Proper PAD Assessment: Understanding the Ankle-Brachial Index (ABI)
Part One in a Series

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This installment will address the cornerstone of lower extremity peripheral arterial testing, the ABI. The ABI is the most widely used indicator of peripheral arterial disease (PAD), and as such, warrants a discussion on its own: To ensure full understanding, the calculation of the ABI based on ankle pressures alone, is NOT a reimbursable procedure; however, the ABI with hard-copy waveform tracings taken at the ankle level with continuous wave (CW) Doppler or pulse volume recordings (PVR) is reimbursable under CPT code 93922.

Before we begin, it is important to understand some exam fundamentals many practitioners often neglect:

**Patient Positioning:** To assure accurate blood pressure measurements at the arm and ankle level, the patient should lie supine on the examination table, with a single pillow elevating the head.

**Cuff size:** To record an accurate blood pressure, the pressure cuff should be 20% wider than the diameter of the limb.

The “Gold Standard” for obtaining arm and ankle pressures is using a CW Doppler probe for determining presence or absence of blood flow. Photoplethysmographic (PPG) sensors can also be used, with some loss of accuracy and specificity, but with a shorter examination time.

**Arm Pressures:** Apply the appropriate sized cuffs to both biceps area.

If using Doppler, hold the probe at a 45-degree angle to the patient's arm and locate the brachial artery. Position the probe to obtain the strongest (loudest) signal.

If using PPG, place the sensor snugly on the patient's index or middle fingers, using clips, or Velcro straps, and you will see a waveform “pulsing” on your instrument screen.

Inflate the Right arm cuff until the Doppler sound ceases, or the PPG waveform “flat-lines”. Bleed the pressure out of the cuff SLOWLY (2 – 3 mmHg per second) until the Doppler sound returns, or the PPG tracing becomes pulsatile. Most vascular devices will automatically inflate and deflate the pressure cuff, and record the pressure (systolic) at which the pulse returns.

Repeat this procedure on the Left arm. The higher of the two arm pressures will become your “Brachial Reference” and will be used to calculate the ABI. The arm pressures in a normal patient should be within 10 - 15 mmHg pressure of each other. It is important to measure BOTH arm pressures, as your patient may have stenosis or occlusion of the, subclavian, axillary or brachial artery, which would result in a lower brachial pressure on that side.

When using Doppler, it is not uncommon for the Left arm pressure to be 15 to 20 mmHg LOWER than the right arm pressure. Most often, this is a result of artifactual elevation of the right arm pressure due to the patient "tensing up" when they initially hear the Doppler sound. Should you see such a difference, REPEAT the Right arm pressure and you will often record a lower value.
Ankle Pressures: Doppler pressures (systolic pressure measurements obtained with the use of a Doppler probe) are considered the “Gold Standard” in PAD assessment because you can obtain pressures individually from the dorsalis pedis, and posterior tibial arteries. By doing so, you can accurately detect flow-reducing arterial disease in specific vessels, recognize the probability of collateral tibial arterial flow, and better define the therapeutic options. Using a PPG sensor at the toe to obtain ankle pressures will give you a global ankle perfusion pressure.

Apply the appropriate size cuffs to both ankles, taking care not to position the cuff too low on the ankle as this could interfere with Doppler probe position. When performing ankle pressures with Doppler, maintain proper Doppler angles while inflating and deflating the cuff.

When using the Doppler probe on the dorsalis pedis artery, use a very LIGHT touch to avoid compressing the artery. The posterior tibial artery can sometimes be tortuous around the medial malleolus, and a Doppler angle of 90 degrees to the skin surface, will sometimes yield the best signal.

When performing ankle pressures with the PPG sensor, affix the PPG sensors to both great toes, using clips or Velcro straps.

As in obtaining brachial pressures, inflate the ankle cuff until the PPG signals disappear, bleed off pressure slowly and note the first return of pulse.

The ankle arteries can frequently be affected by vessel calcification, especially in diabetic patients, and it is not uncommon to inflate the pressure cuff to 250 mmHg pressure and still note arterial pulsation. As a rule of thumb, there is no need to inflate the ankle cuff more than 50 mmHg pressure higher than the highest brachial pressure.

Divide the ankle pressures by the higher of the two arm pressures, and you will derive the ABI’s. The general diagnostic values for the ABI are:

- > 1.4 Vessel Calcification
- .97 – 1.25 Normal
- .75 -.96 Mild Disease
- .50 -.74 Moderate Disease
- < .50 Severe Disease
- < .30 Critical

Note: If the ankle vessels are incompressible, or yield an ABI of greater than 1.3, consider taking digit pressures at the great toes, and calculating a toe-brachial index (TBI), to better assess arterial perfusion to the feet. Toe pressures and lower limb segmental pressures will be covered in the next vascular education installment.

As with any medical examination, the time involved and the accuracy of the test results will be dependent on the knowledge and experience of the person performing the examination. Adherence to the above nationally recognized guidelines, will help ensure optimum results.

About the Author:

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