Vascular medicine and osteopathic medicine: treating the whole patient

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Education and instruction in the care of the patient with peripheral vascular diseases is, at best, fragmented during the first years of medical training. Attention to the issues of peripheral arterial, venous, and lymphatic disorders deserves a more formal approach with respect to physician education, patient evaluation and treatment, knowledge and application of various diagnostic modalities, and involvement of our physician colleagues in complementary disciplines. The vascular medicine internist is an invaluable resource in these areas. The aging of our general population will lead to an increase in manifest peripheral vascular disease within our patient population. Having received additional comprehensive training in the management of the complex patient with peripheral vascular disease, the vascular medicine internist may serve as a complete resource for their care.

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Vascular medicine is a subspecialty discipline of internal medicine concerned with the identification, prevention, and treatment of peripheral vascular disease (PVD). Working closely with the patient and colleagues in various other complementary disciplines, vascular medicine internists think that the evaluation and treatment of PVD requires a comprehensive assessment of the many facets of vascular disease and other associated clinical areas that may influence its course. With this information, vascular medicine internists can better educate patients to accept an active role in their care, formulate succinct recommendations for review and implementation by their osteopathic primary care physicians, and explore new horizons for research efforts.

What is vascular medicine?
Care for the patient with PVD is an ongoing, dynamic process with its roots firmly based in internal medicine. Disciplines involved in the care of the patient with PVD may include hypertension, hyperlipidemia, rheumatology, neurology, endocrinology, cardiology, and vascular biology. Perhaps most important is an essentially close collaboration with vascular surgical colleagues. Involvement of other subspecialties may also be required. Daily discussion of approaches to patient care helps to foster plans of treatment that best fit the individual patient with manifest PVD.

Vascular medicine internists undergo formal training through accredited internal medicine residency training programs. Successful completion in this area allows one to progress toward one of the many fellowships in vascular medicine. These programs have and continue to be associated with some of the most well-known medical institutions in the United States, Canada, and Europe. Continuing medical education is fostered within the various institutions supporting these programs as well as within the parent Society for Vascular Medicine and Biology (SVMB). Founded in 1989, the SVMB conducts annual meetings for members, nonmember physicians, and other interested healthcare professionals who focus on clinical approaches to vascular diseases and the basic sciences that form their foundation. Position publications on the care of those with PVD are compiled and new approaches to care formulated. The SVMB also oversees recognition of those who have formal training in vascular medicine, and those who are so formally trained may be inducted as a fellow of the SVMB.

Vascular medicine internists also have additional training within the noninvasive vascular laboratory and can help to direct, perform, and interpret appropriate testing within these facilities. Interpretation of this information in conjunction with knowledge of the patient’s clinical status can further help to direct efficient medical, surgical, and peripherally based interventional care. No matter which treatment pathway is chosen, attention to comprehensive medical care is paramount.

Management of patients with PVD encompasses clinical concerns, including peripheral arterial disease (PAD), hypercoagulability and thromboembolic disorders, venous disorders, stroke, and extracranial carotid arterial disease, vasculitides, the painful and swollen limb, visceral and mesenteric vasculopathy, cutaneous ulcerative problems, coronary artery disease (CAD), atherosclerosis, and aneurysmal disease. More the rule rather than the exception, these processes will not be present singularly. The prevalence of peripheral atherosclerosis was approximately 1.8 million in 1995. Mortality from processes including atherosclerosis exceeded 135,700 in 1996. Although death rates appear to be decreasing, vascular disease remains exceedingly common. Because more than one type of vascular pathologic process may exist at a time, usually associated with one or more common diseases (such as hypertension and diabetes), it is the charge of the physician to recognize their interaction and formulate a comprehensive plan for further evaluation, treatment, and prevention.

Clinical evaluation
The clinical evaluation for the patient with PVD begins with a thorough history and physical examination. Attention to the chief complaint is an introduction to a more complete review and may hold other clues to vascular disease. It may be helpful to approach the initial evaluation with intent to establish a person’s risk factors for PVD, with specific concerns to identify those modifiable risk factors. Careful discussion of the patient’s past history and family history, along with review of any accompanying information, may also give further guidance.

The vascular medical evaluation must not only take into account each specific disease entity, but also consider their interrelationships. This approach parallels osteopathic medical philosophies quite well. Consider, for example, the sedentary, hypertensive, smoking patient with
Recovery of traditional risk factors for either that will need review. To the possibilities for underlying disease an area of unexplored terrain with respect to the lipid profile. This individual represents type 2 diabetes mellitus and an unknown entity that can be approached by instituting lifestyle changes and well-established pharmacotherapy. Perhaps more difficult to achieve and maintain is long-lasting lifestyle modification. Lifestyle modification is often easier to maintain in those patients who exhibit the interest and motivation to play an active role in their care. Targeted patient education may help to strengthen this aspect of patient involvement.

The remainder of historical questioning should focus on including or excluding the other aspects of vascular disease. It may be helpful to approach each individual similarly with emphasis on stroke and transient ischemic attack, CAD, lipid disorders, hypertension, diabetes mellitus, PAD, and venous disorders. Once the history has been established, the findings on physical examination will guide further diagnostic and treatment modalities.

**Arterial disease**

Cold hands and cold feet are neither sensitive nor specific indicators of PAD. Anxious patients who have just had a cigarette and a cup of coffee before their examination may exhibit these findings despite a fully intact underlying arterial circulation. Likewise, complaints or observation (or both) of abnormalities of hair-growth patterning, nail deformities, and dry skin are also poor indicators of PAD. One must not be led astray by those processes that may mimic PAD. Pseudoclaustrication caused by lumbar spinal canal stenosis will often produce leg pain while walking, but the distance to onset may be variable and relief may only come with sitting for more than 5 minutes. True intermittent claudication, a symptom of PAD, produces ambulatory symptoms that occur at a relatively consistent distance. Relief can usually be obtained within 1 to 2 minutes of stopping and standing in place. Interestingly, some persons may notice a lessening in the intensity of symptoms by slowing the pace of walking or when returning to level ground after attempting an incline.

Palpation of all pulses is a necessary task, as is auscultation for bruits. Blood pressure should be measured in both arms. Functional assessment with pulse volume recording (PVR), including ankle-brachial index, will help to determine if there are further objective findings that support the physician’s clinical suspicions. Arterial duplex sonography may be useful in carotid, subclavian, aortic, renal, or mesenteric disease. When findings of the clinical evaluation and directed testing do not support the existence of significant PAD, one must consider evaluation of other entities that may be active. Comprehensive musculoskeletal and neurologic examinations will often be indicated at this time. The recent technologic advances in computed tomography, magnetic resonance imaging, and electromyography have been well used in this setting to help clarify other issues not related to PAD.

Evaluation of cerebrovascular symptoms includes a thorough neurologic review and may be supported by noninvasive testing with carotid arterial duplex ultrasonography or other modalities as aforementioned. Magnetic resonance angiography, although not the “gold standard” of diagnostic evaluation, is an up-and-coming modality that has been used in lieu of traditional contrasted arteriographic techniques. One specific benefit is avoidance of exposure to and the potential risks of intravascular contrast agents.

Large abdominal aortic aneurysms may be detected in up to 90% of patients as a palpable, pulsating mass. Palpation of abdominal aneurysms is often difficult in the obese patient population, and it may also be challenging in those patients with relatively standard body habitus if the aneurysm is small. Whether in the abdomen or elsewhere, aneurysms should be considered in the differential diagnosis when there has been a related complication such as distal embolization, rupture, or thrombosis. Duplex ultrasonography may provide an efficient, noninvasive means for detection and monitoring of this disease process.

The use of contrast arteriography is best suited to aid in presurgical planning and to identify those lesions that may be amenable to percutaneous catheter-based interventional techniques. Its use as a solely diagnostic tool is controversial but may vary depending on the individual patient’s presentation. One must remember that there are inherent potential risks with any invasive procedure. These risks may be acceptable if, after comprehensive review and discussion with the patient, the perceived expected benefits are greater.

It is important to approach the prevention and treatment of PAD in much the same way as prevention and treatment of CAD. Identification of those patients with risk factors (Figure 1) who do not have clinically apparent disease should lead to primary preventive measures. Patients with known PAD require secondary prevention to minimize risk of ulceration, infection, and limb loss, as well as to ameliorate pain and disability. Clinically apparent PAD should be treated similarly to established CAD. Control of comorbid conditions should be maximized; thus, the level of low-density lipoprotein (LDL) cholesterol should be...
brought below 100 mg/dL, hemoglobin A₁c should be decreased to less than 7.0%, blood pressure should be controlled at less than 140/90 mm Hg, reasonable weight loss should be achieved, and smoking discontinued (Figure 2). The use of empiric antiplatelet therapy for cerebrovascular disease and other vascular diseases, barring no specific contraindication, has become an integral part of treatment. Aspirin remains a first-line therapy; however, clopidogrel bisulfate may be useful in patients with recurrent events while on aspirin therapy, as well as in patients with multiple areas affected by vascular disease.

It is, however, difficult to motivate patients, particularly when a number of different treatment modalities are thrust on them simultaneously. A more appropriate approach is to set reasonable goals within an achievable time frame, provide necessary education, and empower the patient to take control of his or her disease. The responsibility lies with the physician to use the most effective pharmacologic agents with demonstrated benefit in arterial disease. A number of randomized multicenter trials have demonstrated the benefit of lowering LDL cholesterol and controlling diabetes mellitus and hypertension in patients with cerebrovascular disease. Glycemic control is paramount in the diabetic patient with PAD to prevent further complications. Furthermore, data on the insulin-sensitizing agents suggest additional benefit in improving morbidity in patients with lower extremity arterial disease. Studies are currently ongoing which look at the role of hepatic hydroxymethyl glutaryl coenzyme A reductase inhibitors for their beneficial effects in lower extremity disease. Studies are currently ongoing which look at the role of hepatic hydroxymethyl glutaryl coenzyme A reductase inhibitors for their beneficial effects in lower extremity disease. Additionally, recent evidence suggests that attention to increased homocysteine levels and its potential causes (such as vitamin B₁₂ deficiency, hypothyroidism) may have a positive impact on arterial disease. Supplementation with folic acid may be helpful, as are administration of cyanocobalamin to those patients with pernicious anemia and replacement of thyroid hormone in patients in the hypothyroid state.

Although risk factor management is also appropriate for patients with aneurysmal disease, tight control of blood pressure is paramount, and the importance of close monitoring cannot be overemphasized. There is no substitute for prompt vascular surgical care where applicable.

Venous disease
Deep venous thrombosis (DVT) is unfortunately a more common occurrence in the hospitalized patient when compared with the ambulatory outpatient. Initially established by Virchow in 1854, the risk factors of stasis, vascular (endothelial) injury, and hypercoagulability are often found to exist in the hospitalized patient population. Other risk factors are listed in Figure 1. Patients often present with redness, pain, and swelling of the affected limb. It is well known, however, that the accuracy of the bedside clinical examination for the diagnosis of DVT is less than optimal, and the common presenting signs and symptoms of pain, swelling, and Homan’s sign are not always clinically apparent or reliable. Other entities that may cause such signs and symptoms include musculoskeletal injury, cellulitis, and ruptured Baker’s cysts.

If suspected, a DVT requires immediate attention and diagnostic investigation. Duplex venous ultrasonography should be ordered and performed once DVT is suspected. Although contrast venography is the established gold standard for the diagnosis of DVT, duplex venous ultrasonography is a more readily available modality and the likely first choice for diagnostic evaluation in this setting. In the hands of a competent, trained operator, duplex venous ultrasonography has acceptable specificity and sensitivity for the detection of DVT.

Venous thromboembolism (VTE) is a major cause of morbidity and mortality in hospitalized patients. Symptoms of dyspnea, palpitations, and chest pain are most common in patients with pulmonary embolism but are rather nonspecific. Findings on clinical examination, such as rales, rhonchi, tachycardia, diaphoresis, and cyanosis, when combined with a swollen limb and foregoining history, increase clinical suspicion. The accuracy of the clinical examination, however, is approximately 50%; therefore, most cases of VTE exist unrecognized. This diagnostic challenge fosters the concept of prophylactic therapy in those patients believed to be at risk for DVT or VTE. In the absence of any absolute or certain relative contraindications, this reasoning may also support the idea of empiric systemic anticoagulation once the diagnosis of DVT or VTE has been considered. Novel application of full-dose, subcutaneous fractionated low-molecular-weight heparin products may provide prompt and efficient anticoagulant protection while one is waiting for confirmatory diagnostic testing to be completed. Diagnosis of VTE may be accomplished by radionuclide ventilation/perfusion scanning or spiral computed tomography. Certain cases may require pulmonary angiography to establish the diagnosis (for example, when poor visualization is due to overlying fluid or consolidation).

Superficial phlebitis may present in classic fashion with a palpable, raised, erythematous, tender cord in the area of the involved vein. Conservative therapy with topical moist heat, elevation, and anti-inflammatory medications is appropriate, but one may wish to consider systemic anticoagulation should there be extensive thrombosis or should the extent of thrombus lie in close proximity to the deep venous system. Further investigation with duplex ultrasonography will help to exclude any concomitant DVT that may require additional attention.

Prevention of DVT and the propensity for VTE require modification of risk factors where possible and prophylactic anticoagulation in those patients with nonmodifiable causes. Women who have experienced DVT as well as VTE as the result of oral contraceptive use or hormone replacement therapy should discontinue use of those agents. The woman taking a selective estrogen

Figure 2. Risk factor modification.

- Arterial disease
  - Smoking cessation
  - Weight loss
  - Reduction in serum level of low-density-lipoprotein cholesterol to <100 mg/dL
  - Reduction in hemoglobin A₁c level to <7.0 %
  - Reduction in blood pressure to <140/90 mm Hg
  - Reduction in serum homocysteine level
  - Exercise (preferably aerobic)

- Venous disease
  - Increased mobility
  - Smoking cessation
  - Weight loss
  - Prophylactic anticoagulation
  - Pneumatic compression stockings
  - Reduction in serum homocysteine level
receptor modulator (SERM) may require further consideration. If the SERM is prescribed for the purpose of treating osteoporosis, then it is probably in the patient’s best interest to discontinue use of that agent and use alternate therapy. If prescribed for treatment of breast cancer, then the decision should be made after a discussion with the patient and her oncologist, with the awareness that adequate anticoagulation may mitigate the need for drug discontinuation in certain cases.

Those patients, particularly the elderly or persons having recent major surgery, who have immobility as a risk factor, require increased or early mobilization or prophylactic anticoagulation. It is important to consult with surgical colleagues to determine if low-dose anticoagulation therapy is appropriate or whether pneumatic compression stockings are preferred, based on the type of procedure. Likewise, it is important to consider whether the elderly patient is at risk for falls when considering long-term oral anticoagulation therapy.

Patients who have had previous DVT or VTE are considered at very high risk and should receive meticulous prophylaxis with anticoagulants or consideration for inferior vena caval filter placement if necessary. Anticoagulation, which has been interrupted for a surgical or other invasive procedure, should be restarted as soon as possible.

Inferior vena caval interruption with percutaneous implanted filtering devices can be applied in certain clinical situations. These situations may include those where a patient has a specific contraindication to anticoagulation in the setting of an acute proximal DVT (and will require protection against VTE), when a person has had a complication of anticoagulation such as hemorrhage, or if there has been recurrent VTE despite anticoagulation.

Other more invasive treatment approaches for DVT and VTE include catheter-directed thrombolytic therapy and various suction thrombectomy devices. Elaboration on these topics and discussion of surgical approaches is beyond the scope of this introduction. (Further information on these topics may be found in the text Peripheral Vascular Diseases.2)

Extremity edema and cutaneous ulceration

Limb swelling (edema) and ulcerative lesions account for a significant number of patient care visits. Deep venous thrombosis can be evaluated with duplex ultrasonography, but the evaluation may not end here if edema is persistent. Venous insufficiency is a result of venous valvular incompetence and persistent intraluminal obstruction. When edema is present, the patient may give the history of its having had gradual or acute onset (depending on the etiology), and it may or may not resolve with rest and elevation (as venous insufficiency often does). Ulceration, when associated with venous disease or arterial insufficiency, may be painful. Neuropathic ulcers are usually painless. Treatment consists of daily attention to good skin care, control of edema through the use of properly fitted gradient compression hose, and various ulcer-care protocols.

Lymphedema typically presents with painless, nonpitting swelling and may present alone or in conjunction with venous insufficiency. Affected limbs may appear enlarged, but they are not discolored. Lymphedema may arise through hereditary predisposition, as a result of post-surgical changes, or develop in the setting of an occult intra-abdominal or pelvic obstructive process. Other metabolic entities such as thyroid dysfunction and protein-losing states should be considered. Hepatic, renal, and cardiac issues may be investigated through usual means. The potential for intra-abdominal and pelvic obstructive processes should be excluded when there is lower extremity edema and no apparent explanation provided by the aforesaid testing.

Treatment of edema consists of attention to underlying causative factors; it may also be targeted for relief of symptoms. Limb elevation is practical while at rest. Daily use of properly fitted gradient compression support garments may help to retard accumulation of swelling; use of these garments requires focused patient education and instruction. Control of daytime swelling will allow for enhancement in the patient’s quality of life. It is unfortunate that some of our older patients and those with significant arthritic problems will have difficulty putting on these garments. Various pneumatic pumping devices or an array of other adjustable supportive garments may suit them best. Originally stemming from their use in those with postsurgical upper extremity lymphedema, manual lymphedema drainage techniques and compression-bandage wrapping have effected favorable results. The use of pneumatic compression devices for lymphedema is well known. It is important to note that the patient should be measured and fitted for a proper pair of gradient compression hose to be worn after these modes of therapy are completed. Patient attention to daily limb inspection and good skin hygiene is also necessary, especially in the populations with diabetes mellitus and PAD. More often than not, progressive infection can be avoided by the treatment of interdigital tinea pedis.

Cutaneous ulceration can take many forms and may be associated with other underlying processes. The evaluation of a nonhealing neurotrophic ulcer may include consideration for underlying osteomyelitis and arterial insufficiency. Introduction of growth factor technology is an exciting modality that may also assist in wound healing. The treatment of lesions with multiple etiologies will demand attention in all areas simultaneously and likely require some assistance from colleagues in other disciplines. The concept of a multidisciplinary vascular center has been fostered from this need. The basic tenets of ulcer care are to provide a clean granulating base, restore arterial perfusion if needed, treat underlying infection, and reduce swelling if present.

Comment

The approach to the patient with vascular disease should be comprehensive and thorough. Properly chosen investigational modalities will help to guide modes of therapy as will involvement of colleagues in other complementary disciplines. With a great concern to treat the patient with vascular disease as a whole, the vascular medicine physician is well trained and suited to this task.

References