Peripheral Arterial Disease Overview

Here are some guidelines for prevention and treatment of this disease.

BY DESMOND BELL, DPM

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Following this article, an answer sheet and full set of instructions are provided (pg. 184).—Editor

Introduction

Never as much as now has the team approach to wound management and limb salvage presented the opportunity for podiatric physicians to serve as the gatekeepers in the reduction of lower extremity amputation.

In 2006, Allie reported that a three billion dollar annual saving to the U.S. healthcare system can be realized with a 25% reduction in lower extremity amputations.

As podiatric physicians, we are positioned to identify the early and the advanced symptoms of peripheral arterial disease (P.A.D.) in our patients. The link between P.A.D. and coronary arterial disease makes recognition of P.A.D. symptoms not only important for potentially helping to reduce amputation rates, but also for preventing catastrophic events, such as heart attack and stroke. There is an increased risk of myocardial infarction (MI), stroke, and cardiovascular death in patients with lower extremity P.A.D., including a 20% to 60% increased risk for MI and a two- to six-fold increased risk of death due to coronary heart disease events. The risk of cerebral vascular accident (CVA) is increased by 40% in this pa-

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tient population. Medical- legally, we also find ourselves in the position where recognition of P.A.D. and pro-active intervention will not only be expected, but also necessary for better risk management. An article by Janov entitled “Seven Keys to Preventing Malpractice Lawsuits” included information regarding a case in Michigan where a jury awarded a patient $1.23 million for a podiatrist’s failure to refer to a vascular specialist in a timely manner. The patient of the podiatrist was initially treated for an ulcer that deteriorated within approximately a three week period and led subsequently to ischemic gangrene and a below-the-knee amputation. The jury rejected the podiatrist’s defense which included “the patient had chronic, but stable symptoms,” and “the patient did not need an urgent referral.”

The point here is that where P.A.D. is an underlying issue, especially where a wound is present, deterioration is likely to occur. Referral to the appropriate vascular specialist is not only critical, but is a standard of care. Failure to refer a P.A.D. patient to a specialist can have tragic consequences for both patient and provider, whether podiatrist, primary care physician, internist, or nurse practitioner.

Team Approach
As P.A.D. recognition and treatment modalities improve with advances in technology, so does the opportunity to partner with other specialists. “Intervventionalists” is a term used to refer to those physicians who can provide revascularization of arteries that are occluded due to P.A.D. Interventionalists include not only vascular surgeons, but also interventional cardiologists and interventional radiologists. The key to not only reduce amputation rates, but also improve wound-healing rates often lies in the amount of perfusion available. Working closely with interventionalists ensures better outcomes, reduced risk, and opportunities to not only increase referrals, but to further advance the importance and role of podiatry in the medical community.

P.A.D. Defined
Peripheral arterial disease is a type of occlusive peripheral vascular disease. P.A.D is the most common type of peripheral vascular disease; P.V.D., as defined, includes disease of both the arteries and veins.

P.A.D affects the arteries outside the heart and brain and most commonly affects the arteries of the pelvis and legs. It affects 12-20% of Americans age 65 and older. An estimated 12 million people in the U.S. alone suffer from P.A.D. Compare these numbers with those of other common diseases and the fact is that P.A.D. is not only more prevalent, but is more deadly than diseases that have been better publicized.

Consider the fact that there is a three-time greater risk in those persons with diabetes over the age of 50 to have peripheral arterial disease. The disease prevalence of P.A.D. is approximately 12 million; this is greater than cancer (8.9 million), stroke (5 million), congestive heart failure (4.8 million), and Alzheimer’s disease (4 million). The five-year mortality rate of P.A.D. is 30%, compared to colorectal cancer at 39%, stroke at 28%, CAD at 21%, and breast cancer at 14%.

Atherosclerosis is the most common form of P.A.D. and P.A.D. is a systemic marker of atherosclerosis. The word atherosclerosis is derived from the Greek words athero (“gruel” or “paste”) and sclerosis (“hardness”). It is a process by which plaque builds up in the wall of an artery leading to varying degrees of reduced blood flow through the vessel, ranging from mild to complete (and often multi-segmental) occlusion. Plaque is made up of deposits of fats, cholesterol and other substances.

P.A.D Risk Factors
The risk factors for P.A.D. can be classified as traditional and non-traditional. Non-traditional risk factors include race/ethnicity, elevated levels of inflammatory markers: (C-reactive protein, fibrinogen, leukocytes, inter-leukin-6), chronic renal disease, genetics, hypercoagulable states (altered levels of D-dimer, homocysteine, lipoprotein[a]), abnormal waist to hip ratio, and sedentary lifestyle. Among the traditional risk factors are those that include advanced aging, smoking, diabetes, hypertension and hyperlipidemia.

The prevalence of P.A.D. has been shown to increase with age. The Framingham Heart Study found subjects >65 years old were at increased risk for development of P.A.D., while the National Health and Nutrition Examination Survey, 1999-2000 (NHANES) report found patients >40 years old had a prevalence of 4.3%, while patients who were >70 yearsold had a prevalence of 14.5%, 8,9

Smoking
Smoking increases the risk of P.A.D. four times and accelerates the onset of P.A.D. symptoms, particularly intermittent claudication, by nearly 10 years. Additionally, a dose-response relationship between pack year history and P.A.D. risk has been established. Smoking is the single most important modifiable risk factor for prevention of P.A.D. (Figure 1)

Diabetes
Diabetes increases the risk of developing P.A.D. whether asymptomatic or symptomatic, by 1.5 to 4 times. Diabetes is also associated with an increased risk of cardiovascular events. Among diabetics, there is an early mortality among those with P.A.D. Diabetics are also at higher risk for developing ischemic ulcerations and gangrene. Diabetics also have more risk factors for developing P.A.D. than do non-diabetics. These risk factors include elevated blood pressure, increased triglycerides and increased cholesterol. Diabetics also appear to have greater vascular inflammation, increased endothelial cell dysfunction,

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abnormalities in vascular smooth muscle cells, increased platelet aggregation, and impaired fibrinolytic function when compared to non-diabetics.10

Pathophysiology of P.A.D.
Atherosclerosis frequently occurs at arterial bifurcations and branches where endogenous atheroprotective mechanisms are impaired as a result of disturbed flow on endothelial cells. Atherosclerosis causes the arteries to compensate initially by remodeling vessels which become larger in size. Advanced lesions intrude into the lumen of vessels, resulting in flow-limiting stenoses and chronic ischemia syndromes. Risk factors are involved in the initiation and acceleration of this process.

Atherosclerosis and the evolution of plaque formation may be characterized by four distinct stages that include:
- Lesion initiation
- Formation of fatty streak
- Fibroproliferative atheroma development
- Advanced lesion development

Lesion Initiation
Any mechanical or chemical injury can damage the endothelial cell layer. This alters the normal blood flow and provides sites for the adhesion and aggregation of thrombocytes, leading to the formation of blood clots or thrombi in the arterial wall. Alterations of the endothelial layer cause white blood cells (macrophages) to stick and to migrate into this layer, where they become active macrophages.

Fatty Streaks
The earliest recognizable lesions of the inner arterial layer are called “fatty streaks”, which are aggregations of foam cells. Foam cells induce the further replacement of smooth endothelial cells by muscle cells from the medium arterial wall layer. The fatty streak affects the intima of the artery. The lesion consists largely of smooth muscle cells, monocytes, macrophages, T and B cells.

Fibroproliferative Atheroma
Fibroproliferative Atheroma originates from the fatty streak and contains larger numbers of smooth muscle cells filled with lipids.

Advanced Lesion
This highly cellular lesion contains intrinsic vascular wall cells (endothelial and smooth muscle). Advanced lesions also contain inflammatory cells (monocytes, macrophages, T-lymphocytes).

The advanced lesion also contains a lipid core that is covered by a fibrous cap. Acute arterial events can occur if the fibrous cap is disrupted. The resulting exposure of the “prothrombotic” necrotic lipid core and subendothelial tissue leads to thrombus formation and flow occlusion.

P.A.D. Symptoms and Differentiating Leg Pain Symptoms
An understanding of symptoms of P.A.D. may help to isolate the level(s) of the disease, regions of stenosis and, in most severe cases, the level of possible occlusions (Table 1). Since many patients who are afflicted with diabetes also suffer from P.A.D. and peripheral neuropathy (among other disease manifestations), it is important to recognize the similarities and overlapping of symptoms. Remember that a patient does not have to be diabetic to have P.A.D., peripheral neuropathy, or both. Neuropathy may mask symptoms of P.A.D. Conversely, symptoms of P.A.D. may be mistaken for those of neuropathy.

Claudication is widely recognized as a dull cramping or pain in muscles of hips, thighs, or calf muscles when walking, climbing stairs, or exercising which is relieved with cessation of activity. Claudication is the most common manifestation of P.A.D.

Claudication may also be characterized by fatigue in the legs, which may require a patient to stop and rest while walking. These persons may also exhibit a slow or antalgic gait and may have difficulty keeping up with others when ambulating.

Rest pain or night pain that occurs when legs elevated in bed, and relieved when placed in dependent position is another common symptom of P.A.D. Pain may typically occur in the distal foot, possibly in the vicinity of an ulcer. Questions that should be asked of patients where P.A.D. is suspected should include: “Do you have pain when you elevate your legs at night?” And “Do you ever sleep sitting up with pillows behind your back, or with your legs dangling from the side of the bed?” Impotence may also be a sign of P.A.D. and patients may see some relief with sildenafil citrate.

Critical Limb Ischemia
Critical limb ischemia is characterized by persistently recurring rest pain requiring regular analgesia. Externally,
Arterial Disease

Lower Extremity Disease

Superficial femoral artery or popliteal arteries occlusion usually begins at Hunter’s canal (adductor canal of thigh). P.A.D. at this anatomical level typically occurs in patients over the age of 40. The profunda femoris functions as a bridge between the aortofemoral segment and the femoropopliteal segment. The profunda femoris also provides collaterals to keep the lower leg viable and free of severe ischemia. It is not uncommon for patients with isolated SFA occlusion to have only mild to moderate, stable intermittent claudication.

Femoropopliteal disease is manifested by claudication in the calves and occasionally in the arches of the feet. Walking for consistent distances (example-“2 blocks”) where the onset of pain occurs and cessation of ambulation must result, is the hallmark symptom of intermittent claudication. Pseudoclaudication is a differential diagnosis to intermittent claudication. Pseudoclaudication is caused by lumbar canal stenosis.

Patients with pseudoclaudication experience leg pain with walking or prolonged standing. calf pain arises when walking variable distances, unlike in cases of intermittent claudication. In cases of pseudoclaudication, relief is obtained from sitting or stooping, which decompresses the lumbar canal stenosis, usually taking at least 20 minutes for symptoms to abate. These patients often experience numbness and tingling in feet.

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Patients with severe chronic lower extremity ischemia manifest pallor on elevating the leg above the level of the heart and reveal dependent rubor or rubor-cyanosis. Many patients experience ischemic rest pain, especially when supine, and often dangle their feet from the side of the bed for relief. They may find additional relief from symptoms by sleeping sitting up with pillows behind their back or in a chair to allow for dependent position of legs. In both scenarios, gravity assists in the perfusion of the lower extremities.

**Surgical Management Treatment Options for P.A.D.**

Revascularization is indicated where chronic arterial occlusive disease has caused tissue loss, ischemic rest pain, or “lifestyle limiting intermittent claudication.” Surgery is not recommended as a prophylactic therapy in asymptomatic patients with lower extremity P.A.D. Revascularization of diseased vessels can be categorized according to the approach of the Interventionalist. The approach of the Interventionalist can be classified in terms of traditional surgical revascularization (by-pass procedures) versus endovascular intervention (angioplasty, atherectomy, stent placement, and thermal devices—i.e. cold laser, etc.).

Claudication does not usually progress to limb-threatening ischemia. Surgery is infrequently used to treat claudicants and should be considered only when atherosclerotic risk factors have been treated and appropriate trials of exercise and pharmacotherapy have been utilized.

Endovascular procedures may be useful where patients suffer from symptomatic focal aorto-iliac disease, iliac and femoropopliteal lesions.

Stenting may be useful where iliacs have had suboptimal or failed balloon dilation, in cases of common and or external iliac stenosis or occlusion.

Stents, lasers, cutting balloons, atherectomy devices, and thermal devices can be useful in femoral, popliteal and tibial artery revascularization as salvage treatments or when failed results are found after balloon dilation.

It should be noted that the improvements in endovascular technology have been dramatic over the past five years and have played a major role in re-perfusion of occluded lower extremity vessels in patients previously presented with no further surgical options for revascularization. There exists a debate as to whether endovascular procedures are worthwhile, as a perception exists among some that re-occlusion rates are high. One can argue that even in cases where re-occlusion may occur, the benefit of increased blood flow in a patient with wounds complicated by ischemia may be enough to allow for the healing of such wounds.

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**TABLE 2**

Vascular Surgical Procedures for Inflow Improvement

<table>
<thead>
<tr>
<th>Inflow Procedure</th>
<th>Operative Mortality (%)</th>
<th>Expected Patency Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abortobifemoral bypass</td>
<td>3.3</td>
<td>87.5 (5 years)</td>
</tr>
<tr>
<td>Aortoliac or aortofemoral bypass</td>
<td>1 to 2</td>
<td>85 to 90 (5 years)</td>
</tr>
<tr>
<td>Iliac endarterectomy</td>
<td>0</td>
<td>79 to 90 (5 years)</td>
</tr>
<tr>
<td>Femorofemoral bypass</td>
<td>6</td>
<td>71 (5 years)</td>
</tr>
<tr>
<td>Axillofemoral bypass</td>
<td>6</td>
<td>49 to 80 (3 years)</td>
</tr>
<tr>
<td>Axillofemoral-femoral bypass</td>
<td>4.9</td>
<td>63 to 67.7 (5 years)</td>
</tr>
</tbody>
</table>

**TABLE 3**

Vascular Surgical Procedures for Outflow Improvement

<table>
<thead>
<tr>
<th>Outflow Procedure</th>
<th>Operative Mortality (%)</th>
<th>Expected Patency Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fem-AK popliteal vein</td>
<td>1.3 to 6.3</td>
<td>66 (5 years)</td>
</tr>
<tr>
<td>Fem-AK popliteal prosthetic</td>
<td>1.3 to 6.3</td>
<td>50 (5 years)</td>
</tr>
<tr>
<td>Fem-BK popliteal vein</td>
<td>1.3 to 6.3</td>
<td>66 (5 years)</td>
</tr>
<tr>
<td>Fem-BK popliteal prosthetic</td>
<td>1.3 to 6.3</td>
<td>33 (5 years)</td>
</tr>
<tr>
<td>Fem-Tib vein</td>
<td>1.3 to 6.3</td>
<td>74 to 80 (5 years)</td>
</tr>
<tr>
<td>Fem-Tib prosthetic</td>
<td>1.3 to 6.3</td>
<td>25 (3 years)</td>
</tr>
<tr>
<td>Composite sequential bypass</td>
<td>0 to 4</td>
<td>28 to 40 (5 years)</td>
</tr>
<tr>
<td>Fem-Tib blind segmental bypass</td>
<td>2.7 to 3.2</td>
<td>64 to 67 (2 years)</td>
</tr>
<tr>
<td>Profundoplasty</td>
<td>0 to 3</td>
<td>49 to 50 (3 years)</td>
</tr>
</tbody>
</table>
Evidence to support the use of endovascular procedures is limited to date and can only be established after significant numbers of cases are performed along with follow-up data accumulation. Anecdotal and clinical evidence appears to strongly support the use of endovascular procedures for limb preservation and it is anticipated that further evidence will be forthcoming in the near future.

Surgical bypass data is presented in Tables 2 and 3, for a comparative perspective.

Overall, there is insufficient data to recommend one method of revascularization over another. There is a real

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American College of Cardiology/American Heart Association (ACC/AHA) Guidelines for the Treatment of P.A.D.

‡ 2011 ACCF/AHA Focused Update of the Guideline for the Management of Patients with Peripheral Artery Disease (Updating the 2005 Guideline)

The high prevalence of atherosclerotic risk factors places these patients at a “markedly” increased risk of atherosclerotic ischemic events, including MI and stroke. All patients with lower extremity P.A.D. should achieve risk reduction and specific treatment targets comparable to those of individuals with established coronary artery disease.

Medical Management of P.A.D.:
- To reduce adverse cardiovascular events associated with lower extremity P.A.D., lifelong treatment should include:
  - Modification or elimination of atherosclerotic risk factors, such as cigarette smoking, diabetes, dyslipidemia, and hypertension
  - Promotion of daily exercise
  - Non-atherogenic diet

Lipid-Lowering Drugs:
- Statins (Hydroxymethyl glutaryl [HMG] co-enzyme Q reductase inhibitors) are recommended to achieve a target LDL of <100 mg/dl in ALL patients with P.A.D.
- Statins used with goal of < 70 mg/dl in patients with very high risk of ischemic events.
- Among the statins recommended in the ACC/AHA guidelines are the following:
  - Lipitor (atorvastatin)
  - Lescol (fluvatatin)
  - Mevacor, Altoprev (lovastatin)
  - Pravachol (pravastatin)
  - Crestor (rosuvastatin)
  - Zocor (simvastatin)
- Fibric acid derivatives can be useful for patients with P.A.D. and low HDL cholesterol, normal LDL cholesterol and elevated triglycerides. The fibric acid derivatives include: Antara, Tricor (fenofibrate) and Lopid (genfibrozil).

Anti-hypertensive Therapy:
- Anti-hypertensive therapy should be administered to hypertensive patients with lower extremity P.A.D. to achieve a goal of: reducing blood pressure to <140 / 90 in non-diabetics and <130 / 80 in diabetics to reduce the risk of MI, stroke, CHF and cardiovascular death.
- Beta-adrenergic blocking drugs are effective antihypertensive agents and are not contraindicated.
- Angiotensin-converting enzyme inhibitors are reasonable for symptomatic patients with lower extremity P.A.D. to reduce the risk of adverse cardiovascular events.
- Angiotensin-converting enzyme inhibitors may be considered for patients with asymptomatic lower extremity P.A.D. to reduce the risk of adverse cardiovascular events.
- ACE Inhibitors recommended for use in the treatment of patients with P.A.D., both symptomatic and asymptomatic, include: Captopril, Enalapril, Fosinopril, Ramipril, Perindopril, Quinapril, Verapamil, and Trandolapril.
- Antithrombotic therapy is indicated to reduce the risk of MI, stroke, or vascular death in patients with symptomatic atherosclerotic lower extremity P.A.D. including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia.
- Aspirin, typically in daily doses of 75 to 325 mg, is recommended as safe and effective antithrombotic therapy to reduce the risk of MI, stroke, or vascular death in individuals with symptomatic atherosclerotic lower extremity PAD, including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia.
- Antithrombotic therapy can be useful to reduce the risk of MI, stroke, or vascular death in asymptomatic individuals with an ABI less than or equal to 0.90.
- The usefulness of antithrombotic therapy to reduce the risk of MI, stroke, or vascular death in asymptomatic individuals with borderline abnormal ABI, defined as 0.91 to 0.99, is not well established.
- Clopidogrel (75 mg per day) is recommended as a safe and effective alternative antithrombotic therapy to aspirin to reduce the risk of MI, ischemic stroke, or vascular death in individuals with symptomatic atherosclerotic lower extremity PAD, including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia.
- The combination of aspirin and clopidogrel may be considered to reduce the risk of cardiovascular events in patients with symptomatic atherosclerotic lower extremity PAD, including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia and who are not at increased risk of bleeding and who are at high perceived cardiovascular risk.
- In the absence of any other proven indication for warfarin, its addition to antithrombotic therapy to reduce the risk of adverse cardiovascular ischemic events in individuals with atherosclerotic lower extremity PAD is of no benefit and is potentially harmful due to increased risk of major bleeding.

Homocysteine-Lowering Drugs:
- The effectiveness of the therapeutic use of folic acid and B12 supplements in patients with lower extremity P.A.D. and homocysteine levels of >14 μmol/liter is not well established.
  - Cilostazol (Pletal) 100mg p.o., b.i.d. is indicated as an effective therapy to improve symptoms and increase walking
Peripheral arterial disease is also a common complication for those afflicted with diabetes yet many of the ever-growing number of patients with diabetes are unaware of PAD.

Consider that surgeons perform more than 50 percent of lower extremity amputations without even doing a non-invasive vascular test, such as an ankle-brachial index, let alone an arteriogram.\(^1\)

The Sage Group is a for-profit research and consulting company specializing in lower limb vascular disease including PAD, intermittent claudication, critical limb ischemia (CLI), acute limb ischemia and diabetic foot ulcer. According to SAGE Group Co-Founder Mary Yost, the Hallett study, published in 1997, examined more than 20,000 Medicare patients with CLI who had a major amputation.\(^1\)

Researchers found that practitioners made no attempt at either a diagnostic angiogram or revascularization prior to amputation in 71 percent of these patients.\(^1\)

Since the publication of this study, little headway has been made.

Here are some additional facts to consider when examining the impact of PAD from an economic standpoint:

- Peripheral arterial disease actually costs more than coronary disease and four times more than costs surrounding strokes.\(^1\)
- Seventy-five percent of those with PAD are asymptomatic. While they do not have leg symptoms, 70 percent most likely have coronary and/or cerebrovascular disease.\(^1\)
- Between 5 and 10 percent of patients requiring below-knee amputations die in the hospital. Approximately 15 to 20 percent of patients who require above-knee amputations die while hospitalized.\(^1\)
- A single in-hospital death from PAD or CLI can cost $12,000.\(^1\)
- There is a high rate of revision amputations. This means the initial amputation did not heal adequately and the patient requires another amputation on that same leg at a higher level. The revision amputation rate is

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**Additional ACC/AHA Non-surgical Recommendations for the Management of P.A.D.**

- Patients with lower extremity P.A.D. who smoke or use other forms of tobacco should be advised by each of their clinicians to stop smoking and should be offered comprehensive interventions, including behavior modification therapy, nicotine replacement therapy, or bupropion (Wellbutrin, Zyban).
- Proper foot care including use of appropriate footwear, referral to podiatric medicine, daily foot inspection, skin cleansing and use of topical moisturizing creams should be encouraged.
- Skin lesions and ulcerations should be addressed urgently in all diabetic patients with lower extremity P.A.D. (e.g., all diabetic patients should be assumed to have lower extremity P.A.D.).
- Treatment of diabetes in individuals with lower extremity P.A.D. by administration of glucose control therapies to reduce HbA1C to < 7% can be effective to reduce microvascular complications and potentially improve cardiovascular outcomes.
- A program of supervised exercise training is recommended as an initial treatment modality for patients with intermittent claudication.
- Supervised exercise training should be performed for a minimum of 30-45 minutes, in sessions performed at least three times per week for a minimum of 12 weeks. The usefulness of unsupervised exercise is not well established as an effective initial treatment modality for patients with intermittent claudication.
20 percent in patients requiring below-knee amputations and 12 percent in patients who require above-knee amputations.16 

“Nursing home care after amputation is approximately $100,000 per patient (Figure 3). Each of these statistics adds to the total national bill for amputation. This is before you consider the adverse patient outcomes such as the 60 to 80 percent of patients who are unable to walk, those suffering from depression, hospital re-admissions for amputation related problems, the necessity for long-term care, etc.16

Steps are highlighted to improve P.A.D. treatment and outcomes per the Prevention of Atherothrombotic Disease network (P.A.D. Network).

1) Increase awareness of P.A.D. and its consequences;
2) Identify people with symptomatic P.A.D.;
3) Screen for patients at high risk;
4) Improve treatment for symptomatic P.A.D. cases;
5) Increase early detection of asymptomatic cases.

The P.A.D. network also references the American Diabetes Association’s recommendation that people with diabetes who are over 50 years old be regularly screened for P.A.D. as well as recommend that they have an annual foot exam.

In conclusion, the problems associated with peripheral arterial disease are extensive, and the impact of P.A.D. affects millions of patients and their families and costs billions of dollars to our healthcare system. Baby-boomers are aging and the number of diabetics continues to increase. Fortunately, technology is improving to address complications of P.A.D.; yet prevention remains the best way to address the overall problem. Greater understanding of P.A.D. by all healthcare providers through greater awareness, early recognition, and knowledge of treatment options can have an enormous benefit to individual patients and society as a whole. PM

References
7 "Peripheral Artery Disease in People with Diabetes", American Diabetes Association Consensus Statement, Diabetes Care, Volume 26, Number 12, December 2003, 3333-3341.
9 American Cancer Society, American Heart Association, Alzheimer’s Disease Education/Referral Center, American Diabetes Association, SAGE Group
12 www.tasc-P.A.D.org, TASC Consensus Paper, Outcome Assessment Methodology in Peripheral Arterial Disease—Impetus for Outcomes Research, Page 39, Table IX; Classifications of P.A.D.

Additional References
Strategic Health Resources commissioned by the Spectranetics Corp.

Dr. Bell is a Board Certified Wound Specialist (CWS) (American Board of Wound Management), and is the Executive Director and Co-Founder of the Save A Leg, Save A Life Foundation, a non-profit organization dedicated to reducing lower extremity amputations and improving wound healing outcomes for those afflicted with complications from diabetes, chronic wounds and peripheral arterial disease. He is in private practice, and is the Co-Founder of the Limb Salvage Institute, LLC, Jacksonville, FL.
CME EXAMINATION

1) Allie reported that a 25% reduction in lower extremity amputations could result in multi-billion dollar annual savings to the U.S. healthcare system. This amount is:
   A) $3 billion
   B) $5 billion
   C) $30 billion
   D) $50 billion

2) There is an increased risk of myocardial infarction (MI), stroke and cardiovascular death for patients with lower extremity P.A.D. The risk of these patients suffering a heart attack or stroke, respectively, is:
   A) 20-30% and 50%
   B) 40-60% and 30%
   C) 20-60% and 40%
   D) 40-60% and 20%

3) An interventionalist is a term used to refer to those physicians who can provide revascularization of arteries that are occluded due to P.A.D. Among those considered interventionalists are:
   A) cardiologists, podiatrists, radiologists
   B) cardiologists, podiatrists, vascular surgeons
   C) cardiologists, radiologists, vascular surgeons
   D) podiatrists, radiologists, vascular surgeons

4) The most common type of peripheral vascular disease is:
   A) atherosclerosis
   B) peripheral arterial disease
   C) amaurosis fugax
   D) hyperlipidemia

5) Which of the following is not considered a traditional risk factor for the development of P.A.D.?
   A) Diabetes
   B) Smoking
   C) Hypertension
   D) Hypercoagulable state

6) Which of the following is not considered a non-traditional risk factor for the development of P.A.D.?
   A) advanced age
   B) race/ethnicity
   C) abnormal waist to hip ratio
   D) elevated levels of inflammatory markers: (C-reactive protein, fibrinogen, leukocytes, interleukin-6)

7) The single-most important modifiable risk factor in the prevention of P.A.D. is:
   A) diet
   B) sedentary lifestyle
   C) smoking
   D) abnormal hip-to-waist ratio

8) Atherosclerosis and the evolution of plaque formation may be characterized by four distinct stages, which include the following, EXCEPT:
   A) lesion initiation
   B) formation of fatty streak
   C) fibroproliferative atheroma development
   D) foam cell induction

9) Diabetics have more risk factors for developing P.A.D. than do non-diabetics. Which of the following is not considered among those risk factors?
   A) elevated blood pressure
   B) increased triglycerides
   C) increased cholesterol
   D) peripheral neuropathy

10) The most common manifestation of P.A.D. is:
    A) Arch pain in feet
    B) Claudication
    C) Abdominal pain after eating
    D) Amaurosis fugax

11) Pseudoclaudication is a differential diagnosis for claudication. Which statement is false regarding pseudoclaudication?
    A) calf pain arises after walking consistent distances.
    B) Leg pain is experienced with walking or standing for prolonged periods.
    C) Numbness and tingling in feet are common symptoms.
    D) Relief is obtained from sitting or stooping, typically for at least 20 minutes.

12) The Rutherford-Becker is a classification system used to identify the degree of symptoms of P.A.D. At what levels of Rutherford-Becker can critical limb ischemia be found?
    A) 0, 1, 2
    B) 1, 2, 3
    C) 3, 4, 5
    D) 4, 5, 6

13) Acute limb ischemia is an advanced form of critical limb ischemia. The 6 P.’s of acute limb ischemia include: pulselessness, pain, pallor, poikilothermy, paresthesia and paralysis. Which two symptoms represent the presence of severe and potentially irreversible ischemia?
    A) pain and paresthesia
    B) poikilothermy and paralysis
    C) paresthesia and paralysis
    D) pulselessness and pain

14) Which of the following is manifested by claudication in the calves and occasionally in the arches of the feet?
    A) Leriche’s syndrome
    B) mesenteric ischemia
    C) peripheral aneurysm
    D) femoropopliteal disease

15) Which is not indicated to reduce the risk of cardiovascular ischemic events in patients with atherosclerotic lower extremity P.A.D.?
    A) ACE Inhibitors
    B) Statins
    C) Coumadin
    D) Clopidogrel (Plavix)

16) The following are recommended to reduce the risk of myocardial infarction, stroke, or vascular death in

Continued on page 184
patients with atherosclerotic lower extremity P.A.D.:
A) Coumadin
B) Aspirin
C) Clopidogrel (Plavix)
D) B and C

17) Treatment of diabetes in individuals with lower extremity P.A.D. by administration of glucose control therapies can be effective to reduce microvascular complications and potentially improve cardiovascular outcomes. What is the recommended HbA1C level for this patient population?
A) < 8.5%
B) < 8.0%
C) < 7.5%
D) < 7.0%

18) Endovascular intervention to open occluded arteries includes all of the following modalities, except:
A) atherectomy
B) angioplasty
C) chelation
D) stent placement

19) Which of the following statements regarding pentoxifylline (Trental) is false?
A) Pentoxifylline may be considered as a second line alternative therapy to cilastazol (Pletal) to improve walking distance for patients with intermittent claudication.
B) Pentoxifylline may be considered as a first line therapy over cilastazol (Pletal) to improve walking distance for patients with intermittent claudication.
C) The clinical effectiveness of pentoxifylline as therapy for claudication is marginal and not well established.
D) The typical dosing schedule of pentoxifylline is 400mg three times daily.

20) Which of the following statements is false?
A) Less than 50% of all amputees will regain the ability to ambulate (< 50% of below knee and < 25% of above knee amputees).
B) Amputation is still the most common form of treatment for critical limb ischemia.
C) Less than 50% of lower extremity amputees survive past 2-3 years.
D) Amputation should be recommended versus endovascular procedures in cases where patients have been classified as having no further surgical options at revascularization.

See answer sheet on page 185.
ENROLLMENT FORM & ANSWER SHEET

Please print clearly...Certificate will be issued from information below.

Name _______________________________________________________________________

Please Print: FIRST MI LAST

Address ____________________________________________________________________

City___________________________ State_______________________ Zip________________

Charge to:_____Visa _____ MasterCard_____ AmericanExpress

Card#________________________________________________ Exp. Date____________________

Note: Credit card is the only method of payment. Checks are no longer accepted.

Signature__________________________________ Soc. Sec.#______________________ Daytime Phone_____________________________

State License(s)___________________________ Is this a new address? Yes ______ No_______

Check one: _____ I am currently enrolled. (If faxing or phoning in your answer form please note that $2.50 will be charged
to your credit card.)

_____ I am not enrolled. Enclosed is my credit card information. Please charge my credit card $22.00 for each exam
submitted. (plus $2.50 for each exam if submitting by fax or phone).

_____ I am not enrolled and I wish to enroll for 10 courses at $169.00 (thus saving me $51 over the cost of 10 individual
exam fees). I understand there will be an additional fee of $2.50 for any exam I wish to submit via fax or phone.
## Medical Education Lesson Evaluation

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
</table>

1) This CME lesson was helpful to my practice ____
2) The educational objectives were accomplished ____
3) I will apply the knowledge I learned from this lesson ____
4) I will make changes in my practice behavior based on this lesson ____
5) This lesson presented quality information with adequate current references ____

How long did it take you to complete this lesson?

_____ hour _____ minutes

What topics would you like to see in future CME lessons?

Please list:

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