

# What is the best test for peripheral vascular disease?

## Evidence-based answer

An ankle-brachial index is best for evaluating patients with symptoms of claudication (strength of recommendation [SOR]: **B**, multiple cohort studies). That said, duplex ultrasonography or magnetic resonance angiography may be a preferable first step if immediate revascularization appears necessary (SOR: **C**, expert consensus and case reports). In addition, a toe-brachial index may be superior to an

ankle-brachial index for evaluating elderly and diabetic patients (SOR: **C**, expert consensus and case reports).

After considering the accuracy, cost, and risk of available tests, an appropriate stepwise approach begins with a complete history and targeted physical examination (palpation of pulses) (SOR: **B**, consistent cohort studies); then obtain an ankle-brachial index to confirm the diagnosis.

## Clinical commentary

### Ankle-brachial index: An underused test

In my experience, the ankle-brachial index is often underused because of a lack of time, equipment, and proper training. Nonetheless, as the evidence makes clear, this test is the best approach for patients with symptoms of claudication.

Another option you may want to consider is the Edinburgh Claudication Questionnaire (**FIGURE**). This tool has a strong positive predictive value and positive likelihood ratio and may allow for a presumptive diagnosis, especially among patients with significant risk factors such as diabetes, hypertension, hyperlipidemia,

coronary artery disease, and tobacco use. It has limitations, though, which are detailed in this Clinical Inquiry.

For initial management of peripheral vascular disease (PVD), you can recommend lifestyle modification, antiplatelet agents, and aggressive control of blood glucose, blood pressure, and lipids without further testing. Reserve Doppler ultrasound and magnetic resonance angiography for patients who require revascularization or don't respond to medical therapy.

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## FAST TRACK

**The toe-brachial index may be superior to an ankle-brachial index for evaluating elderly and diabetic patients**

## Evidence summary

PVD is a progressive atherosclerotic narrowing of arteries in the extremities. The prevalence increases with age—it is less than 1% in people between 40 and 49 years of age and 15% in people 70 years and older.<sup>1,2</sup> Risk factors are the same as

for coronary artery disease.<sup>1</sup>

### Weighing your options

Methods for evaluating patients for PVD include medical history, physical examination (inspection of the extremities and palpation of peripheral pulses), and

## The Edinburgh Claudication Questionnaire

### 1. Do you get a pain or discomfort in your leg(s) when you walk?

Yes  No  I am unable to walk

If you answered "Yes" to question (1), please answer the following questions. Otherwise, you need not continue.

### 2. Does this pain ever begin when you are standing still or sitting?

Yes  No

### 3. Do you get it if you walk uphill or hurry?

Yes  No

### 4. Do you get it when you walk at an ordinary pace on the level?

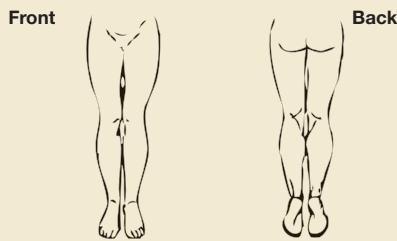
Yes  No

### 5. What happens to it if you stand still?

Usually continues more than 10 minutes.  
 Usually disappears in 10 minutes or less.

### 6. Where do you get this pain or discomfort?

Mark the place(s) with an "x" on the diagram below.



Definition of positive classification requires all of the following responses: "Yes" to (1), "No" to (2), "Yes" to (3), and "usually disappears in 10 minutes or less" to (5); grade 1 = "No" to (4) and grade 2 = "Yes" to (4). If these criteria are fulfilled, a definite claudicant is one who indicates pain in the calf, regardless of whether pain is also marked in other sites; a diagnosis of atypical claudication is made if pain is indicated in the thigh or buttock, in the absence of any calf pain. Patients should not be considered to have claudication if pain is indicated in the hamstrings, feet, shins, joints, or appears to radiate, in the absence of any pain in the calf.

Source: Leng GC, Fowkes FG.<sup>4</sup> Adapted with permission.

ancillary testing (ankle-brachial index, duplex ultrasound, and magnetic resonance imaging with contrast, and angiography). The toe-brachial index may be useful in the elderly and patients with advanced diabetes because noncompressible vasculature in these patients may render the ankle-brachial index unreliable.<sup>3</sup>

The **TABLE** lists the sensitivities, specificities, positive predictive values, and likelihood ratios for commonly used tests.<sup>3-8</sup> The calculations assume peripheral vascular disease to have a prevalence

of 14% among people older than 60 years, based on pooled results from several epidemiologic studies.<sup>1</sup>

A questionnaire-based history of claudication (the Edinburgh Claudication Questionnaire) has been shown to have a high positive predictive value and likelihood ratio for PVD; physical examination techniques appear to be less predictive.<sup>4-7</sup> However, the gold standard in the questionnaire study was "clinician determination," which carries a risk of subjectivity and lack of testing independence that may make the test appear more accurate than it is in typical application.

### A stepwise approach

After balancing the accuracy, cost, and risk of available tests, an appropriate stepwise approach to evaluation for PVD is:

**First**, do a complete history and targeted physical examination (palpation of pulses).

**Next**, obtain an ankle-brachial index to confirm the diagnosis.

**Then**, proceed directly to either duplex ultrasonography or magnetic resonance angiography when revascularization is clearly needed.<sup>9</sup>

The major advantages of the ankle-brachial index include low cost and non-invasiveness (low potential for harm). However, it doesn't detect proximal aneurysms or PVD distal to the ankle, and it may be difficult to perform on patients with noncompressible distal vasculature. Adequately evaluating such patients may require invasive testing.

### Recommendations

The US Preventive Services Task Force recommends against (D recommendation) any screening tests for PVD in patients *without symptoms*.<sup>10</sup> The American College of Cardiology gives a class I recommendation (tests for which there is evidence or general agreement that a procedure is useful, beneficial, or effective) to the ankle-brachial index as the baseline diagnostic tool for establishing peripheral vascular disease, except in elderly

TABLE

## Commonly used tests for peripheral vascular disease

TEST	COMPARISON/ STANDARD	SENSITIVITY % (95% CI, IF REPORTED)	SPECIFICITY % (95% CI, IF REPORTED)	PPV*	LR-	LR+	REIMBURSEMENT ESTIMATE†	CPT CODE	ESTIMATED COST
<b>MEDICAL HISTORY</b>									
Edinburgh Claudication Questionnaire <sup>4</sup>	Claudication by clinician assessment	91.0 (88.1-94.5)	99.0 (98.9-100.0)	0.955	0.09	91.0	99203	99203	\$87.29
<b>PHYSICAL EXAMINATION</b>									
Color abnormality of extremity skin (pale, red, or blue) <sup>5</sup>	ABI<0.9	35.0	87.0	0.305	0.75	2.7	99203	99203	\$87.29
Cool skin unilaterally <sup>5</sup>	ABI<0.9	10.0	98.0	0.449	0.92	5.0	99203	99203	\$87.29
Any abnormal pulse by palpation <sup>6</sup>	Multiple criteria <sup>‡</sup>	76.9	86.4	0.479	0.27	5.7	99203	99203	\$87.29
Presence of femoral bruit <sup>6</sup>	Multiple criteria <sup>‡</sup>	20.0	95.7	0.431	0.84	4.7	99203	99203	\$87.29
Absent pedal pulses (dorsalis pedis and posterior tibial) <sup>7</sup>	ABI<0.9	63.0	99.0	0.912	0.37	63.9	99203	99203	\$87.29
<b>LABORATORY INVESTIGATIONS</b>									
ABI <0.9 <sup>3</sup>	Conventional angiography	79.0	96.0	0.763	0.22	19.8	93923	93923	\$165.18
Duplex ultrasound <sup>8</sup>	Conventional angiography	87.6 (84.4-90.8)	94.7 (93.2-96.2)	0.729	0.13	16.5	93923	93923	\$165.18
Gadolinium-enhanced magnetic resonance angiography <sup>8</sup>	Conventional angiography	97.5 (95.7- 99.3)	96.2 (94.4-97.9)	0.807	0.03	25.7	73725	73725	\$504.00

ABI, ankle-brachial index; CI, confidence interval; LR, likelihood ratio; PPV, positive predictive value.

\*Based on a prevalence of peripheral vascular disease of 14% (Pasternak RC et al').

† Based on estimated Medicare-approved CPT reimbursement rates, [https://catalog.ama-assn.org/Catalog/cpt/cpt\\_search.jsp](https://catalog.ama-assn.org/Catalog/cpt/cpt_search.jsp). Accessed December 2, 2007. History and physical items based on a new-patient visit of moderate complexity, CPT Code 99203. Cost estimate for conventional invasive angiography (angiography, extremity, unilateral, radiological supervision and interpretation, CPT Code 75710) \$426.14 (Downstate Illinois estimates).

‡ Multiple criteria = segmental blood pressure, flow velocity by Doppler, postocclusive reactive hyperemia, pulse reappearance half-time, small or large-vessel peripheral arterial disease, and surgery.

patients or those with advanced diabetes, for whom the test is unreliable.<sup>11</sup> ■

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