

Peripheral Artery Disease

Leg Pain and Much More



written by Harvard Medical School



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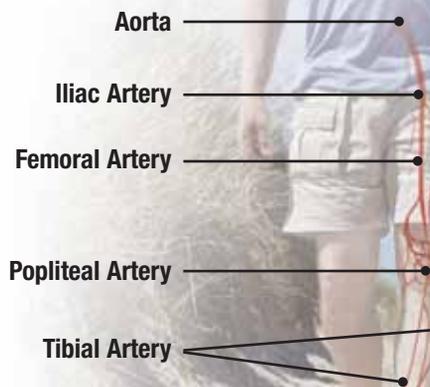
Arteries are the vital channels that carry oxygen-rich blood from the heart to all the body's tissues. When blockages develop, blood flow slows and tissues suffer. Blockages in the coronary arteries cause angina and heart attacks; blockages in the arteries that supply blood to the brain cause strokes. But the peripheral arteries that carry blood to the legs are also vulnerable. Heart attacks and strokes get all the publicity but *peripheral artery disease* (PAD) is a major problem that deserves more attention and respect—especially since new methods make diagnosis easier and treatment better than before.

For more information about peripheral artery disease from Harvard Health Publications, go to www.patientedu.org/pad.

What is PAD?

Like most strokes and nearly all heart attacks, PAD is a form of *atherosclerosis*. The disease begins when LDL (“bad”) cholesterol passes from the blood into the walls of an artery. Arteries damaged by high blood pressure, diabetes, or smoking are at particular risk. As the cholesterol builds up, it triggers inflammation, which adds to the damage. Unless treatment halts the process, the cholesterol deposit builds up into a *plaque*, or a blockage that narrows the artery. Mild narrowing may not produce any symptoms, but moderate narrowing may prevent muscles from getting the extra blood they need during exercise. When blockages are severe, the tissues suffer—even during rest. Blood clots can add to the problem by adding to the blockages.

PAD is much more common in the legs than the arms. The most frequent locations include the *femoral* or *popliteal arteries* (about 80%), the *tibial arteries* (40%), and the *aorta* or *iliac arteries* (30%) (See below).



Who Gets PAD?

PAD is rare in young adults but more common in senior citizens. Only about 3% of Americans younger than age 50 have the problem, but about 20% of people older than 75 have PAD. In all, nearly 8 million Americans have PAD and up to 30% of these patients will die within 5 years. About 75% of these deaths will be caused by heart disease.

Because PAD is a form of atherosclerosis, most major heart disease risk factors also increase the chances of developing PAD. But there are some differences; in particular, ethnicity and chronic kidney disease appear to have a greater influence in PAD than heart disease (See Table 1).

Table 1 PAD Risk Factors

Major Factors	Minor Risk Factors
Previous or family history of stroke or heart attack	Abdominal obesity
Smoking	African-American heritage
Diabetes	Chronic kidney disease
Abnormal cholesterol levels	Increased tendency to form blood clots
High blood pressure	Increased levels of homocysteine (<i>an amino acid in the blood</i>)
Advancing age	



Symptoms

Most people with PAD experience no symptoms. Fortunately, there is a very simple test your doctor can perform (called the ankle-brachial index [see page 10]) to determine if you have PAD. Patients with PAD often have atherosclerosis in other arteries, which can increase their risk of heart attack and stroke and increase the risk of cardiovascular death by 2 to 4 times. The more severe the PAD, the higher the risk. This is why testing for PAD is so important.

When symptoms do arise, the earliest and most common symptom is *intermittent claudication*. Patients usually experience it as a cramp-like muscular discomfort, but PAD can also produce numbness, tingling, weakness, or fatigue. Claudication develops when muscles are not getting the oxygen they need. Because muscles need more oxygen when they're working, claudication begins during exercise and resolves with a few minutes of rest. People with mild blockages can walk long distances before the symptoms set in, but patients with severe PAD may experience distress after walking just a few yards.

The location of the discomfort depends on the site of the blockage (See Table 2).

Table 2 Blockages and Symptoms

Location of Blockage	Location of Symptom
Tibial artery	Foot
Femoral or popliteal artery	Calf
Aorta or iliac artery*	Thigh, hip, or buttock

*Men with aorta-iliac disease may also develop erectile dysfunction as a symptom of PAD.

A more serious symptom is *rest pain*. It occurs when blockages are so severe that muscles can't

get enough oxygen, even when they're at rest. Foot pain is the most common symptom. At first, it's most troublesome when the leg is elevated, particularly in bed at night. But if the disease progresses, the pain can become constant and is no longer relieved by sitting or standing. Patients with moderate-to-severe PAD can also develop ulcers or other skin problems in their feet and legs.

The most dangerous symptom is known as *critical limb ischemia*, which is tissue damage caused by a lack of blood and oxygen. In the case of PAD, it can be triggered by a blood clot that blocks a narrowed artery.

Critical limb ischemia requires immediate treatment to prevent amputation, gangrene, or death. Although rest pain is much less urgent, it usually requires surgery. But patients with claudication may respond well to lifestyle treatment and medications—which is why early diagnosis and treatment is so important.



Protecting Against PAD

If you follow a strategy to prevent heart disease, you are also protecting yourself from PAD. Taking medications to control your blood pressure or cholesterol can be helpful. Here's what to do:

Learn your family's history of stroke or heart attack. If someone in your family has had a stroke or heart attack, that puts you at greater risk of these events—and PAD.



Control cholesterol levels. LDL ("bad") cholesterol that builds up in the arteries causes the production of plaque, which narrows the arteries and eventually causes blockages that can result in PAD. Improving your diet, exercising, limiting alcohol, and taking prescription cholesterol-lowering medications (if needed) can help.

Control high blood pressure.

Having high blood pressure puts you at greater risk for PAD and other heart-related diseases. Control your blood pressure by eating a healthy, low-sodium diet and by exercising and taking blood pressure-lowering medications, if needed.



Manage diabetes. If you have diabetes, you are at higher risk for cardiovascular events, including PAD. Control your blood glucose levels to reduce your risk.



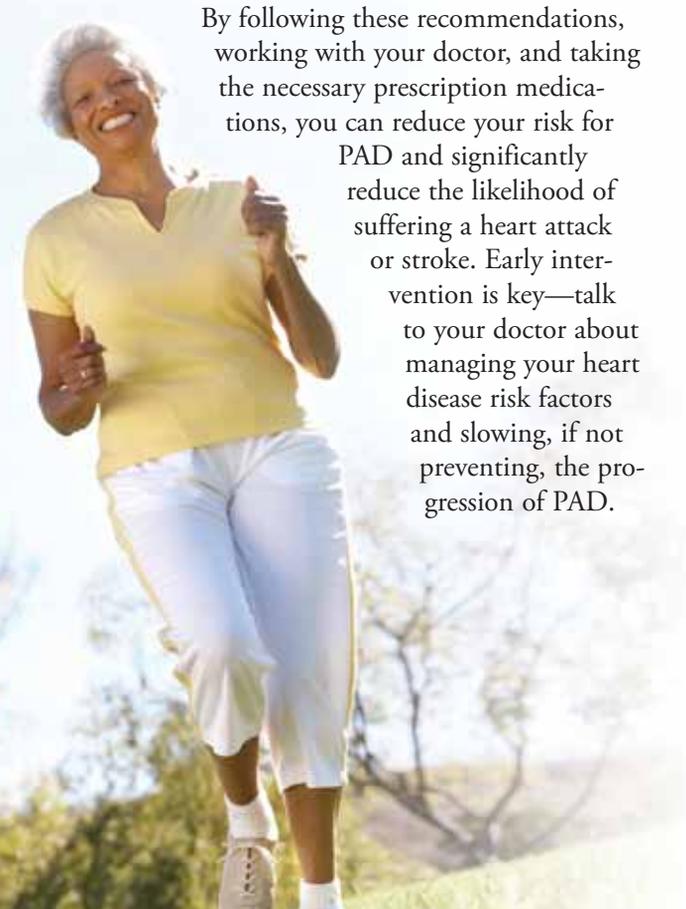


Quit smoking. Smoking is a major cause of PAD. Quit smoking, or better yet, never start. Remember to also avoid secondhand smoke.

Have your blood tested. The ratio between total blood cholesterol and HDL (“good”) cholesterol and C-reactive protein levels, which are found in your blood, may be able to predict your risk of PAD.

Exercise and lose weight. Exercise can help you lose the extra weight that might be putting you at risk for heart disease and PAD. Always talk to your doctor before starting an exercise program.

By following these recommendations, working with your doctor, and taking the necessary prescription medications, you can reduce your risk for PAD and significantly reduce the likelihood of suffering a heart attack or stroke. Early intervention is key—talk to your doctor about managing your heart disease risk factors and slowing, if not preventing, the progression of PAD.



Office Evaluation

Your doctors will ask about your risk factors and symptoms. If you have claudication, they should consider other causes of exercise-induced leg pain. Arthritis of the lower spine (*spinal stenosis*) is the most important.

The next step is a physical exam, which should focus on your blood pressure and your pulses. Your leg arteries are mostly covered by muscle, but doctors can feel pulses on the top of your feet, at your ankle, behind your knee, and in your groin. It’s important for the doctor to check your pulses in both legs and to examine your skin. In PAD the skin may not get enough oxygen-rich blood. Over time, it becomes cool, thin, and shiny, and hair growth is diminished. A few simple maneuvers may also be revealing: elevation of the affected leg makes it pale, while dangling it down from the exam table makes it a dusky bluish-red. Finally, painful, hard-to-heal skin ulcers or infections may occur in advanced PAD cases.

You’ll also need blood tests to check your cholesterol, blood sugar, and kidney function.



The ankle-brachial index is a safe test that can detect PAD and give a good estimate of its severity.

The Ankle-Brachial Index

The ankle-brachial index (ABI) is a safe test that can detect PAD and give a good estimate of its severity. It can be performed in some doctors' offices or in vascular labs. To understand how it works, just step on a garden hose; the blockage produced by your foot will reduce water pressure at the nozzle. Similarly, a blockage in a leg artery will lower blood pressure at the ankle.

To check your ABI, a technician will use a *Doppler probe* and a blood pressure cuff to measure the systolic blood pressures in your ankles and arms (the *brachial artery*). To calculate your index, your ankle pressure is divided by your arm pressure. Table 3 shows what the numbers mean.

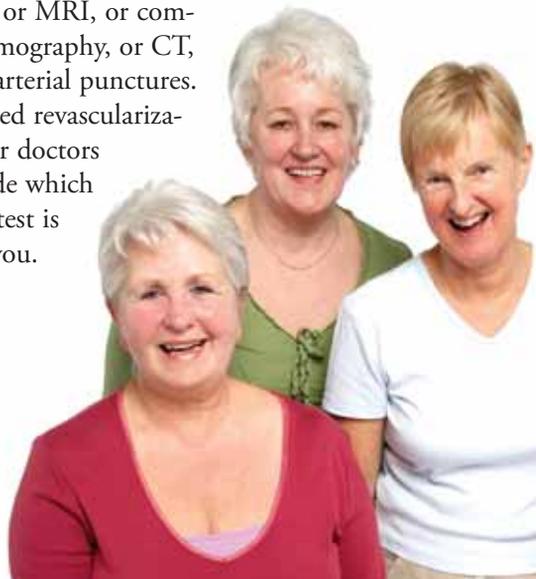
<i>Table 3</i> Interpreting the ABI	
ABI	Severity of PAD
.90 and higher	None
.60-.89	Mild
.40-.88	Moderate
.39 and lower	Severe

Imaging Studies

Although the ABI is an accurate test, most patients with PAD will benefit from a *Doppler duplex ultrasound* test. It's a non-invasive, risk-free way to identify the site of a blockage and to determine how much it narrows the artery. In general, a narrowing of more than 50% is likely to produce symptoms.

Patients who are candidates for revascularization procedures (see page 16) require detailed images produced by *angiography*. Until recently, that meant an invasive test that required puncturing an artery and injecting a dye to allow blockages to show up on x-rays.

Today, though, many centers are relying on angiographic images produced by magnetic resonance imaging, or MRI, or computed tomography, or CT, without arterial punctures. If you need revascularization, your doctors will decide which imaging test is best for you.





Everybody with PAD should adopt the lifestyle that will fight atherosclerosis.

Treatment: *Lifestyle*

Everybody with PAD should adopt the lifestyle that will fight atherosclerosis. Here are some key elements:

Avoid tobacco, including secondhand smoke.

Exercise. Exercise helps with weight, cholesterol, blood pressure, and stress, but walking triggers leg pain in patients with PAD. If you have advanced PAD or heart problems, your doctor may refer you to a medically supervised exercise program. If you get the okay to walk on your own, plan to set aside 30 minutes at least 3 days a week. Walking helps your leg muscles use oxygen better. Walk at a comfortable pace, but stop at the first hint of pain. When your legs feel better, start again and repeat the cycle until your time is up. In time, you'll find yourself walking more and resting less. Many people find that exercise training can double or even triple their pain-free walking distances. And a 2006 study reported that physical activity lowers the overall death rate in patients with PAD.

Eat right. Cut down on saturated fat (from red meat and whole dairy products) and trans fat (from stick margarine, fried foods, snack foods,

and some baked goods). Eat lots of whole grains, vegetables, fruits, and fish. Restrict sodium (salt), ideally to 1,500 mg a day or less, by avoiding processed foods, salty snacks, dried or canned soups, and sauces. If you choose to drink alcohol, limit yourself to two drinks a day. Cut down on portion sizes and calories if you are overweight (See PEC booklet, 'Good Eating for Good Health').

Reduce stress. Establish priorities. Talk out your worries. Try relaxation techniques to lower your stress levels and to protect your arteries.

Take care of your feet. Wash them in lukewarm water at least once a day and apply lanolin afterwards. Avoid extreme temperatures. Never use a heating pad on your feet. Don't put them in hot or cold water. If your bed is cold, wear socks at night. Never go barefoot. Wear cotton socks and properly fitting shoes. Place lambs wool between overriding toes. Trim your nails carefully. Inspect your feet daily. If your feet ache at night, raise the head of your bed by using 6-to-10 inch blocks.





reported that statin therapy reduces the risk of heart attack and stroke in PAD patients.

Your blood pressure should be 130/80 or less. For most people, 140/90 is the goal, but the lower target applies to people with PAD as well as those with diabetes, kidney disease, and heart disease. Many drugs can help (see PEC booklet, ‘High Blood Pressure’). *ACE inhibitors* may be good choices since they can increase walking distance in people with PAD. If you have diabetes, your HbA1C should be 7% or less.

In addition to these drugs, nearly every patient with PAD will benefit from an anti-platelet drug to fight blood clots. Many physicians recommend low-dose aspirin (typically 81 to 325 mg daily), or the prescription drug *clopidogrel*, an excellent alternative. Be sure to ask your doctor about the medications that are right for you.

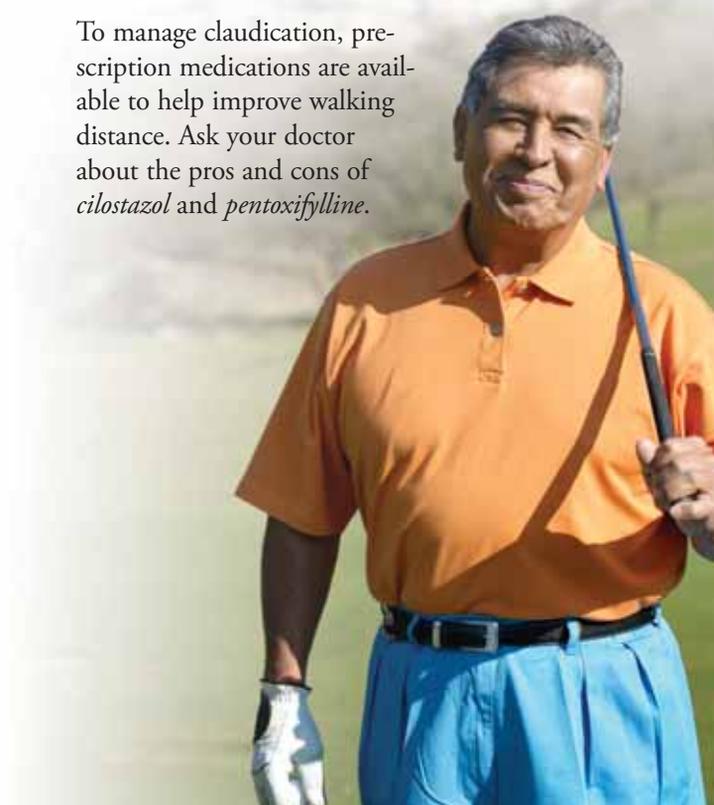
To manage claudication, prescription medications are available to help improve walking distance. Ask your doctor about the pros and cons of *cilostazol* and *pentoxifylline*.

Treatment: Medication

Since PAD is a form of atherosclerosis, your doctor will talk to you about medications to help relieve any symptoms you may have and—more importantly—to reduce your risk of a serious event such as a heart attack. In fact, your doctor may recommend two separate treatment strategies—one to manage your symptoms and one to reduce your risk (See Table 4).

Table 4	Treatment Strategies
Cardiovascular Risk Reduction	
Anti-platelet therapy (<i>aspirin and/or clopidogrel</i>)	
High blood pressure medication	
Cholesterol-lowering therapy	
Therapy for diabetes	
Managing Symptoms	
Treatment for claudication	

Your LDL (“bad”) cholesterol should be below 100 mg/dL, or below 70 mg/dL if you have severe disease. Most patients will benefit from a statin drug to reach their goal. In fact, a new study

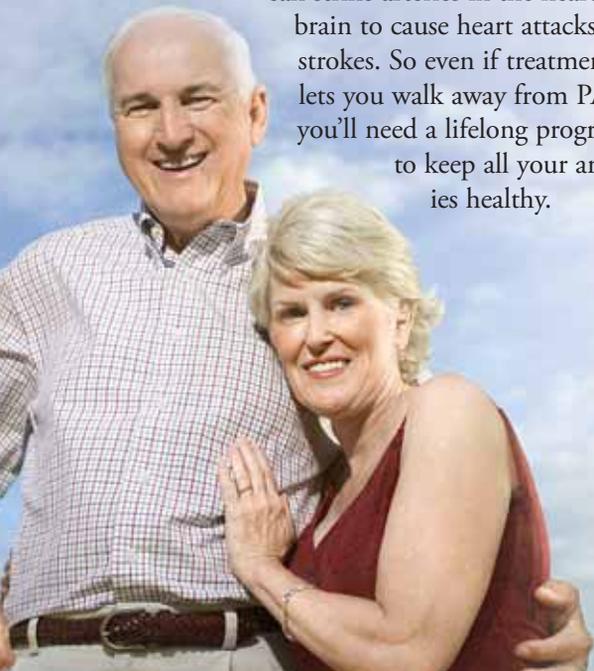


Treatment: *Revascularization*

Patients with moderate-to-severe PAD may need *revascularization* treatment to restore blood flow to their legs. Sometimes doctors can do this by passing a catheter into the blocked artery, inflating a tiny balloon to open the blockage, and positioning a tiny metal stent to keep the artery open. But if *angioplasty with stenting* won't do the job, *bypass surgery* may; surgeons can use a segment of the patient's vein or a synthetic graft to bypass the troublesome blockage. Additional procedures are available to treat blockages caused by blood clots.

Beating PAD

Many patients with PAD don't have any symptoms, and many others get the needed relief from lifestyle treatment and medications. If that's not enough, revascularization may control pain and save a limb. But that's not the end of the story. PAD is a symptom of atherosclerosis, a disease that can strike arteries in the heart or brain to cause heart attacks and strokes. So even if treatment lets you walk away from PAD, you'll need a lifelong program to keep all your arteries healthy.



For more information about PAD, visit these Web sites:



The PAD Coalition
www.padcoalition.org
301.524.1535



**National Heart, Lung,
and Blood Institute**
www.nhlbi.nih.gov
301.592.8573



**The American Heart
Association**
www.americanheart.org
1.800.AHA.USA.1
(1.800.242.8721)



**Vascular Disease
Foundation**
www.vdf.org
1.866.PADINFO
(1.866.723.4636)



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