

PERIPHERAL ARTERY DISEASE AND ANKLE BRACHIAL INDEX

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Abstract

Peripheral artery disease (also called peripheral arterial disease) is a common circulatory problem in which narrowed arteries reduce blood flow to the limbs. When peripheral artery disease (PAD) is develop on the legs or arms usually the legs don't receive enough blood flow to keep up with demand. This may cause symptoms, such as leg pain when walking (claudication). Peripheral artery disease is also likely to be a sign of a build up of fatty deposits in the arteries (atherosclerosis). This condition may narrow the arteries and reduce blood flow to the legs and occasionally arms.

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RISK FACTORS

- Smoking
- Diabetes
- Obesity (a body mass index over 30)
- High blood pressure
- High cholesterol
- Increasing age, especially after age 65 or after 50 if you have risk factors for atherosclerosis
- A family history of peripheral artery disease, heart disease or stroke
- High levels of homocysteine, an amino acid that helps your body make protein and to build and maintain tissue

People who smoke or have diabetes have the greatest risk of developing peripheral artery disease due to reduced blood flow.

SIGNS AND SYMPTOMS INCLUDE

- Painful cramping in one or both of your hips, thighs or calf muscles after certain activities, such as walking or climbing stairs
- Leg numbness or weakness
- Coldness in your lower leg or foot, especially when compared with the other side

- Sores on your toes, feet or legs that won't heal
- A change in the color of your legs
- Hair loss or slower hair growth on your feet and legs
- Slower growth of your toenails
- Shiny skin on your legs
- No pulse or a weak pulse in your legs or feet
- Erectile dysfunction in men
- Pain when using your arms, such as aching and cramping when knitting, writing or doing other manual tasks

DIAGNOSIS

- **Physical exam.** Your doctor may find signs of PAD during a physical exam, such as a weak or absent pulse below a narrowed area of your artery, whooshing sounds over your arteries that can be heard with a stethoscope, evidence of poor wound healing in the area where your blood flow is restricted, and decreased blood pressure in your affected limb.
- **Ankle-brachial index (ABI).** This is a common test used to diagnose PAD. It compares the blood pressure in your ankle with the blood pressure in your arm.
To get a blood pressure reading, your doctor uses a regular blood pressure cuff and a special ultrasound device to evaluate blood pressure and flow.
You may walk on a treadmill and have readings taken before and immediately after exercising to capture the severity of the narrowed arteries during walking.

ULTRASOUND

Special ultrasound imaging techniques, such as Doppler ultrasound, can help your doctor evaluate blood flow through your blood vessels and identify blocked or narrowed arteries

- **Angiography.** Using a dye injected into your blood vessels, this test allows your doctor to view blood flow through your arteries as it happens. Your doctor can trace the flow of the dye using imaging techniques, such as X-rays, magnetic resonance angiography (MRA) or computerized tomography angiography.
- Catheter angiography is an invasive procedure that involves guiding a small hollow tube (catheter) through an artery in your groin to the affected area and injecting the dye. This type of angiography allows your doctor to treat a blocked blood vessel at the time of diagnosis. After finding the narrowed area of a blood vessel, your doctor can then widen it by inserting and expanding a tiny balloon or by administering medication that improves blood flow.

BLOOD TESTS

A sample of your blood can be used to measure your cholesterol and triglycerides and to check for diabetes.

COMPLICATIONS

If the peripheral artery disease is caused by a build up of plaque in the blood vessels, clients are also at risk of developing:

- ☐ **Critical limb ischemia.** This condition begins as open sores that don't heal, an injury, or an infection of your feet or legs. Critical limb ischemia occurs when the injuries or

infections progress and cause tissue death, sometimes requiring amputation of the affected limb.

- ☒ **Stroke and heart attack.** The atherosclerosis that causes the signs and symptoms of peripheral artery disease isn't limited to your legs. Fat deposits also build up in arteries supplying blood to your heart and brain.

Prevention

The best way to prevent claudication is to maintain a healthy lifestyle. That means:

- ☒ Quit smoking if you're a smoker.
- ☒ If you have diabetes, keep your blood sugar in good control.
- ☒ Exercise regularly. Aim for 30 to 45 minutes of exercise several times a week after you've gotten your doctor's OK.
- ☒ Lower your cholesterol and blood pressure levels, if needed.
- ☒ Eat foods that are low in saturated fat.
- ☒ Maintain a healthy weight.

ANKLE BRACHIAL INDEX

The ankle-brachial index test is a quick, non-invasive way to check for peripheral artery disease (PAD). The disease occurs when narrowed arteries reduce the blood flow to your limbs. PAD can cause leg pain when walking and increases the risk of heart attack and stroke.

The ankle-brachial index test compares the blood pressure measured at your ankle with the blood pressure measured at your arm. A low ankle-brachial index number can indicate narrowing or blockage of the arteries in your legs.

You may have ankle-brachial index testing before and immediately after walking on a treadmill. An exercise ankle-brachial index test can assess the severity of the narrowed arteries during walking.

The ankle-brachial index test is done to check for PAD — narrowed arteries that reduce blood flow, usually in legs. Research indicates that PAD affects about 10 percent of people over age 55. The doctor might recommend an ankle-brachial index test if the client has leg pain while walking or risk factors for PAD, such as:

- ☒ History of tobacco use
- ☒ Diabetes
- ☒ High blood pressure
- ☒ High cholesterol

Restricted blood flow (atherosclerosis) in other parts of your body.

PREPARATION FOR ABI

No special preparations are needed for an ankle-brachial index test. The test is painless and similar to getting the blood pressure taken in a routine visit to the doctor. The client might want to wear loose, comfortable clothing that allows the technician performing the ankle-brachial index test to easily place a blood pressure cuff on the ankle and upper arm.

The doctor uses the blood pressure measurements from the arms and ankles to calculate the ankle-brachial index.

- ☐ **No blockage (1.0 to 1.4).** An ankle-brachial index number in this range suggests that you probably don't have PAD. But if you have symptoms of PAD, your doctor might perform an exercise ankle-brachial index test.
- ☐ **Borderline blockage (0.91 to 0.99).** An ankle-brachial index number in this range indicates that you have borderline PAD. Your doctor might recommend an exercise ankle-brachial index test.
- ☐ **PAD (less than 0.90).** An ankle-brachial index number in this range is considered abnormal and indicates a diagnosis of PAD.
- ☐ The ABI is performed by measuring the systolic blood pressure from both brachial arteries and from both the dorsalis pedis and posterior tibial arteries after the patient has been at rest in the supine position for 10 minutes. The systolic pressures are recorded with a handheld 5- or 10-mHz Doppler instrument. Usually a standard blood pressure cuff can be used at the ankle. As with arm pressures, the most accurate pressure readings are obtained when the blood pressure cuff is appropriately sized to the patient's lower calf (immediately above the ankle). It is recommended to begin with the right arm, then the right leg, then the left leg, and finally the left arm, as the blood pressure may drift during the exam, and the two arm pressures at the beginning and end of the exam provide for some quality control.

MEASURING THE BRACHIAL PRESSURE

- ☐ The patient should be in the supine position. Place the blood pressure cuff on the arm, with the limb at the level of the heart. Place the ultrasound gel in the antecubital fossa over the patient's brachial pulse. Place the transducer of the handheld Doppler on the gel, and position the transducer to maximize the intensity of the signal. Inflate the cuff to about 20 mmHg above the expected systolic blood pressure of the patient. The Doppler signal should disappear. Then slowly deflate the cuff, approximately 1 mmHg/sec. When the Doppler signal re-appears, the pressure of the cuff is equal to the brachial systolic pressure. Record the brachial systolic pressure.

MEASURING THE ANKLE PRESSURES

- ☐ Place the cuff immediately proximal to the malleoli. Place ultrasound gel on the skin overlying the dorsalis pedis (DP) and posterior tibial (PT) arteries in the foot. The Doppler signal of the DP can often be found slightly lateral to the midline of the dorsum of the foot. Using a standard hand-held Doppler probe and the ultrasound gel, locate the signal from the DP. Slowly move the Doppler until the strongest signal is heard. To measure the systolic pressure at the DP artery, inflate the cuff until you no longer hear the signal. Then slowly deflate using the same technique used in the arms until the Doppler signal re-appears. Record the measurement.
- ☐ Next, measure the systolic pressure of the PT artery. The PT signal is detected posterior to the medial malleolus. Once again, using the Doppler with ultrasound gel, locate the signal, and follow the process described above to measure the PT systolic pressure. Repeat both measurements on the opposite leg.

CALCULATING THE ABI

- ☒ An ABI is calculated for each leg. The ABI value is determined by taking the higher pressure of the 2 arteries at the ankle, divided by the brachial arterial systolic pressure. In calculating the ABI, the higher of the two brachial systolic pressure measurements is used. In normal individuals, there should be a minimal (less than 10 mm Hg) interarm systolic pressure gradient during a routine examination. A consistent difference in pressure between the arms greater than 10mmHg is suggestive of (and greater than 20mmHg is diagnostic of) subclavian or axillary arterial stenosis, which may be observed in individuals at risk for atherosclerosis.
- ☒ Calculated ABI values should be recorded to 2 decimal places.
- ☒ Right ABI=Highest Pressure In Right Foot divided by Highest Pressure in Both Arms

INTERPRETING THE ANKLE BRACHIAL INDEX

1. Normal ABI ranges from 1.0 — 1.4
 - a. Pressure is normally higher in the ankle than the arm.
2. Values above 1.4 suggest a noncompressible calcified vessel.
 - a. In diabetic or elderly patients, the limb vessels may be fibrotic or calcified. In this case, the vessel may be resistant to collapse by the blood pressure cuff, and a signal may be heard at high cuff pressures. The persistence of a signal at high pressure in these individuals results in an artifactually elevated blood pressure value.
3. A value below 0.9 is considered diagnostic of PAD.
4. Values less than 0.5 suggests severe PAD.
 - a. Individuals with such severe disease may not have sufficient blood flow to heal a fracture or surgical wound; they should be considered for revascularization if they have a non-healing ulcer.

<u>ABI Value</u>	<u>Interpretation</u>	<u>Recommendation</u>
Greater than 1.4	Calcification/Vessel Hardening	Refer to vascular specialist
1.0-1.4	Normal	None
0.9-1.0	Acceptable	None
0.8-0.9	Some Arterial Disease	Treat risk factors
0.5-0.8	Moderate Arterial Disease	Refer to vascular specialist
Less than 0.5	Severe Arterial Disease	Refer to vascular specialist

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