

## Peripheral artery disease: Leg pain and much more

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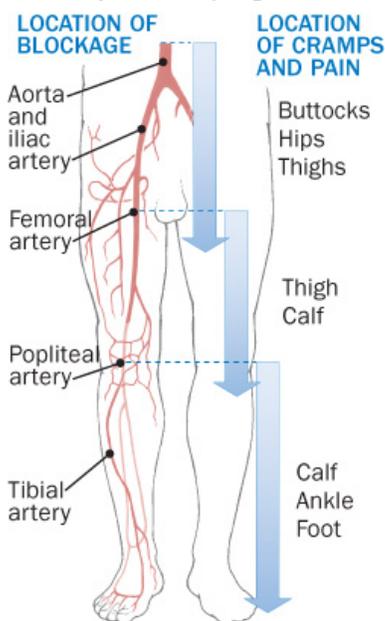
Arteries are the vital channels that carry oxygen-rich blood from the heart to all the body's tissues. When blockages develop, blood flow slows and tissues suffer. Blockages in the coronary arteries cause angina and heart attacks; blockages in the arteries that supply blood to the brain cause strokes. But the peripheral arteries that carry blood to the legs and other parts of the body 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 ever before.

### What is PAD?

Like most strokes and nearly all heart attacks, PAD (sometimes called peripheral vascular disease) is a form of atherosclerosis. The disease begins when LDL ("bad") cholesterol passes from the blood into the wall of an artery. Arteries damaged by high blood pressure, smoking, or diabetes 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 blockage, that narrows the artery. Mild narrowing may not produce any symptoms, but moderate narrowing may prevent tissues from getting the blood they need to fuel the extra work of exercise. When blockages are severe, the tissues suffer even during rest. Blood clots can add insult to injury by increasing blockages.

PAD is much more common in the legs than anyplace else. The most frequently affected locations include the aorta (about 30%), the femoral and popliteal arteries (80%), and the tibial artery (40% — because men can have blockages in several arteries, the numbers add up to over 100%; see figure).

### Blockages and symptoms



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## Who gets PAD?

PAD is rare in young adults but common in senior citizens. Only about 3% of Americans below age 50 have the problem, but about 20% of people over 75 are affected. In all, some 8 million Americans have PAD.

Because PAD is a form of atherosclerosis, most heart disease risk factors also increase the chances of developing PAD (see Table 1). But there are some differences; in particular, ethnicity and chronic kidney disease appear to have a greater influence in PAD than heart disease. You can use the Framingham Heart Study test to evaluate your personal risk (see box).

Table 1: PAD risk factors

### Major factors

- Smoking
- Diabetes
- High blood pressure
- Abnormal cholesterol levels
- Advancing age

### Minor factors

- Abdominal obesity
- African American heritage
- Chronic kidney disease
- Increased tendency to form blood clots
- Increased levels of homocysteine (an amino acid in the blood)
- Vitamin D deficiency
- Testosterone deficiency

## Symptoms

The earliest and most common symptom is called intermittent claudication. Patients usually experience it as a cramp-like muscular discomfort, but PAD can also produce numbness, tingling, weakness, or fatigue. In any form, claudication occurs when muscles are not getting all 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 substantial distances before the symptoms set in, but patients with severe PAD may experience distress in just a few yards. The location of the discomfort depends on the site of the blockage (see figure).

Men with aorta-iliac disease may also develop erectile dysfunction as a symptom of PAD. But a more serious symptom is rest pain. It occurs when blockages are so severe that muscles can't get enough oxygen when they're at rest. Foot pain is most common. 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. Ischemia means tissue damage caused by 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 is a true emergency that requires immediate treatment to prevent gangrene, amputation, or death. Although rest pain is much less urgent, it usually requires revascularization (surgery or angioplasty with a stent). But patients with claudication may respond well to lifestyle treatment and medications — which is why early diagnosis and treatment are so important.

Many patients with PAD don't have any symptoms at all. But diagnosis and treatment are important for them, too. Patients with PAD often have atherosclerosis in other arteries. That's why they have an increased risk of heart attack, stroke, and cardiovascular death. The more severe the PAD, the higher the risk.

## Are you at risk?

Are you at risk for developing symptoms of peripheral artery disease? To find out, take the test developed by researchers at the Framingham Heart Study.

Add up your point score, then evaluate your risk with the second chart. Remember, though, that whether your score is reassuringly low or frighteningly high, you can — and should — take steps to reduce your risk; if you smoke, stop at once. Follow a good diet and exercise regularly to reduce your risk of diabetes, high cholesterol, and high blood pressure.

Risk points								
Risk factors	0	1	2	3	4	5	6	7
Age	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80+
Gender	Female			Male				
Blood pressure	Normal	High normal	Mild hypertension	Moderate to severe hypertension				
Cigarettes smoked per day	0	1–5	6–10	11–20	More than 20			
Cholesterol (mg/dL)	Below 170	170–209	210–249	250–289	290 or higher			
Diabetes	No					Yes		
Coronary artery disease	No					Yes		

Source: Merobito et al. *Circulation* 1997;96:44–49.

## Risk of developing symptoms of peripheral artery disease within four years

Point score	Risk
Less than 10	Less than 1%
10–12	1%
13–15	2%
16–17	3%
18	4%
19	5%
20	6%
21	7%
22	8%
23	10%
24	11%
25	13%

26	16%
27	18%
28	21%
29	24%
30	28%

## Office evaluation

Although peripheral artery disease is the most common cause of exercise-induced leg pain, other disorders can cause similar symptoms. Spinal stenosis is the closest mimic; so close, in fact, that its pain is called pseudoclaudication. Spinal stenosis results from a narrowing of the lower spinal canal that puts pressure on the nerves to the legs. Usually caused by degenerative arthritis, it is most common in the same older age groups that are at risk for PAD. Like true claudication, pseudoclaudication occurs with exercise, and like true claudication, it is relieved by rest, but the relief usually occurs more slowly. Both symptoms are triggered by walking, but patients with peripheral artery disease also get leg pain from biking, while patients with spinal stenosis do not. That's because people bend forward when they bike, and flexion widens the spinal canal, reducing pressure on the nerves. But even if the symptoms of PAD and spinal stenosis overlap, doctors can readily distinguish the two by checking the leg pulses (diminished in arterial disease) and reflexes (decreased after walking in spinal stenosis).

The box below discusses other vascular disorders that can affect your legs. Remember, too, that nonvascular conditions such as osteoarthritis can cause leg pain that flares with activity.

### Other arterial disorders

Atherosclerosis is the most common cause of narrowing of a limb artery, but other disorders can also be responsible. Blood clots (thrombi) can form in the heart or in the aorta or other large arteries. Clots may break loose and travel in the bloodstream (embolize) until they lodge in a smaller artery; such thromboemboli cause severe pain and pallor that begins abruptly and requires urgent treatment to remove the clot. Cholesterol emboli are less urgent; these tiny particles of cholesterol break off from plaques and block small arteries, usually causing painful, blue toes. Unlike these conditions, popliteal artery entrapment occurs primarily in healthy young individuals when enlargement of the calf muscles puts excessive pressure on the artery beneath them; it usually requires surgery to relieve the pressure. Popliteal artery entrapment occurs mostly in men; in contrast, Raynaud's phenomenon is more common in women. In this condition, cold temperatures cause temporary arterial spasms that produce painful blue or white fingers or toes; warmth is the best approach to prevention and treatment. Finally, arteritis, or inflammation of an artery, can also limit blood flow to a limb; it's a serious condition but it's quite uncommon, especially in men.

## Diagnosis

To check for possible PAD, your doctor will examine you, focusing on 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.

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

## 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 pressure in your ankles and arms (the brachial artery). To calculate your index, divide your ankle pressure by your arm pressure. Table 2 shows what the numbers mean. If your ABI is

borderline but your doctor still suspects PAD, he may ask you to repeat the test after exercise.

Table 2: Interpreting the ankle-brachial index (ABI)

ABI	Severity of PAD
0.90 and higher	None
0.60–0.89	Mild
0.40–0.59	Moderate
0.39 and lower	Severe

## Imaging studies

Although the ABI is an accurate test, most patients with PAD will also benefit from a Doppler duplex ultrasound test. The test can be done at rest and after exercise. It's a noninvasive, 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 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 MRIs or CTs without arterial punctures. If you need revascularization, your doctors will decide which imaging test is best for you.

## Treatment: Lifestyle

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

- Avoid tobacco in all forms, including secondhand smoke.
- Eat right. Cut down on saturated fat (from red meat and whole-fat dairy products) and trans fat (from stick margarine, fried foods, snack foods, and some commercial baked goods). Eat lots of whole grains, vegetables, fruits, and fish. Restrict sodium (salt), ideally to less than 1,500 mg a day, by avoiding processed foods, salty snacks, dried or canned soups, and sauces. If you choose to drink, limit yourself to two a day. Cut down on portion sizes and calories if you are overweight.
- Exercise. Exercise helps with weight, cholesterol, blood pressure, and stress, but walking triggers leg pain in patients with PAD. What to do? Walk! 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 three days a week. 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. Walking helps your leg muscles use oxygen better, so in time you'll find yourself walking more and resting less; resistance training can also help. Many men find that exercise training can double or triple their pain-free walking distances, and it may even relieve symptoms as well as angioplasty does. Exercise preserves physical function in men with PAD, and two important studies found that physical activity lowers the overall death rate in patients with PAD.
- Reduce stress.
- Take care of your feet. Wash them in lukewarm water at least once a day and apply lanolin afterward. Avoid extremes of temperature. 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 lamb's wool between overriding toes. Trim your nails carefully. Inspect your feet daily. If your feet ache at night, raise the head of your bed on 6- to 10-inch blocks.

## Alcohol and peripheral artery disease

Can a drink a day keep peripheral artery disease away? Perhaps, according to the Physicians' Health Study. This Harvard-based study has been tracking more than 22,000 American male doctors since the early 1980s. Among many other things, the study found that moderate drinking reduces a man's risk of developing peripheral artery disease. After accounting for the effects of diabetes,

smoking, exercise, blood pressure, cholesterol, and a family history of coronary artery disease, men who consumed at least one drink a day were 26% less likely to develop peripheral artery disease than men who drank less. Since moderate drinking also reduces the risk of coronary artery disease and possibly stroke, the results are logical. But because excessive drinking poses enormous health risks, men who choose to drink must do so with care and moderation, averaging just one to two drinks a day.

## Treatment: Medication

Since PAD is a form of atherosclerosis, your doctor will set strict goals for your risk factors. In most cases, you'll need medication to reach these goals:

- Your LDL 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 study reported that statin therapy reduces the risk of heart attack and stroke in PAD patients.
- Your blood pressure should be 130/80 mm Hg or less. For most people, 140/90 is the goal, but the lower target now applies to people with PAD, as well as to those with diabetes, kidney disease, and heart disease. Many drugs can help; an ACE inhibitor may be a good choice since it 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 mg to 325 mg daily), with the prescription drug clopidogrel (Plavix) as an alternative for patients who can't take aspirin.

Ask your doctor about the two prescription drugs that may improve walking distance in PAD: although its benefits are modest, cilostazol (Pletal) appears more effective than the older medication, pentoxifylline (Trental, Pentoxil, Pentopak).

## 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 men with PAD don't have any symptoms, and many others get important relief from lifestyle treatment and medications. If that's not enough, revascularization may control pain and save a limb. But the story doesn't end there. PAD is a symptom of atherosclerosis, a disease that can strike arteries in the heart or brain, causing 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.

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