

A Fast, Easy Test for PAD Diagnosis – the ABI-Q

Primary care providers recognize the need to find and manage their patient’s PAD before the development of other atherosclerotic problems. However, the perceived time, training, and expertise required to perform the “gold standard” Doppler ABI test for PAD has discouraged many from adding this test to already very busy practices¹. We have developed an accurate new test, the ABI-Q, that can be done more quickly and easily and does not require training in vascular anatomy or Doppler techniques. The ABI-Q is based on a system for assisting with PVR waveform analysis and grading by providing a quantitative result with an agreement of 94%.

PAD is a serious but often hidden disease. Approximately 50% of those with PAD report no symptoms. Often, they have stopped walking far enough to induce claudication, or they believe that their leg pain is due to arthritis or other infirmities of “old age”.

- 29% of high-risk patients have PAD, but over half are undiagnosed.
- Patients diagnosed with PAD have a 21% increased risk of a heart attack, stroke, hospitalization, or death within one year².
- Patients with PAD have a two- to six-fold increase in cardiovascular mortality and a significantly increased risk of amputation, disability, and diminished quality of life³.
- The outcomes of PAD apply to both symptomatic and asymptomatic patients.

PAD Outcomes

- **Foot ulcers, gangrene, CLI**
- **Heart disease, stroke**
- **Loss of mobility, depression**
- **Amputation**
- **Death (2-6 fold increased risk)**

The simple ABI-Q

To provide a test that is accurate, takes minimal time, and reduces the potential of operator error, we have developed a new test, the ABI-Q. The ABI-Q test is based on the PVR (Pulse Volume Recording). This is a recording of pulse waveforms in the extremity created by small pressure changes in a blood pressure cuff encircling the limb. It has been used in vascular laboratories as part of the diagnosis of PAD for more than 30 years. The PVR has several advantages⁵.

PVR Advantages

- **Much easier and faster procedure**
Wrap ankle cuffs, inflate to patient comfortable 65 mmHg, take waveforms
- **No vascular anatomy knowledge or Doppler probe placement skills necessary**
- **Not affected by incompressible arteries**
Especially important for many diabetics
- **Not affected by temperature**
- **Not affected by ambient light**
- **Not affected by skin pigmentation**

Accuracy of PVR

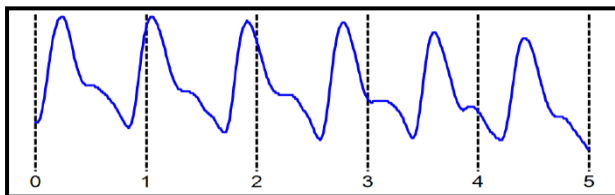
Recent studies have indicated that a properly analyzed and graded PVR waveform study can accurately determine the presence of PAD when compared to other modern diagnostic techniques. In one⁶, graded PVR waveforms were compared to ultrasound duplex imaging of the leg arteries and resulted in a PVR sensitivity of 97%. A second study⁷ compared graded PVR waveforms to flow velocities at the posterior tibial artery using color flow Doppler. In this test the PVR agreement was 92%.

PVR Accuracy:

- **Vs. Duplex: 97%**
- **Vs. Color Flow Doppler: 92%**

Development of the ABI-Q

Considering the accuracy and ease of the PVR but aware of the subjective nature of PVR waveform analysis, we have developed a system for assisting with PVR waveform analysis and grading by providing a quantitative result. Our simpleABI systems digitize the PVR, allowing a detailed computerized analysis of the waveform and examining some of the key parameters shown on the PVR waveform below. We analyzed studies from 120 patients (240 limbs), including 32 limbs with PAD. A proprietary algorithm was developed from this analysis resulting in a quantitative grading of the waveform we have called the ABI-Q.



Typical PVR Waveform. Key parameters include sharpness of peak, rise time, amplitude, absence or presence of dicrotic notch

ABI-Q < 0.90 implies increased risk of PAD, 0.91 to 0.99 is borderline, and >1.00 implies decreasing risk of PAD. The PVR waveforms were graded, and the results compared to the value of the ABI-Q. The ABI-Q was able to separate normal/borderline PVR waveforms from abnormal with an accuracy of 94%.

ABI-Q Agreement with PVR: 94%

The ease of obtaining the ABI-Q, along with its accuracy, has the potential to substantially aid in the improvement of PAD diagnosis and care, especially in the primary care setting. Earlier detection and treatment of PAD will save lives, reduce health care costs, improve patient satisfaction, and reduce surgeries and hospitalizations.

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