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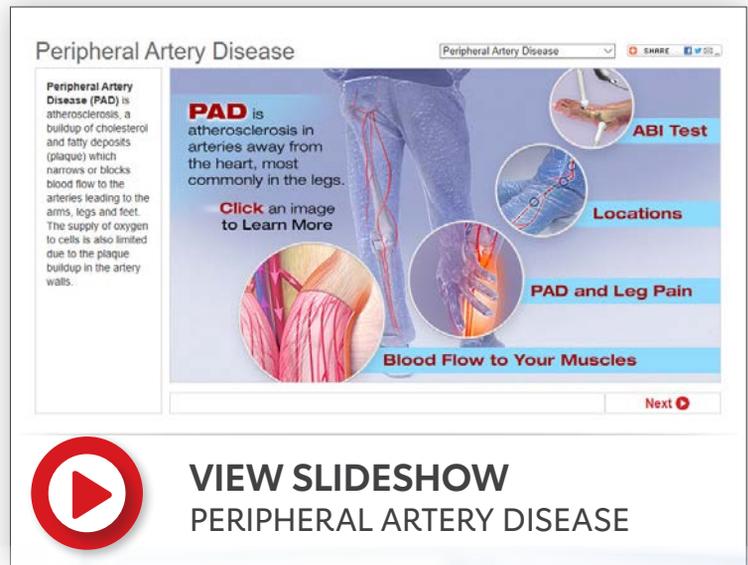
Learn more about  
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# Helping Your Patients with PERIPHERAL ARTERY DISEASE –Lower Extremity: A Clinician’s Guide

Visit [heart.org/PADtoolkit](https://heart.org/PADtoolkit)

# A Primer on Peripheral Artery Disease – Lower Extremity

Lower extremity peripheral artery disease (PAD) is a common and potentially deadly disease affecting about 8.5 million Americans over age 40. It's caused by narrowed or blocked arteries in the pelvis and legs. The underlying etiology of PAD is atherosclerosis, or a buildup of plaque in the iliac, femoral and popliteal arteries. PAD is progressive and can lead to significant morbidity, mortality and impaired quality of life.



Peripheral Artery Disease

Peripheral Artery Disease (PAD) is atherosclerosis, a buildup of cholesterol and fatty deposits (plaque) which narrows or blocks blood flow to the arteries leading to the arms, legs and feet. The supply of oxygen to cells is also limited due to the plaque buildup in the artery walls.

**PAD** is atherosclerosis in arteries away from the heart, most commonly in the legs.

Click an image to Learn More

ABI Test

Locations

PAD and Leg Pain

Blood Flow to Your Muscles

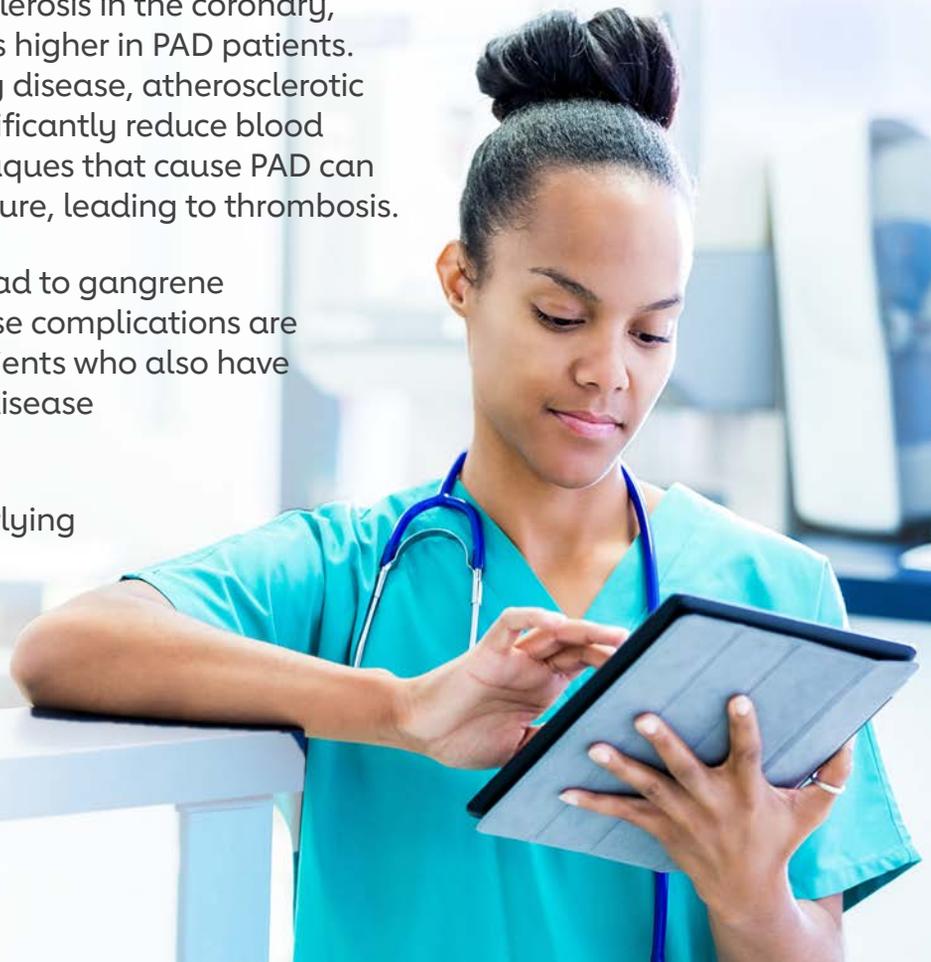
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**VIEW SLIDESHOW**  
PERIPHERAL ARTERY DISEASE

The prevalence of atherosclerosis in the coronary, carotid and renal arteries is higher in PAD patients. In PAD, like coronary artery disease, atherosclerotic plaque formation can significantly reduce blood flow through an artery. Plaques that cause PAD can become unstable and rupture, leading to thrombosis.

Left untreated, PAD can lead to gangrene and limb amputation. These complications are especially prevalent in patients who also have advanced chronic kidney disease and diabetes.

In 2018, PAD was the underlying cause in 12,264 deaths. People with PAD have a higher risk of coronary artery disease, heart attack and stroke.



Studies have also demonstrated that PAD is associated with elevated inflammatory markers linked to the development of heart disease, including C-reactive protein. Intermittent claudication symptoms are common in patients with PAD and can lead to significant impairment in function and quality of life. The symptoms include mild to severe fatigue, discomfort, cramping or pain in the buttocks and legs that occurs with physical activity and is relieved by rest.

Being aware of patients' risk for PAD can help health care professionals to accurately and timely identify and treat PAD.


[PAD Initial Symptom Checklist Download PDF](#)

## Risk factors for PAD include:

- Age 65 and older
- Age 50 to 64 years with risk factors for atherosclerosis, such as diabetes mellitus, a history of smoking, hyperlipidemia, hypertension or family history of PAD
- Less than age 50 with diabetes and at least one other risk factor for atherosclerosis
- Patients with known atherosclerotic disease in another vascular bed (such as coronary, carotid, subclavian, renal, mesenteric artery stenosis or abdominal aortic aneurysm)

## Obstacles to Detection and Treatment

PAD and its risk factors are diagnosed and treatable with lifestyle changes, medications and surgical procedures. Yet, obstacles prevent accurate diagnoses and effective treatment. Many people mistake the symptoms of PAD for other more minor conditions. PAD can also be asymptomatic, which makes detection more challenging. Awareness of PAD among health care professionals and the public also remains less than optimal.

A 2019 American Heart Association report on improving PAD awareness noted that despite its relatively high prevalence, the gap is significant in the public's understanding of PAD, its symptoms and complications compared to other similarly prevalent atherosclerotic conditions, such as heart attack. The knowledge gap among physicians is also significant, resulting in a large number of patients with PAD going undiagnosed. This gap highlights the need for education, as proper diagnosis and treatment reduce morbidity and mortality.

Even among people correctly diagnosed, evidence shows they often don't receive appropriate treatment. The variance may partially be due to a knowledge gap among patients, clinicians and health systems about the value of preventing, detecting and managing the condition.

Patients with prior diagnosis of PAD or previous amputations are at high risk for additional limb loss and increased mortality. PAD is also a multifactorial and multisystem disease. By the time a patient presents with limb ischemia, often other systems and organs have pre-existing morbidities that may not have been previously diagnosed.

Efforts to improve the diagnosis and treatment of PAD include public awareness campaigns, sponsored by the AHA and other organizations, and consensus reports and clinical guidelines to inform physicians about best practices. Research and clinical trials have also increased understanding of the use and efficacy of lipid-lowering therapies, ACE inhibitors and antiplatelet drugs to prevent the complications of atherosclerosis and PAD.

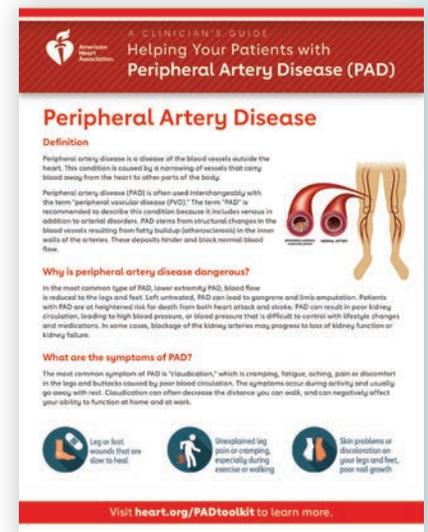


A U.S. national survey found that 1 in 4 adults with risk factors for PAD and walking impairment had any awareness of PAD, and of those aware, less than 1 in 7 knew that PAD is the most important cause of leg amputation.

## Striding Forward in PAD Management

Research shows that it's vital for clinicians to remain aware of the importance of identifying PAD through a careful clinical history, physical examination and diagnostic tests. Using guideline-recommended treatments for the disease is crucial. Also, patient education about PAD detection, prevention and treatment needs to be bolstered.

These statistics show that improvement in preventing, detecting and treating PAD is critical. Health care professionals who understand the diagnosis, risk factors and recommended treatments for PAD are more likely to accurately identify and treat it appropriately. Taking time to educate patients about PAD and its risk factors will increase the likelihood that they will be motivated to make heart-healthy lifestyle choices and follow recommended treatments.



➔ PAD vs. PVD AHA  
Fact Sheet  
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## Diagnosing PAD

Evaluating a patient at increased risk for PAD should begin with a clinical history (that thoroughly reviews PAD risk factors), symptom review and physical examination. Patients may present with no symptoms, with claudication, impaired walking function and critical limb ischemia (CLI) in advanced disease. In CLI, patients have had more than two weeks of ischemic pain at rest, and/or nonhealing wounds/ulcers or gangrene in one or both legs. In diagnosing PAD, a physical exam will often yield abnormally weak lower extremity pulses and vascular bruits (or murmurs).

The resting ankle brachial index (ABI) is the initial diagnostic test for PAD and may be the only test required. It measures the systolic blood pressure in the lower legs compared to the SBP in the arms. It's done in the supine position with a Doppler device and only takes a few minutes. A normal ABI is greater than 1. A value less than or equal to 0.90 is considered abnormal, and in severe disease, it's less than 0.5.

Depending on the clinical presentation, and the resting ABI values, additional physiological studies may be needed, including exercise treadmill testing or measurement of the toe-brachial index. Exercise treadmill testing is important to measure the functional limitations of a patient with PAD, and is also useful in diagnosing symptomatic patients with lower extremity PAD when the resting ABI is normal or borderline. Other imaging tests may be used in highly symptomatic patients or in patients undergoing revascularization procedures.

## Additional imaging tests include:

- **Duplex Ultrasonography:** Depicts a change in flow pattern and provides anatomical and functional information about the artery being investigated. It's non-invasive and requires no contrast media (dye) or radiation.
- **Magnetic Resonance Angiography (MRA):** MRA images large and medium-size vessels. The test uniquely provides cross-sectional images without using contrast media.

Peripheral Artery Disease

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What is PAD
Blood Flow
PAD and Leg Pain
Common Locations
<b>The ABI Test</b>

**The Ankle Brachial Index (ABI)**  
compares the blood pressure (BP) in your arms to the pressure in your ankles.

Brachial Artery: Ultrasound records BP in both arms.

Dorsalis Pedis A., Posterior Tibial A.: BP in the ankles is recorded from one of these arteries.

**VIEW SLIDE**  
ANKLE-BRACHIAL INDEX

- **Computed Tomography (CT) Angiography:** Another modality that images arterial disease, it uses X-ray and contrast media to create pictures of blood vessels and pinpoints the location of any blockages in the leg arteries. It produces three-dimensional images of the vessels. It provides rapid, noninvasive assessment of the peripheral arteries and can reveal blockages, or stenoses, in the scanned anatomical territory.
- **Early diagnosis of PAD is important to managing the disease.** Lifetime risk stratification tools may be impactful in diagnosing and managing PAD. Just as we have parallel tools for risk stratification (such as the CHADsVAsC score for stroke risk in patients with atrial fibrillation), increasing physician familiarity with a risk stratification tool for PAD might provide more resources to objectively evaluate the patient and intervene accordingly.

# Differential Diagnoses for PAD

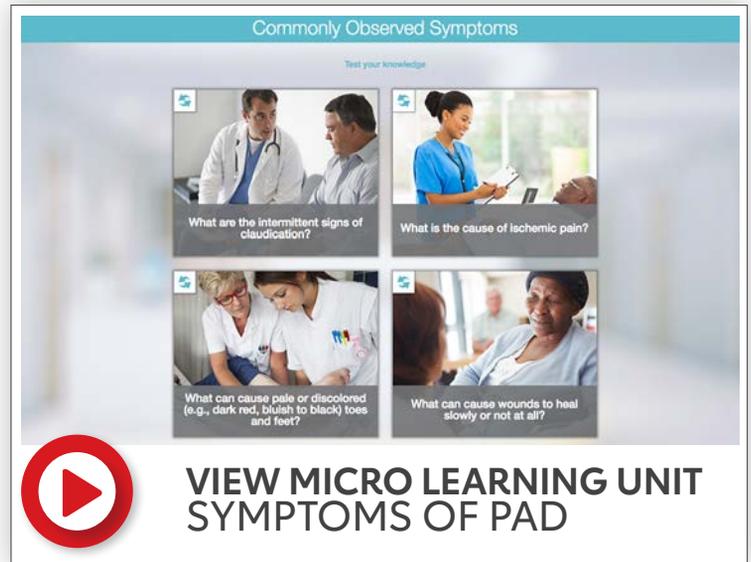
In some cases, patients may have symptoms that appear to signal a PAD diagnoses, such as leg pain, claudication or nonhealing wounds, but physiological testing is normal, so the symptoms may not be PAD-related. These are diagnoses and characteristics of conditions that mimic PAD:

## Other Diagnoses for Leg Pain or Claudication

- **Symptomatic Popliteal (Baker's) Cyst:** Characterized by swelling and tenderness behind the knee. The pain is present at rest and with exercise.
- **Venous Claudication:** Presents with tight pain in the entire leg, although it's worse in the calf. The pain is present during walking and only subsides with rest and elevation.
- **Venous Thrombosis:** Swelling and leg pain that occurs while walking. Pain is relieved by extremity elevation, a finding that distinguishes this from arterial insufficiency. Patients often have a history of deep vein thrombosis and edema.
- **Chronic Compartment Syndrome:** This typically occurs in heavily muscled athletes. The symptoms are tightness in the affected limb, bursting, aching or cramping pain in the calf muscles after strenuous exercise such as jogging. The pain subsides slowly with rest.
- **Spinal Stenosis:** Characterized by back pain that radiates to the buttocks and posterior legs. The pain is worse with standing and spine extension (e.g., going downstairs or leaning back) and may be relieved by lumbar spine flexion (e.g., ascending stairs or hunched over a shopping cart). Sensory loss or weakness in the legs may also be present. Pain relief is variable with rest, and it often takes a long time to recover.
- **Nerve Root Compression:** Patients usually have a history of back problems and the pain is often present at rest. It's induced by sitting, standing or walking and relieved with position changes. A symptom is sharp, stabbing pain that radiates down the leg. Other symptoms may include numbness, sensory change or loss of strength in the affected leg.
- **Hip Arthritis:** The symptoms are aching discomfort or arthritic pain in the lateral hip and thigh that's not quickly relieved by rest. However, the pain improves when the patient is not engaged in weight-bearing activities.
- **Foot and Ankle Arthritis:** Patients experience aching pain in the ankle and foot, particularly in the arch, that may be relieved when they're not participating in weight-bearing activities. At rest, pain relief may be slow.

## Other Diagnoses for Nonhealing Wounds

- **Venous Ulcer:** Patients with these ulcers often have chronic venous disease and local venous hypertension. The wounds often have wet drainage in the distal leg, most often around ankles, especially above the medial malleolus.
- **Distal Small Arterial Occlusion:** Wounds that occur in the toes, feet and/or legs can be due to various causes, including diabetic microangiopathy, end-stage renal disease, vasculitis, scleroderma and embolic and thrombotic conditions such as cholesterol emboli or antiphospholipid antibody syndrome.
- **Local Injury:** The wounds may be located on the toes, feet or legs, and usually occur from trauma, an insect or animal bite or a burn.
- **Medication-Related:** These skin sores can be seen on the toes, feet or legs, and may be caused by drug reactions, as in erythema multiforme, characterized by hypersensitivity to a medication. The wounds can also be due to the direct toxicity of certain medications, such as doxorubicin, hydroxyurea and some tyrosine kinase inhibitors.
- **Neuropathic:** The wounds or ulcers occur on pressure zones of the foot and often occur in patients with peripheral neuropathy with or without Type 2 diabetes.
- **Autoimmune Injury:** Characterized by wounds with or without blisters on the toes, feet and legs. They can be due to conditions such as pemphigus, pemphigoid, lupus or scleroderma.
- **Infection:** Wounds can form secondary to bacterial, fungal, mycobacterial, parasitic or viral infections. They can be located on the toes, feet and legs.
- **Malignancy:** These wounds may appear on the toes, feet and legs, and can result from primary skin malignancy, metastatic malignancy or malignant transformation of an ulcer.
- **Inflammatory:** Patients usually have conditions such as necrobiosis lipoidica, pyoderma gangrenosum or granuloma annulare. The wounds occur on the toes, feet or legs.



# Treatments for PAD

Patients with PAD often need a goal-directed, comprehensive treatment program that includes medications, structured exercise and other lifestyle modifications to improve function and protect against cardiovascular ischemic events. Smoking cessation is also vital. A weight-loss program should be discussed with patients who are overweight or obese. A guideline-based program of pharmacotherapy should be customized to each patient and their risk factors, such as diabetes and hypertension.

It's important to inform the patient that PAD is a chronic disease that will require long-term follow-up and close monitoring to get the best outcomes. This provides the right context and perspective for the patient. It's also important to emphasize that PAD requires a multidisciplinary approach to its long-term management — so the patient appreciates the role of the other specialists (endocrinology, nephrology, podiatry, dermatology, vascular surgery, etc.).

## Medication Recommendations

These guidelines can help determine medical therapies and medications to manage PAD and its symptoms, prevent complications and control conditions that can worsen PAD:

- If the PAD patient is asymptomatic, but has an ABI less than or equal to 0.90, antiplatelet therapy is reasonable.
- In patients with symptomatic PAD, treatment with antiplatelet medications such as aspirin or clopidogrel can reduce the risk of myocardial infarction, stroke and death.
- Dual antiplatelet therapy (aspirin and clopidogrel) may reduce the risk of limb-related events in patients with symptomatic PAD after lower extremity revascularization.
- Statin medications should be prescribed for all patients with PAD.
- In patients with both hypertension and PAD, angiotensin-converting enzyme inhibitors or angiotensin-receptor blockers can reduce the risk of MI, stroke, heart failure and cardiovascular death.
- Cilostazol is an effective therapy to improve symptoms and increase walking distance in patients with claudication. Cilostazol is contraindicated in patients with heart failure.

## Other Therapies for PAD:

- The usefulness of anticoagulation to improve patency after lower extremity autogenous vein or prosthetic bypass is uncertain. Anticoagulation shouldn't be prescribed in patients with PAD to reduce the risk of cardiovascular events.
- Pentoxifylline isn't effective in treating claudication.
- Chelation therapy (e.g., ethylenediaminetetraacetic acid) isn't beneficial for treating claudication and doesn't improve symptoms.
- B-complex vitamin supplements are not recommended to lower homocysteine levels and prevent cardiovascular events in patients with PAD.

Geekard Brown Mills et al. 2016 AHA/ACC Lower Extremity PAD Guidelines: Executive Summary Page | 7

Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care\* (Updated August 2015)

CLASS (STRENGTH) OF RECOMMENDATION	LEVEL (QUALITY) OF EVIDENCE
<b>Class I (Strong)</b> Suggested phrase for writing recommendations: • It is recommended. • Can be used in practice. • Comparative (Beneficial) Phrasing: • "Treatment X is recommended (Class I) over treatment Y." • "Treatment X is preferred over treatment Y." • It is reasonable to use treatment X over treatment Y.	<b>Level I</b> • High quality evidence from randomized trials (RCT). • Meta-analysis of high quality RCTs. • Data on case RCTs, controlled by high quality register studies.
<b>Class IIa (Moderate)</b> Suggested phrase for writing recommendations: • It is reasonable. • Can be used in practice. • Comparative (Beneficial) Phrasing: • "Treatment X is probably recommended (Class IIa) over treatment Y." • It is reasonable to choose treatment X over treatment Y.	<b>Level IIa</b> • Moderate quality evidence from 1 or more RCTs. • Meta-analysis of moderate quality RCTs. • Non-randomized (well) studies.
<b>Class IIb (Weak)</b> Suggested phrase for writing recommendations: • It may be reasonable. • May not be considered. • Comparative (Beneficial) Phrasing: • "Treatment X is possibly recommended (Class IIb) over treatment Y." • It is reasonable to consider treatment X over treatment Y.	<b>Level IIb</b> • Moderate quality evidence from 1 or more well designed, but not randomized studies, observational studies, or multiple RCTs. • Non-randomized (well) studies.
<b>Class III (No Benefit)</b> Suggested phrase for writing recommendations: • It is not recommended. • It is not useful in practice. • Comparative (Beneficial) Phrasing: • "Treatment X is probably not recommended (Class III) over treatment Y." • It is reasonable to choose treatment X over treatment Y.	<b>Level III</b> • Randomized or nonrandomized observational or registry studies with limitations of design or execution. • Non-randomized (well) studies. • Physiological or mechanistic studies in human subjects.
<b>Class IV (Harm)</b> Suggested phrase for writing recommendations: • It is not recommended. • It is not useful in practice. • Comparative (Beneficial) Phrasing: • "Treatment X is probably not recommended (Class IV) over treatment Y." • It is reasonable to choose treatment X over treatment Y.	<b>Level IV</b> • Evidence of expert opinion based on clinical experience.

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## Helping Your Patients Make Lifestyle Changes to Control PAD

Initiating discussions with your patients who have been diagnosed with PAD can have a significant impact on their symptoms, risk for cardiovascular events and overall health. Be prepared to educate your patients thoroughly about why lifestyle changes matter in managing PAD. Recommend programs that can help them establish a heart-healthy lifestyle. By taking time for these discussions, it's more likely that your patients will adhere to your recommendations.

### AHA's Lifestyle Recommendations

It's well established that lifestyle changes can reduce high cholesterol, even if it's due to genetics. The four most important lifestyle changes to discuss with your

patients are following a heart-healthy diet, avoiding tobacco smoke, exercising regularly and losing weight (if your patient is overweight or obese).

Here are suggested recommendations about changes and programs for your patients:

## Heart-Healthy Diet

- Tell your patients to choose a heart-healthy diet that emphasizes vegetables, fruits and whole grains high in dietary fiber. It should include low-fat or fat-free dairy products, poultry, fish, legumes, nontropical vegetable oils (not coconut or palm kernel) and nuts. It should limit sweets, sugar-sweetened beverages, salty or highly processed foods, and red or processed meats. If they eat red meat, they should be advised to choose lean or extra-lean. These recommended food choices will help them reduce saturated fat, trans fat, dietary sodium and sugar intake. This diet can be adapted to the cultural, ethnic and food preferences of your patients.
- Be sure to emphasize to your patients the importance of reducing saturated fat, trans fats and sodium in their diets. The AHA recommends avoiding trans fat and patients at cardiovascular risk should limit saturated fat to less than 6% of total calories. Also, reduced intake of egg yolks (180 mg cholesterol per yolk) may be appropriate for some people (e.g., those with elevated LDL-C). Sodium intake should be reduced to less than 2,300 mg/day (1,500 mg/day if hypertensive or prehypertensive).

## Smoking Cessation

- Discuss quitting smoking with your patients. Tobacco smoking is a major risk factor for CVD and stroke. Smoking creates a higher risk for PAD and decreases HDL (good) cholesterol.



## Exercise

- Advise patients that an individualized, safe exercise prescription is necessary. Structured exercise therapy is an important component of care for the PAD patient and helps improve functional status and decrease symptoms.

## Weight Management

- Point out the importance of losing weight and becoming more physically active if your patients are sedentary, overweight or obese. Weight loss is crucial for controlling CVD risk factors. Encourage patients to lose about 5% to 10% of baseline weight within six months.

## Controlling Hypertension

Lifestyle changes and adhering to medication prescriptions can help your patients manage their hypertension. Here are some tips for instructing your patients about controlling hypertension:

- Advise your patients to eat a heart-healthy diet, reduce sodium intake to 1,500 mg/day for enhanced BP lowering and limit alcohol.
- Point out the importance of participating in regular physical activity and maintaining a healthy weight.
- Caution your patients that over-the-counter medications such as decongestants may raise blood pressure and react with hypertension medications.
- Be sure to emphasize that patients should take hypertension medications exactly and as long as prescribed.
- Discuss over-the-counter medicines and prescription drugs that your patients take. Advise your patients about any cautions for using these medicines. It's important to ask your patients about dietary supplements they may use.
- Talk to your patients about the side effects of their hypertension medication and recommend that they report them.
- If they can't afford their prescriptions, offer information about assistance programs or generic forms of hypertension medication.

## Glycemic Control and Smoking Cessation Programs

Two of the most important health risks for patients with PAD are diabetes and exposure to tobacco smoke. Here are the recommended guidelines for smoking cessation and glycemic control in patients with PAD:

- Advise your patients who smoke to quit at every visit.
- Help your patients who smoke to devise a plan for quitting. This plan may include pharmacotherapy such as varenicline and bupropion, nicotine replacement and referral to a smoking cessation program.
- Patients with PAD should be told of the dangers of secondhand smoke and advised to avoid exposure to environmental tobacco smoke at work, home and in public places.
- Diabetes mellitus increases the risk of adverse outcomes among patients with PAD, including progression to critical limb ischemia, amputation and death.
- Managing a patient with PAD and diabetes should be coordinated between all members of the patient's health care team.
- A comprehensive care plan for patients with PAD and diabetes mellitus is important and may include diet and weight management, pharmacotherapy for glycemic control, managing other cardiovascular risk factors, foot care and ulcer prevention.
- Achieving glycemic control is beneficial in all patients with diabetes and can reduce limb-related outcomes in patients with CLI. Evidence has demonstrated that patients with PAD and a hemoglobin A1c level less than 6.5% had lower odds of major amputation compared to patients with PAD and a HbA1c of 6.5% to 9.5% and higher.

## Prescribed Exercise Programs

Structured exercise therapy is an important element of care in the patient with PAD, according to the AHA and American College of Cardiology treatment guidelines. The data supporting the efficacy of supervised exercise programs as an initial treatment for claudication continue to develop and remain convincing, building on many earlier randomized controlled trials. Trials with long-term follow-up from 18 months to seven years have demonstrated a persistent benefit of supervised exercise in patients with claudication.

Supervised exercise has benefits and is safe for patients with PAD, even when they have contraindications to exercise, such as cardiovascular disease, amputation, wheelchair confinement and other major comorbidities that would preclude exercise. The efficacy of structured community- or home-based exercise programs in patients with PAD is supported by strong research evidence, which is more recent and convincing than studies on supervised exercise programs in clinics or health care institutions. Unstructured community- or home-based programs providing general recommendations to patients with claudication to simply walk more aren't effective for relieving claudication, although increasing activity can improve the risk factors for PAD.

Here are recommendations for structured exercise therapy:

- In patients with claudication, recommend a supervised exercise program to improve leg symptoms, function and quality of life.
- A supervised exercise program should be discussed as a treatment option before recommending revascularization.
- In patients with claudication, suggest alternative strategies of exercise including upper-body ergometry, cycling and low-intensity walking that avoids moderate to maximum claudication.

## **The Elements of Structured Community- or Home-Based Exercise**

Structured exercise programs that take place in the patient's home or community should provide oversight of the patient's activities as well as encouragement for behavior change.

- Although the programs are self-directed, the clinician provides regular guidance.
- The elements of the exercise program should include activity for 30- to 60-minute sessions three times a week for a minimum of 12 weeks.
- Exercise training involves intermittent periods of walking to achieve moderate to maximum claudication, which are alternated with periods of rest.

- Warm-up and cool-down periods precede and follow each session of walking.
- Counseling should be provided on how to start and maintain an exercise program, and how to increase the patient's activity level by adding distance or greater speed.
- To help ensure that patients stick with an exercise program, include behavioral change techniques such as health coaching and activity monitors.

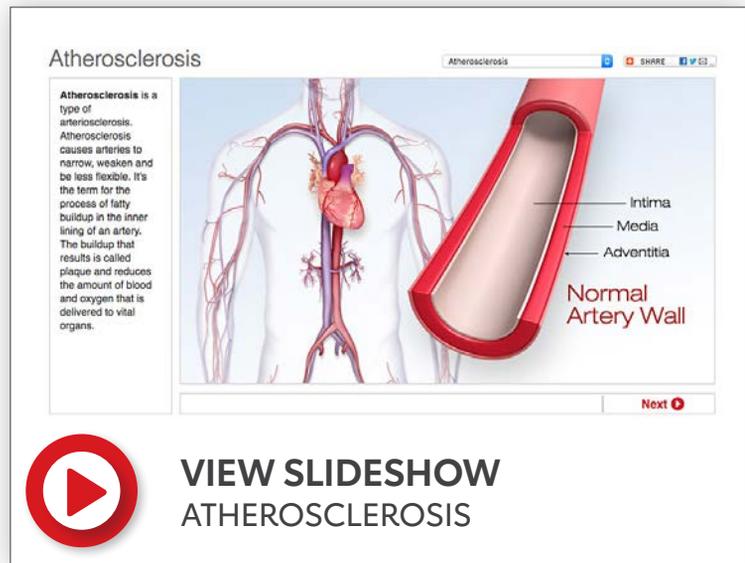
## Minimizing Tissue Loss in Patients with PAD

Preventing wounds through patient education, foot examination and promptly recognizing foot infection can minimize tissue loss. The important actions to take are:

- Educate patients about healthy foot care, including daily foot inspection, wearing socks and shoes, not walking barefoot and selecting proper footwear.
- Discuss the importance of seeking prompt medical attention for new foot problems.
- Be especially aware of the need to educate patients with PAD who also have diabetes with peripheral neuropathy.
- Any untreated foot infection in a patient with PAD can lead to tissue loss and gangrene. Clinicians should be diligent about checking for signs of infection, and provide prompt referral to an interdisciplinary care team that includes vascular medicine specialists, nurses, orthopedic surgeons, podiatrists, infectious disease and vascular imaging specialists, and orthotics and prosthetic specialists.
- Signs of foot infection in a patient with PAD can include local pain or tenderness, periwound erythema or edema, induration or fluctuance, pretibial edema, discharge, a foul odor, visible bone or a wound close to the bone. It may also include signs of systemic inflammation such as elevated or decreased temperature, elevated heart rate, elevated respiratory rate and an elevated or decreased white blood cell count.

## Revascularization for Claudication and Atherosclerosis

Claudication doesn't commonly progress to critical limb ischemia. So the aim of most revascularization procedures is improving claudication symptoms, function and quality of life, rather than limb salvage. Revascularization should be considered when a patient with PAD has been treated with a comprehensive program, including medical therapy and a structured exercise program, but is still experiencing persistent claudication that limits their function and lifestyle. Revascularization for claudication should be evidence based and can include endovascular revascularization, surgery or both. Patients should be selected for revascularization procedures and surgeries based on the severity of their symptoms, comorbidities, response to previous therapies, patient goals and the likelihood of achieving durable symptom relief.



## Endovascular Revascularization Procedures

Endovascular techniques to treat arterial blockages and claudication include angioplasty, stents and atherectomy. A technique for revascularization should be based on the lesion characteristics and the surgeon's or clinician's experience.

Here are some guidelines to assess patients for endovascular revascularization:

- Revascularization should be performed in lesions that are hemodynamically significant. Stenoses appropriate for endovascular treatment limit perfusion to the distal limb.
- Stenoses of 50% to 75% diameter by angiography may not be hemodynamically significant. Provoked or resting intravascular pressure measurements can determine whether a lesion is significant enough for an endovascular procedure.

- Effectiveness of the procedure can depend on the location of the stenosis. Long-term patency is often greater after endovascular procedures in the aortoiliac than the femoropopliteal segment.
- In femoropopliteal disease, durability of the revascularization is reduced with greater lesion length, occlusion rather than stenosis, the presence of multiple diffuse lesions, diabetes, chronic kidney disease, renal failure and smoking.

## **Surgical Revascularization for Claudication and Atherosclerosis**

Surgical procedures can effectively treat claudication and improve quality of life and walking ability. However, there is little evidence that surgical procedures are superior to other treatment. Although symptoms may improve more with surgery than endovascular procedures, risk for perioperative events is also greater. Thus, surgery should be reserved for patients who have not derived benefits from nonsurgical therapy, have arterial anatomy favorable to obtaining a durable result, and don't have symptoms or comorbidities that significantly increase the risk for perioperative complications.

Here are guidelines for selecting which type and when to perform surgical revascularization:

- Femoral-popliteal artery bypass is one of the most common surgeries, and successful outcomes often depend on the conduit and site of popliteal anastomosis (i.e., above versus below the knee).
- Recent reviews and meta-analyses show more favorable and consistent patency outcomes with autogenous vein versus prosthetic grafts for popliteal artery bypass.
- Femoral-tibial artery bypasses with prosthetic graft material shouldn't be used to treat claudication.
- Surgery shouldn't be performed solely to prevent progression to critical limb ischemia.

## Critical Limb Ischemia: Surgical or Endovascular Revascularization

The goal of revascularization for critical limb ischemia is to provide in-line blood flow to the foot through at least one patent artery. This helps decrease ischemic pain, aids wound healing and helps preserve a functional limb. Randomized controlled trials have demonstrated that endovascular revascularization is a more effective treatment option than open surgery.



Treatment guidelines provide these recommendations for using revascularization procedures for CLI:

- In patients with CLI, revascularization should be performed whenever possible to reduce tissue loss. Endovascular procedures for patients with CLI should be considered for nonhealing wounds and gangrene.
- Before amputation in a patient with CLI, an evaluation for revascularization should be conducted by an interdisciplinary care team.
- Evaluating lesion characteristics is useful for selecting the appropriate endovascular approach for a patient with CLI.
- For patients with CLI and nonhealing wounds or gangrene, angiosome-directed endovascular therapy may be reasonable. More research is needed to fully understand the benefits and risks of this approach.

# Health Literacy

Health literacy are skills (both cognitive and social) that allow a person to access, understand and use information that benefits their health. Only 12% of Americans have “proficient” health literacy. Also, most patients read at or below a 6th grade level. It’s clear that lack of health literacy can interfere with a patient’s understanding of and adherence to a PAD or cardiovascular disease treatment plan.

## Active Listening and Motivational Interviewing

Active listening is key to understanding the patient’s issues in adhering to a treatment plan. This requires avoiding distractions and keeping the focus on the patient while they’re talking. This technique should include asking relevant questions, making the appropriate level of eye contact (without staring, which can be intimidating), remaining nonjudgmental, carefully reflecting on what the patient says with thoughtful paraphrasing, and summarizing the patient’s statements.

Motivational interviewing can be used along with active listening to increase compliance. This process involves exploring the benefits of adhering to a self-management plan and how to overcome the patient’s obstacles to adherence.

Once a mutual understanding of these issues and solutions is found, the clinician can offer medical advice that’s targeted to the patient’s needs.



Gearing education about PAD to the patient’s situation and literacy level can help improve outcomes in managing the disease.

### These steps outline the process of motivational interviewing:

- Gain permission to discuss the condition and treatment plan with the patient.
- Begin the discussion with an open-ended question.
  - How are you feeling today?
  - How are you spending your days?

○ Is there anything troubling you about your condition or treatment plan?

- When the patient states an opinion, reflect it back to them to show your understanding.
- Discuss the importance of the condition and the treatment plan, but from the patient's point of view.
- Ask what might affect that importance, either positively or negatively.

Engaging with PAD Patients

Talking to patients about PAD should encourage engagement in their treatment plan.

Test your knowledge

Understanding Active Listening Motivational Interviewing

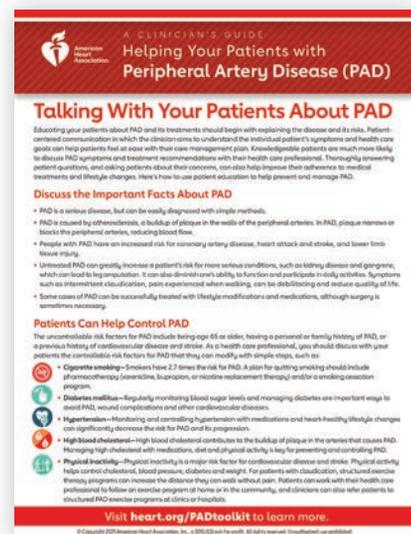
**VIEW MICRO LEARNING UNIT**  
**ENGAGING WITH PAD PATIENTS**

- Explore how confident the patient is about making changes if needed.
- Ask what might affect that confidence, either positively or negatively.
- Discuss the patient's ambivalence about the treatment program and its goals.
- Once the patient has indicated readiness, collaborate on a treatment plan.

## The Behavior Change Model

Patients need to feel ready and able to make healthy changes to follow their treatment and self-management plan. The behavior change model suggests that people who are modifying their behavior move through a series of stages, from contemplation to action.

- **Precontemplation:** Not thinking about the change
- **Contemplation:** Thinking about the change, but not ready to make it
- **Preparation:** Ready to make the change
- **Action:** Actively changing
- **Maintenance:** Preventing relapse
- **Termination:** 100% self-efficacy is achieved




**Talking with Your Patients About PAD**  
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When engaging with patients, health care professionals should take time to establish the stage at which a patient might be to help determine whether they are motivated. Using a positive and patient tone, ask the patient:

- What they know about PAD.
- To list their personal reasons and specific goals for managing PAD.
- What you (as the clinician) can do to help.

If a patient isn't ready to change, it's best to begin with more education about their condition and the benefits of symptom management. Remind patients why change is important. Also, continue to teach them the skills they need to manage their PAD.



## Long-Term Follow-Up for Patients with PAD

PAD is a lifelong medical condition, and clinicians need to develop a comprehensive care plan for patients. This follow-up plan should include regular clinical evaluations by a health care professional with experience in treating PAD. Ongoing care for patients with PAD will involve cardiovascular risk reduction with medical therapy and lifestyle changes, optimizing patient function with structured exercise and revascularization when needed.

The continued reevaluation of patients with PAD is necessary to assess cardiovascular risk factors, limb symptoms and functional status. It's recommended that patients with PAD who have undergone lower extremity revascularization have periodic clinical evaluations and ABI measurements. A change in ABI of 0.15 is considered clinically significant. Duplex ultrasound imaging tests can be valuable in the routine surveillance of patients who have undergone infrainguinal, autogenous vein bypass grafts and for those who have had endovascular procedures.

The bottom line and good news for clinicians is that efforts to promptly identify and treat PAD and to educate patients about the disease will result in more durable control of the disease and prevention of complications.

## Health care professionals can find more information about PAD through:

- [AHA's Life Long Learning Catalog](#)
- [2016 AHA/ACC Guideline on the Management of Patients with Lower Extremity Peripheral Artery Disease](#)
- [2018 Optimal Exercise Programs for Patients With Peripheral Artery Disease](#)
- [2019 Implementation of Supervised Exercise Therapy for Patients With Symptomatic Peripheral Artery Disease](#)

Additional AHA educational resources for patients with PAD can be found at [heart.org](#). News and web resources discuss PAD and lifestyle recommendations for those with the condition.

- [Watch, Learn & Live — Peripheral Artery Disease](#)
- [Cocoa May Ease Walking Pain From Peripheral Artery Disease](#)
- [Obesity May Increase Peripheral Artery Disease](#)
- [Research Opens New Avenues to Reduce Foot, Toe Amputations](#)
- [Cigarette Smoking Associated With Increased Risk of Peripheral Artery Disease in African Americans](#)
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