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Management of Chronic Venous Disease

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More than 30 million people in the United States have some form of chronic venous disease (CVD). The prevalence of CVD is 10 times that of peripheral arterial disease.[1] Chronic venous disease is a major source of morbidity (incidence, 92 cases per 100,000 hospital admissions annually).[2] Most admissions are for venous ulcers, the most advanced clinical manifestation of the disease, occurring in approximately 20,550 patients each year.[3] The direct cost of treating venous disease in the U.S. is $3 billion annually.[4]

Risk factors for CVD vary, but they tend to be related to conditions that lead to venous dilation or other disruption of basic vein structure. These include older age, family history, female sex, pregnancy, obesity, occupations performed while standing, high-impact physical activity, and comorbid conditions such as deep vein thrombosis (DVT), superficial thrombophlebitis, and obstructive sleep apnea. Patients can present with pain, cramping, burning, itching, skin discoloration at the ankle, edema, phlebitis, or bleeding; and spider, reticular, or varicose vein patterns.

The lower-extremity superficial venous system has 3 major divisions: the greater saphenous, the small saphenous, and the lateral venous system. The greater saphenous vein (GSV) and small saphenous vein (SSV) originate in the foot and extend cephalad, communicating with the deep venous system via perpendicularly oriented perforating veins. The GSV terminates at the saphenofemoral junction. The GSV has several normal anatomic variants and is often duplicated (25% of the time in the calf, and 8% in the thigh).[5] The SSV terminates and joins the femoral or popliteal vein near the popliteal crease in approximately two thirds of cases. It can also extend into the thigh and terminate in the GSV (vein of Giacomini) or in the femoral vein.

Venous blood return to the heart is aided by muscular contractions that pump blood through the low-resistance venous system. Valves within veins open during systole and close during diastole, to prevent retrograde flow. In one contraction, the calf muscle can empty 40% to 60% of the blood volume in the leg, which can decrease venous pressure by >70 mmHg in just a few steps.[6] Primary venous reflux can occur in any superficial or deep vein of the lower limb but is more prevalent in the former. Over time, venous dilation prevents adequate valvular coaptation, leading to blood reflux. Reflux can further distort the venous architecture and lead to progressive dilation and varicosity, with aneurysm formation in rare instances. A system of perforator veins communicating between the superficial and deep veins is also part of the valvular structure and can act as a hidden source of increased venous pressure during the treatment of refractory venous ulceration. Large perforator veins (diameter, ≥3.5 mm), which can cause substantial reflux (outward flow, >500 ms by Doppler measurement), are potential targets for therapy.[1]

The severity of CVD is usually evaluated by means of the CEAP (Clinical, Etiologic, Anatomic, Pathophysiologic) classification system, which focuses chiefly on the clinical element. The main feature of stage C1 is telangiectasias or reticular veins; that of C2, varicose veins; of C3, edema; C4a, pigmentation or eczema; C4b, lipodermatosclerosis or atrophie blanche; C5, healed venous ulcer; and C6, active venous ulcer. Evaluation of patients involves physical examination and reviews of current general health conditions, medical history, and symptoms. Doppler ultrasonography is the most important diagnostic tool beyond the physical examination, and thorough imaging procedures are necessary to document venous reflux. Imaging performed with the patients in different positions and with varying degrees of external compression helps to expose concealed areas of venous reflux.

The goal of CVD treatment is to decompress sources of increased venous pressure. Initial therapy with graduated compression stockings (GCS) is recommended for most patients. More aggressive initial treatment may be considered in patients who present with complications such as recurrent superficial vein thrombosis, bleeding varicose veins, or ulceration. Stockings can be of varying pressure; in our practice, we generally recommend class II GCS, consisting of external compression pressures of 20 to 30 mmHg. Decreased proximal compression promotes forward flow.

Advanced treatments include surgery. Vein-stripping usually involves surgical excision of the refluxing vein (frequently performed with patients under general anesthesia). Ultrasound-guided foam sclerotherapy involves cannulating the vein under ultrasound guidance and injecting a foaming agent or sclerosant (for example, sodium tetradecyl sulfate). This, upon contact with the vessel wall, leads to denudation of the endothelium, organized thrombosis, and occlusion with sclerosis. The sclerosant must contact the venous endothelium for technical success. Radiofrequency and laser ablation, endovascular techniques that use thermal energy to damage and contract the venous wall, have been used successfully to treat GSV reflux. In support of this are reports of the efficacy of the ClosureFast™ Endovenous Radiofrequency Ablation Catheter (Medtronic, Inc.; Minneapolis, Minn). Duplex ultrasound detected occlusion rates of 100% at 1 week, 97% to 99.7% at 3 months, 95% to 98% at 1 year, and 85% to 93% at 3 years.[7,8] Five-year follow-up investigation of clinical outcomes revealed a general shift from CEAP class C2 to class C1 after use of ablation, suggesting long-term clinical efficacy. Risks and complications of all these procedures include perforation, DVT, pulmonary embolism, phlebitis, hematoma, infection, skin burns, and nerve injury.

Rasmussen and colleagues[9] conducted a randomized clinical trial (involving 500 patients) to compare the treatment of GSV varicosities by means of the above methods. As evidenced by the reflux-free rate at one year, the clinical effectiveness of radiofrequency ablation (95.2%), laser ablation (94.2%), and stripping (95.2%) was superior to that of foam sclerotherapy (83.7%; P <0.001). The time until patients could resume work was significantly shorter after radiofrequency ablation and foam sclerotherapy (both 2.9 d) than after laser ablation and stripping (3.6 and 4.3 d, respectively; P <0.001).

Other techniques are available. One is VenaSeal™ (Medtronic), an alternative injection system that uses cyanoacrylate, the same product used to treat intracranial aneurysms, to solidify and close the treated vein.[10] Another is mechanochemical ablation with use of the ClariVein® (Vascular Insights, LLC; Quincy, Mass), in which a rotating wire is used to cause cellular damage to the intimal layer of the vein and result in spasm while a sclerosant is injected to penetrate the vessel wall, resulting in obliteration.[11] Both techniques have produced results comparable to thermal ablation, without need of tumescent anesthesia and with low postoperative pain.

Nonthrombotic Iliac Vein Lesions

Primary venous obstructions, often called nonthrombotic iliac vein lesions (NIVL), usually occur when the right common iliac artery compresses the left common iliac vein (May-Thurner syndrome). Focal stenosis can also occur at these anatomic "choke" points. Over time, repetitive pulsations of the intimately related artery cause traumatic injury, such as mural fibrosis, webs, and membranes, which limit venous flow. Although these obstructions might be present in up to 50% of the general population, symptoms occur in just 3% to 5% of cases, when additional insult, such as trauma, infection, or reflux, is added.[12]

Diagnostic evaluation begins with clinical findings. Patients may have acute DVT of the left leg or more indolent symptoms, such as chronic edema. Venography, Doppler ultrasonography, computed tomographic venography, magnetic resonance venography, and intravascular ultrasound (IVUS) are adjunctive tools for confirming the diagnosis. The diagnostic sensitivity of venography is notoriously low: in one case series, 34% of patients with CVD symptoms and stenosis on IVUS had no detectable vein occlusion upon venography.[13] Intravascular ultrasound improves diagnostic accuracy and spatial resolution and can be advantageous when treatment options are considered.

Unlike CVD, in which distal venous incompetence leads to increased pressure, NIVL is the result of proximal stenosis that causes venous incompetence. Treatment depends on relieving obstruction, typically by means of stenting. In addition to its diagnostic accuracy, IVUS can help to identify disease-free central and peripheral landing zones for stents, determine the lengths and diameters of diseased vessels, and clarify the degree of recoil and venous wall apposition after stenting. In a retrospective analysis of 302 NIVL patients who underwent IVUS-guided stenting, the primary patency rate was 79% at 6 years[13]; 303 post-thrombotic patients had lower patency rates (57% at 6 yr), probably because of space-occupying lesions or clots and disrupted venous architecture.[13] Of note, in NIVL patients with combined superficial and deep venous reflux who underwent stenting, 75% had "good or excellent" symptomatic relief, similar to 79% of patients who had no venous reflux.[14] This suggests that proximal obstruction contributes to distal reflux in these patients.

Chronic Deep Vein Thrombosis

Chronic DVT is associated with grave sequelae that affect patients physically and socioeconomically. The incidence of DVT in the U.S. is 350,000 to 600,000

persons annually. Post-phlebitic syndrome (PPS) affects over 40% of patients after DVT and is heralded by symptoms of edema, claudication, and ulceration. Involvement of the common femoral and iliac veins is associated with the worst clinical outcomes and a doubled risk of recurrent DVT and PPS.[15] These patients should be treated aggressively, with consideration of thrombolysis or thrombectomy.

To avoid PPS, patients should use GCS immediately upon diagnosis and daily for at least 2 years; this might lower the risk of PPS by >50%. The American Heart Association (AHA) issued an iliofemoral-DVT management statement that emphasized the role of GCS as first-line therapy. Of importance, the AHA gave a IIa (benefit-exceeds-risk) recommendation for treating isolated obstructive lesions in the common femoral vein by means of percutaneous transluminal angioplasty without stenting (level of evidence C) and for placing iliac vein stents to reduce PPS symptoms and heal venous ulcers in patients with advanced PPS and iliac vein obstruction (level of evidence C).[16]

Chronic venous diseases are prevalent and can substantially affect patients' quality of life. Taking careful medical histories and performing thorough physical and imaging examinations enable the treatment of this constellation of diseases. As worldwide experience increases and dedicated technology improves, continuously better treatments and outcomes should result.

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