

Bedside ankle-brachial index testing: *Time-saving tips*

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A hot flush of embarrassment creates a bead of sweat on my forehead. “I’ve got to get this measurement,” I plead to myself. One glance at the clock tells me this bedside ankle-brachial index (ABI) procedure has already taken more than 30 minutes. My stomach sinks as I realize I’ll have to abandon the test as inconclusive.

If you can relate to this story, you’re not alone. Although a 2009 study found an ABI test can be done in 5 to 10 minutes on healthy individuals, it can be more time-consuming in older patients with limited

mobility, significant edema or lymphedema, obesity, tissue fibrosis, or diminished pulses. In 2005, Lorraine French found that 74% of 50 trained home health nurses took 51 to 90 minutes to complete an ABI procedure and 20% took 30 to 50 minutes.

ABI is the ratio of systolic blood pressure (BP) in the ankle to systolic BP in the arm. An ABI of 0.90 or lower indicates peripheral arterial disease (PAD) and is linked to an increased risk of heart attack or stroke. For wound care clinicians, ABI testing helps determine how much compression is safe to apply and reflects the wound’s healing potential. (See *Interpreting ABI results*.)

However, finding the time to obtain ABIs in a busy clinic can be challenging. This article offers time-saving tips you can use when performing a bedside ABI test.



Interpreting ABI results

The ankle-brachial index (ABI) is calculated by dividing the higher of the dorsalis pedis and posterior tibial systolic blood pressures in one ankle by the higher of the brachial systolic pressures measured in both arms. Here’s how to interpret the results, according to the 2011 American College of Cardiology and American Heart Association guidelines.

ABI result	Interpretation
> 1.40	Falsely elevated
1.00 to 1.40	Normal
0.9 to 0.99	Borderline peripheral arterial disease (PAD)
0.8 to 0.89	Mild PAD
0.5 to 0.79	Moderate PAD
< 0.5	Severe PAD with pain at rest
< 0.4	Severe PAD with critical limb ischemia

Tip #1: Request ABI testing before referrals.

Save time by acquiring ABI results from a diagnostic service instead of performing bedside ABIs. Initially, this may take some proactive education, especially if your referral sources don't routinely order ABIs. According to 2011 guidelines from the American College of Cardiology and American Heart Association, an ABI should be done if a patient has leg pain with exertion, has a nonhealing wound, is age 65 or older, or is age 50 or older with a history of smoking or diabetes. Many patients fall into these categories, so it's reasonable to ask referral sources to order ABIs before referrals.

[Click to view and print patient educational flyers about PAD and ABI.](#)

Tip #2: Multitask ABIs into the initial assessment.

Before your initial assessment, instruct the patient to take all medications as prescribed and avoid tobacco, caffeine, alcohol, and heavy exercise for an hour before the appointment. (These factors can affect ABI results.) Also, have the patient rest supine for at least 10 minutes before the ABI procedure. During this rest period, perform a lower-extremity vascular and skin assessment. If an ABI is indicated, you can then perform the test immediately. (If you suspect severe PAD, increase the rest period to 20 minutes. You can use this time to take wound or edema measurements.)

Assess the patient for PAD risk factors. Pain on rest is associated with severe PAD and an ABI below 0.5. Observe and feel the patient's skin. Signs of PAD include dry, brittle skin and nails, lack of toe hair, cool skin, rubor on dependency, pallor on

elevation, and bluish or dusky purplish discoloration. Assess for arterial ulcers or necrotic areas on the tips of toes, lateral malleolus, and metatarsal heads. These ulcers are associated with an ABI below 0.20 and severe PAD.

Tip #3: Use Doppler sounds to avoid unnecessary ABIs.

A triphasic Doppler signal is distinctive and indicates normal blood flow, whereas biphasic or monophasic signals indicate PAD. By learning to identify triphasic sounds, you can eliminate unnecessary ABIs. Some portable Doppler units include printable waveforms or reversing arrows, which give visual confirmation of Doppler sounds and are useful when learning to distinguish normal and abnormal signals.

Research during the 1990s showed pulse palpation alone is unreliable in detecting PAD. However, most pulses were nonpalpable when ABI was less than 0.82; the lowest ABI with a palpable pulse was 0.5. Doppler auscultation and ABIs were used to validate pulse palpation. The combination of a normal palpable pulse, low PAD risk factors, and a triphasic Doppler signal indicates adequate lower-extremity blood flow for the purpose of compression therapy and wound healing. When these findings are present, an ABI test isn't necessary.

Even if a clinician misses underlying mild or moderate PAD using pulse palpation and Doppler auscultation alone, compression therapy is safe when inelastic or short-stretch bandaging systems are used. A new study found these bandaging systems are safe up to 30 or 40 mm Hg in patients with ABIs as low as 0.5, as long as ankle systolic pressure exceeds 60 mm Hg. Also, these systems improve venous return to near-normal levels and increase arterial

blood flow by up to 33% in mixed venous-arterial disease.



View: Doppler sounds

Tip #4: Reverse the test sequence to avoid inconclusive ABIs.

The standard procedure for ABI testing is to obtain systolic pressures in bilateral brachial arteries first. But you can save time by first obtaining systolic pressure for the leg(s) that will be treated. This allows you to avoid procedures that would end up being inconclusive.

First, palpate for pulses to locate the dorsalis pedis and posterior tibial arteries. With soft edema, let your fingertips gently sink into the tissue closer to the artery. Next, place the Doppler probe at an angle of 45 to 60 degrees toward arterial blood flow until you hear the strongest signal.

If you can't auscultate either artery, you won't be able to calculate ABI; abandon the test as inconclusive and refer the patient to a vascular lab or mobile diagnostic service. If you can find only one artery, use that for the test and continue the procedure. Ultimately, you'll throw out the

lower of the two ankle pressures (don't use it to calculate ABI). Record systolic pressure; a result above 60 mm Hg correlates better with leg viability and safe compression levels than the ABI does.

Typically, atherosclerosis advances symmetrically in both arteries, but patients with diabetes commonly have segmental arterial disease, causing perfusion levels to vary in different parts of the foot. One artery may be occluded while the other isn't. So if your patient has diabetes, assess systolic pressure in both arteries, and use the lower reading for your calculation. If you're unable to auscultate pressure in one of the arteries, consider possible occlusion and refer the patient to a vascular lab for further testing.

In patients with diabetes, falsely elevated ABIs are common because of arterial-wall calcification. If you inflate the ankle BP cuff to 200 mm Hg and still hear arterial sounds, **stop**. Inflating the cuff beyond 200 mm Hg can cause plaques to dislodge from the arterial wall. Also, such inflation isn't needed because it yields falsely elevated ABI results. Document the test as "inconclusive due to noncompressible vessels" and refer the patient to a vascular lab for further testing.

Choosing the right cuff size

Using a blood pressure cuff that's too large or too small for your patient can skew ankle-brachial index results. Follow this guideline to select the appropriate size for your patient.

Limb circumference	Cuff description	Cuff dimensions
22 to 26 cm	Small adult	12 × 22 cm
27 to 34 cm	Adult	16 × 30 cm
35 to 44 cm	Large adult	16 × 36 cm
45 to 52 cm	Adult thigh	16 × 42 cm

Note: Be sure to choose the right cuff size for each patient. (See *Choosing the right cuff size*.)

View: ABI video



Standard vs. incorrect ABI procedure

As this chart shows, using the incorrect procedure when obtaining the ankle-brachial index (ABI) can yield inaccurate results. (Note: PAD means peripheral arterial disease.)

Standard ABI procedure	Incorrect ABI procedure	How incorrect procedure affects ABI results
Have patient rest supine for 10 to 20 minutes before test.	Reduce rest time to 5 minutes.	PAD causes ABI to drop after exercise such as walking. Severe disease warrants longer rest period (20 minutes).
Perform ABI with patient supine.	Perform ABI with patient sitting.	Sitting position can cause inaccurate hydrostatic pressure.
Use aneroid sphygmomanometer.	Use automatic oscillometric blood pressure (BP) device.	Use of automatic devices tends to overestimate systolic BP, especially when arteries are calcified.
Use cuff with width 1.2 times diameter of limb.	Use standard adult cuff size for large limbs.	If cuff size is too small, ABI may be higher than it actually is. If cuff size is too large, ABI may be falsely low.
Place Doppler probe at 45- to 60-degree angle toward arterial blood flow.	Use stethoscope instead, or hold Doppler probe at 90-degree angle.	Stethoscope yields inaccurate reading. Holding Doppler probe at 90-degree angle obscures audible signal.
Apply BP cuff just above malleolus.	Apply BP cuff too high on ankle.	Cuff placement too high doesn't accurately measure blood flow of distal aspects of arteries.
Deflate BP cuff at rate of 2 to 3 mm Hg/second. Wait 1 minute before reinflating cuff.	Deflate BP cuff too quickly or repeatedly.	Deflating cuff too quickly can cause clinician to miss highest systolic pressure. Repeatedly inflating cuff or inflating it for long periods may cause pressures to fall.
Inflate cuff until pulse sound disappears, but stop at 200 mm Hg.	Inflate cuff past 200 mm Hg.	Inflating cuff past 200 mm Hg may dislodge plaques in vessels.
Measure systolic pressure in both brachial arteries and choose highest pressure for calculating ABI.	Measure brachial systolic pressure in only one arm.	In 20% of patients with PAD, right vs. left brachial artery pressures differ by 20 mm Hg or more. Inadvertently using lower brachial pressure significantly skews ABI calculations.

Tip #5: Save time by obtaining ABI correctly.

Using incorrect technique when obtaining ABI can result in inaccurate findings. (See *Standard vs. incorrect ABI procedure.*)

Click to download an ABI policy and procedure.

Scroll down to “Procedure Ankle Brachial Index (ABI) updated May 2012 (2.07 MB).”

Links

- www.podiatrytoday.com/keys-diagnosing-peripheral-arterial-disease?page=2
- www.mayoclinic.com/health/ankle-brachial-index/MY00074/DSECTION=results
- <https://www.clwk.ca/cop/skin-wound-care/clinical-dsts>

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