

PVD and DPM: Should Podiatrists Be the Referrer or the Referee?

Podiatrists should surely be diagnosing, preventing, and treating vascular disease of the lower extremity.

By Earl Horowitz, DPM and Kenneth B. Rehm, DPM

Obesity, hypertension, metabolic syndrome and diabetes have become almost epidemic in our Western culture. This portends several increasingly glaring trends. First, there is more vascular and diabetic foot disease. Secondly, podiatric physicians are seeing more vascular and diabetic foot disease in their practices. As a result, a very large, statistically significant number of podiatry patients present with peripheral vascular disease. This places podiatric physicians as key providers of services for the vasculopathic patient.

There is irrefutable evidence of an interrelationship among peripheral vascular disease, coronary heart disease, and stroke. All three of the above conditions stem from atherosclerosis and commonly occur together. The importance of this for the podiatric physician is highlighted by the fact that vascular disease of the periphery is often a marker for overall cardiovascular disease which particularly involves the coronary, cerebral and renal arteries, and unquestionably leads to an increased risk of myocardial infarction, stroke, and death.

The signs and symptoms of this syndrome commonly presents in the lower extremity before anywhere else. This creates an opportunity for the astute podiatric physician to identify potential or actual life-threatening diseases before they are

otherwise clinically evident to other healthcare providers. This allows the podiatric physician to pick up potential problems before they become critical, and positions this specialty as an increasingly decisive member of the healthcare team.

Because we are given this opportunity, it then is our ethical responsibility to our patients to be that astute podiatric physician. Given the fact that almost 100,000 limbs in the U.S. alone, and about a million worldwide, are lost each year to the ravages of diabetes, most of which is vascular-related, it is incumbent upon the podiatric community to endorse all aspects of peripheral vascular disease as central to their practice. This, in turn, will ultimately benefit not only the patients who are the recipients of this care, but also the individual's practice, as well as both the podiatric and medical community in general.

At present, there is very little that a podiatrist can do to reverse atherosclerosis, thrombosis, or emboli, but being able to treat podiatric pathology and prevent lower extremity amputations relies on thorough patient assessment with special emphasis on vascular assessment of the lower limb.

If pathology is discovered after thorough podiatric evaluation, it is customary to make a referral to specialists outside the podiatric profession. With such expertise in the foot and its vascular pathology, what conditions should be treated

by or referred to the podiatric physician specialist?

To answer this question, let's start out with a background discussion.

Peripheral Arterial Diseases: Arterial, Venous, and Lymphatic

There are three major components of peripheral vascular disease: arterial, venous, and lymphatic. In recent years, peripheral arterial disease (PAD) has become the most well known of these various conditions, probably because of all the media attention to this disorder. The increase in number and types of vascular interventions, including those that are both invasive and minimally invasive, has become a driving force toward public awareness. These revascularization procedures are associated particularly with diabetic and cardiovascular pathology.

Peripheral arterial disease, a nearly pandemic condition, is characterized by a lack of tissue perfusion caused by existing atherosclerotic plaque. It can be exacerbated by emboli, thrombosis, and vasoconstrictive phenomena. Those affected are often able to participate in their normal activities of daily living until the disease progresses to limb ischemia and other life-threatening conditions.

The atherosclerotic core can advance gradually from partial to complete occlusion of arterial ves-

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sels. Disease is usually segmental with significant variations from patient to patient. Emboli are the most common cause of sudden ischemia, usually of cardiac origin. They can also occur from proximal atheroma, tumors, or foreign objects. Emboli tend to lodge in arterial bifurcations or when vessels abruptly narrow. Multiple factors can lead to thrombotic events, such as sepsis, hypotension, low cardiac output, aneurysms, bypass grafts, and underlying atherosclerotic narrowing of arterial lumens.

Acute trauma can also compromise perfusion. Peripheral arterial disease can coexist with myocardial infarction, arterial fibrillation, transient ischemia, strokes, and renal disease, and is associated with a higher mortality rate. Even asymptomatic peripheral arterial disease is associated with increased mortality due to cardiac disease.

Major Risk Factors

Major risk factors such as smoking, hyperlipidemia, diabetes, hypertension, and hyperviscosity of the blood are on the rise; as well as radiation-induced peripheral arterial disease, which is becoming more common due to current anti-neoplastic treatments and increased survival rates of cancer patients.

Intermittent Claudication

Intermittent claudication is a common presenting complaint, and may in fact be the sole manifestation of early symptoms of peripheral artery disease. The level of arterial compromise and the location of claudication are closely related. Aorto-iliac stenosis can produce thigh and buttock problems. Femoral-popliteal stenosis can cause calf, hip, and leg symptoms and cause the leg to feel weak and "give way" with even mild exercise. Pain at rest indicates advanced occlusion and a severe reduction of tissue perfusion. Symptoms can be pain, paralysis, paresthesias, pulselessness, and pallor.

Skin changes are common. These include trophic changes such as shiny skin, dry scaly skin, pigmentation, brittle nails, poor healing of skin ulcerations, cyanotic

changes, and gangrene.

Chronic Lower Extremity Venous Disease

Chronic lower extremity venous disease is the most common peripheral vascular disease. Chronic venous disease refers to the presence of morphological (venous dilation) or functional abnormalities (venous reflux). The initial clinical presentation is highly variable. The most common signs and symptoms are pain and discomfort, venous dilation, telangiectasias, varicose veins, edema, inflammation, dermatitis, and ulcerations.

Chronic venous disease, whether morphological or functional, represents the most common of all peripheral vascular disorders, and venous ulcerations are the most common, up to 70%, of

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all lower extremity ulcerations that occur. It is easy to see that chronic venous insufficiency can diminish the quality of life and can involve costly treatments.

Diagnosis

Diagnosis is predominantly clinical, although vascular testing is imperative. The initial history and physical examination is critical to developing a clinical classification of the disease severity. It is broken down into clinical groups, by etiology, anatomy (valvular insufficiency of the superficial or deep perforator veins), and pathophysiological dysfunction, which is designated as either reflux, obstruction, or a combination of both. Venous ulcers are

caused mainly by improper function of the venous valves, causing the pressure in veins to increase and also change the direction of flow, which is especially prominent in the perforator veins. The body needs the pressure gradient between the arteries and veins in order for the heart to pump blood forward through the arteries into the veins; and this is altered in chronic lower extremity venous disease.

Venous Hypertension

With venous hypertension, which is usually caused either by valvular insufficiency or obstruction, the arteries no longer have significantly higher pressure than the veins. Therefore, arterial blood is not pumped through the small arterial vessels and can pool in that area. This usually will cause less arterial perfusion and all the nutrients and oxygen that the arterial perfusion brings with it will be greatly reduced.

Venous Ulcers

Ulcers will develop mostly along the medial distal area of the lower leg. They are usually very painful and make up approximately 70% of all chronic wound cases. Venous hypertension can also stretch veins, allowing blood proteins to leak into the extra-vascular spaces. This prevents growth factors from helping wounds to heal and prevents oxygen and nutrients from reaching the wounds, especially venous wounds.

Deep venous thrombosis is usually caused by venous stasis, a vessel wall injury, or a hypercoagulable state. These conditions are known as Virchow's Triad. In practical terms, the development of venous thrombosis is usually caused by activation of the coagulation in areas of reduced blood flow. DVTs usually begin in the deep veins of the calf around the valve cusps, or within the soleal plexus at the popliteal area. A minority of cases arise from the iliofemoral system as a result of direct vessel wall injury or status post-hip surgery or intravenous catheters.

Most calf vein thromboses dissolve completely without therapy. About 20% move proximally. Ad-

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herence with organization of the thrombus takes about five to ten days after the thrombus forms and the non-adherent disorganized thrombus may move forward or embolize. The principle long-term morbidity usually linked to DVT is coupled with post-thrombotic syndrome and its morbid sequellae. Mortality from a DVT is usually consequent to a pulmonary embolism.

Diagnosis

Color duplex ultrasound, a non-invasive exam, is typically considered, for all practical purposes, a definitive diagnostic test for DVTs, valvular insufficiency, and most other vein dysfunctions. In addition, a clinical history that indicates edema, leg pain, tenderness in affected areas, signs of pulmonary embolism, unilateral lower extremity edema, calor, and erythema should all be warning signs of severe venous pathology.

Lymphedema

Lymphedema is a notoriously debilitating, progressive condition that currently has no known cure. These patients undergo a lifelong struggle dealing with this condition. Patients present with varying degrees of severity from mild swelling to severe debilitating disfiguring engorgement of the lower extremities causing severe disability and life-threatening complications.

Lymphedema is a condition of localized fluid retention, tissue edema and various degrees of swelling in the extremity caused by a compromise in the lymphatic system. Lymph flow from the leg to the heart is the result of the calf pump action. There are valves in the lymphatic system that prevent the fluid from returning to the lower extremity. Lymph flow goes through the lymph nodes and is filtered through these nodes and ends up in the thoracic duct area. From the thoracic duct area, the lymph is returned to the venous circulation through the left subclavian vein. Signs and symptoms of lymphedema include severe fatigue, heavy, swollen legs, discoloration of skin and severe deformity (elephantiasis).

Lymphedema should not be confused with edema arising from venous insufficiency. Untreated venous insufficiency can lead to combined venous and lymphatic disorders. Cellulitis may be a factor in causing lymphedema, especially in the lower extremities. Diagnosis can be difficult in the early stages until its signs and symptoms become more evident. When lymphatic impairment becomes so great, lymph fluid exceeds the lymphatic system's ability to transport it. Protein-rich fluids collect in the tissue, causing tissue channels to increase in size and number, and thereby reducing the availability of oxygen. This can interfere with wound healing and provides a rich culture medium for bacteria, placing the patient at risk for infectious processes and cellulitis.

Infection further damages the lymphatic system, setting up a vicious cycle. Consequently, lymphangitis and, in severe cases, skin ulceration can develop. Because of its disfiguring characteristics, this results in severe limitations to a person's ability to adequately per-

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form activities of daily living, and can lead to a challenged lifestyle that is fraught with physical problems and psychological distress.

The typical approach of a podiatric physician would be to refer these conditions to M.D. counterparts, with little thought given toward his/her own role in prevention, diagnosis, or treatment of these problems. This is especially evident when it comes to venous and lymphatic dysfunctions.

Toe and Flow

In the "toe and flow" model, a conjoined model of limb salvage, recently described by Lee Rogers, et al., in the *Journal of the American Podiatric Medical Association*, in September of 2010, the treatment algorithm involving podiatry and vascular surgery begs the question: "Are we just the toe, or are we an integral part of the flow?" Should appropriately trained podiatric physicians refer all vascular symptomatology and disease conditions, especially peripheral arterial diseases, to vascular surgeons or always obtain a vascular surgical consult initially?

Other options to any vascular intervention have to be considered when surgical risk is not warranted or the patient is not a candidate for any circulation augmentation procedure, including endovascular procedures such as atherectomy, stenting, angioplasty, bypass surgery, etc.

When all medical, pharmaceutical, non-invasive and invasive surgical treatments have failed and all apparent options for re-perfusion of the wounded and gangrenous lower extremity have been exhausted, the resourceful and talented podiatric physician, in spite of all the failures, just may be able to accomplish limb preservation.

The ingenuity of our podiatric physicians who are open to, and skilled in, the many conservative treatments that the field of podiatric medicine has archived brings with them many therapeutic modalities such as nerve blocks, various physical therapy modalities and variations of electromagnetic therapy, such as pulsed and non-

pulsed circulator boot therapy, etc. These doctors and modalities have been responsible for accomplishing what was previously thought of as impossible. When such a podiatric physician looks into the eyes and face of a patient who has been told that all treatments to save the leg have failed and that amputation is the only alternative, the podiatric physician would be able to say "We can try conservative therapy to solve your problem," and have confidence to back it up. One can easily see the renewed vitality seen in the patient's face. Medicine can surely use the talents of a skilled podiatric physician who capitalizes on vascular expertise to enhance his/her role as part of the limb salvage and preservation team.

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Non-Invasive Vascular Testing Equipment

For podiatric physicians to take a more proactive role in peripheral vascular disease, they must either have diagnostic equipment in their offices or utilize a vascular lab. Both have their advantages. For office testing, a vascular certified technician should become a staff member of the podiatric office. This could become economically advantageous for the office, as well as presenting more professional testing controls. The most important ingredient for non-invasive vascular testing for the DPM is being knowledgeable about the interpretations of the results of these tests. These tests can adequately diagnose, prevent, and treat most pe-

ripheral vascular diseases.

It should be noted, especially with peripheral arterial disease, that one test alone should not be used to make a determination as to the conditions involved or their severity. This is especially true where ABIs are the lone interpretation of arterial dysfunction. Non-invasive equipment used today can give enough information to establish a definite pattern for diagnosing, treating, and preventing most peripheral vascular diseases; or can allow the practitioner to suggest when more sophisticated testing or a referral is needed. This is an especially important consideration for treatment of acute or chronic conditions, or when vascular intervention or surgery is indicated. This diagnostic equipment can also help ascertain or monitor the effectiveness of treatments, or even be a great aid in developing a prevention program.

Office Set-Up

The equipment necessary for an office set-up would be plethysmographic in nature, which would include photo-plethysmography, instrumentation for pulse volume recording, segmental pressure testing—including ABIs, toes, ankles, legs, thigh pressures, Doppler bi-directional, color duplex ultrasound and a laser Doppler. It is highly suggested that if duplex studies are to be done, both arterial and venous, that a certified vascular technician be employed to perform these exams. The professional expertise augments the quality of the testing.

All these tests can determine the quality of the vessels and flow as well as the quantity of flow. They can locate and determine the degree of stenosis or obstruction, be they singular or multiple. They can determine the degree of vasoconstriction. They can determine if there is a functional (vasoconstriction) or obstructive condition. They can determine a specific blockage, be it thrombus or emboli.

Remember, when ordering tests from a vascular lab, it is important that multiple tests be required, that the graphic results as well as the written report should be given to

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you for your evaluation. Testing for valvular insufficiency, both superficial and deep, as well as thrombus and emboli conditions in the venous system, are evaluated best with the use of color duplex ultrasound studies. These studies have become the standard for determining venous dysfunction. Lymphatic testing is more difficult. Duplex studies can be an aid in establishing as well as differentiating between venous insufficiency and lymphedema.

The quality of non-invasive testing and its interpretation should be, in itself, a start of the new role of the podiatric physician in peripheral vascular diseases.

The Treatment Phase

In the treatment phase, the intermingling and synergistic effect that arterial, venous, and lymphatic mechanisms have on each other must be appreciated. The end product of successful treatment must be

based on perfusion and drainage. Even with the restoration of blood flow to the lower extremity after revascularization, arterial problems manifested by the lack of micro-circulation present continuing difficulties. This includes a wide set of complicating factors that might consist of functional problems with micro-circulation, chronic peripheral vascular disease, or reperfusion injuries to the existing capillaries.

In the treatment of peripheral vascular diseases, the opportunity that podiatric physicians have is to create a niche surrounding a conservative approach that would include not only the therapies previously mentioned, but preventive educational and physical modalities as well as diagnostic capabilities. The conservative concept not only depends on thorough diagnostic testing and evaluation, but the maintenance and follow-up of accurate documentation of treatments, with consistent re-evaluation.

Appropriate testing and record-

keeping, the cornerstone of a conservative and preventive approach, helps eliminate the chances of recurrence or worsening of these conditions. Notwithstanding, lifestyle changes, such as appropriate diet, exercise, proper body and foot mechanics, and eliminating smoking, as well as being cautious observers of important markers of health and disease in the blood are necessary to accomplish the conservative approach. The appropriate referral at the appropriate time ensures that the podiatric physician maintains his/her status as a valuable member of the team.

Many physical types of equipment can produce exceptional results that will help increase the success of surgery, increase arterial perfusion and drainage and, in many cases, stop the need for vascular surgical intervention entirely. Compression is one of the main sources of perfusing tissue, normally in the lower extremity. The musculature, especially in the calf area, perfuses the leg and foot

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structures and aids in its drainage. This is the concept of the push-pull method, pushing blood down through the macro-circulation and pulling it through the microcirculation, especially the capillaries.

Circulator Boot System®

In order to accomplish this in a treatment phase other than normal walking, which cannot always be accomplished for many patients, the authors have found the Circulator Boot System® to be the most successful piece of equipment for this conservative treatment phase. It is a compressive device synchronized with the heartbeat. The boot may be timed to compress the leg after each heartbeat or be manually controlled. Both are controlled by a heart monitor. It does not compress the leg during moments of heart contracture and arterial inflow to the leg.

For example, a man with a pulse of 80, with the usual 40-minute treatment, would have 3200 compressions. These compressions aid dramatically in venous and lymphatic drainage and increase arterial flow (both macro and micro). It aids in creating new capillaries, reducing venous pressure, and increases arterial perfusion dramatically. It has the additional capability of treating wounds by pumping antibiotic solutions and wound solutions directly into the open wounds, aiding in its versatility as a conservative therapy device. We have found this to be the most useful conservative treatment modality in existence today for increasing arterial flow, aiding in wound healing and controlling venous and lymphatic drainage. It is a form of conservative treatment that a podiatrist could utilize in developing a referred-to podiatric peripheral vascular practice.

All podiatry practices that are going to enter into the field of peripheral vascular disease should make this equipment available, either in a center or within their individual offices.

The Neurovasix MicroVas System®

The next phase found to aid in bringing more perfusion to tissue,

to aid in healing, to develop more capillaries and aid in drainage, is the use of neurovasix's Microvas System®. These treatments have been in existence for many years. The concept of electrical stimulation is to increase arterial blood flow and perfusion and aid in reducing edema from both the venous and lymphatic systems. Investigation over the years has shown an increase in capillary formation and capillary dilatation, and an increase in the amount of nitric oxide through the use of electrical stimulation. The result is increased arterial perfusion and drainage.

It has been observed that the combination of using the neurovasix MicroVas System and the Circulator Boot System® have produced extremely favorable results in prevention and treatment of peripheral vascular diseases, wound healing, both venous and arterial, pre- and post-surgical situations, and has reduced amputation rates dramatically, especially where no arterial surgery could be performed. It has aided in reducing the number of post-operative peripheral arterial vascular complications and reduced the number of re-do type surgeries that are being performed for these PAD conditions. The results of this combination of conservative therapy has been verified by the use of non-invasive testing, especially the use of laser Doppler, to show perfusion in areas that had reduced perfusion before the conservative treatment had started.

Conservative Treatment for Venous Problems

Once the diagnosis is made, especially where valvular insufficiency of the saphenous system and perforators are the problem, the establishment of treatments is critical. The use of compression in the form of Circulator Boot® therapy, electrical stimulation, along with Unna boots and compression garments, as well as ulcer treatments, have given us an excellent means of controlling these conditions. Where the scope of practice is not a problem, podiatrists, with the use of a certified vascular technician in their office, are using closure proce-

dures of the saphenous veins, perforators and telangiectasias with the use of radiofrequency, lasers, and injection therapies. These procedures are classified now as office procedures along with the conservative compression treatment programs.

Lymphatic Treatments

Treating lymphedema should become a primary part of the podiatry practice to try to prevent and aid in controlling this disabling and lifestyle-changing condition. Patients with lymphedema need treatments consisting of compressions, massages, garments, and in severe conditions, the need for psychological care has to be a part of our treatment program in aiding them in their lifestyle changes.

It has been found that in most cases, peripheral arterial problems have a peripheral venous component, and in many cases, a lymphatic system breakdown. Most venous problems will also have a reduction in arterial perfusion due to pressure changes.

By incorporating lifestyle changes, vascular testing, meticulous record-keeping and follow-up, the ability to use this approach to optimize results in the following contexts is the ultimate goal:

- 1) To increase perfusion in early suspected peripheral artery disease.
- 2) To increase micro-circulation before vascular intervention or surgery. (This might mitigate the need for any procedure.)
- 3) To increase perfusion post-arterial intervention or surgery, maintaining the flow of the macro-circulation, and help assure a successful outcome.
- 4) To increase perfusion for optimal wound healing and to diminish the risk involved in podiatric prophylactic foot care in the "high-risk patient".
- 5) To maintain vascular health of the lower extremity to permit exercise through ambulation.

It is important to note that if exercise is going to be accomplished by walking, then proper biomechanical function and structural integrity of the kinetic chain should be maintained. This would eliminate abnormal pressure points

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so that walking can continue to be used for aerobic exercise.

Summary

In summary, conservative therapy should be instituted before and after any kind of peripheral arterial disease surgical intervention is to be considered. This is especially important where surgical intervention cannot be performed. It should now be evident that podiatry's position regarding the treatment of peripheral vascular disease should be that DPM's should be functioning via not only the toe but as part of the flow as well. This concept opens up new opportunities for the profession of podiatry to offer what it can do best in diagnosing, preventing, and treating these very common, almost pandemic conditions; and these treatments prove the value of the podiatric physician and surgeon as a part of the peripheral vascular team. ■

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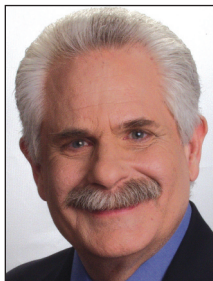
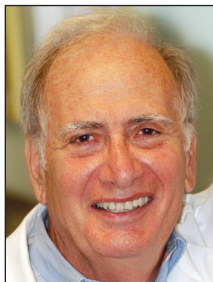
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