FACC, FSVM, FSCAI, FACP, Director of Vascular Medicine and the Interventional Vascular Laboratories at Rhode Island and The Miriam hospitals; Assistant Professor of Medicine in The Department of Medicine and Director of the Vascular and Endovascular Medicine Fellowship Program at The Warren Alpert Medical School of Brown University.

Correspondence

Peter A. Soukas, MD, FACC, FSVM, FSCAI, FACP
Cardiovascular Institute
208 Collyer St.
Providence, RI 02904
401-793-7191
401-793-7200